



BHARAT HEAVY ELECTRICALS LIMITED, HARIDWAR

STE-TL ENGINEERING DEPARTMENT

PRE-QUALIFICATION REQUIREMENT TIP INSULATION

DOCUMENT NO.
PED/TIPIN/PQR/20190003
Rev:01 Dt:09.04.19

The Pre- Qualification Requirements pertaining to Engineering are as follows:

1. The vendor should have an experience in Design, Supply & Application of Thermal Insulation (Non Spray type) of Hot Pipes (as per ASTM C 680/ IS 14164) of at least 2 different Steam turbine power plants sets of 200MW or above (each unit).
2. The vendor should furnish the following documents satisfying criteria in clause 1 above -
 - a. Executed Purchase Orders should not be older than 7 years, as on the date of enquiry.
 - b. Vendor to submit Purchase Order copies (as mentioned at 2a) along with all Technical documents like BOM (containing - outer dia of pipe, insulation thickness and fluid temperature), Site Data conditions (containing- cold face temperature, ambient temperature, wind velocity and emissivity of cladding) for any of the project. Vendor to furnish k value at different mean temperature (100, 150, 200, 250 and 300 deg C, etc).

Or

In case vendor is not able to furnish BOM as mentioned above due to non-disclosure agreement then vendor to submit Purchase Order copy (as mentioned at 2a) along with 3 Nos sample calculations (at Fluid temperature – 100, 200 & 500 deg C) of insulation thickness (as per ASTM C-680/IS:14164) showing OD of pipe, cold face temperature, ambient temperature, wind velocity and emissivity of cladding. Vendor to furnish k value at different mean temperature (100, 150, 200, 250 and 300 deg C, etc). Vendor to furnish copy of non-disclosure certificate.

- c. Vendor to furnish customer certificate for any one project mentioning that vendor has designed, supplied and applied thermal insulation of piping and is working successfully at _____ (name of site) and rating _____ MW. Signed customer certificate should contain details of signing authority such as Name, designation, contact number, email address etc.

Note:-

1. All documents should be self-certified by vendor.
2. Vendor's offer shall not be considered if vendor fails to furnish the correct and complete document / information / clarifications as mentioned above or vendor doesn't meet the acceptance criteria as mentioned above.

----End of PQR----

Prepared By
09/04/19

Checked BY
9/4/19

Approved By
9/4/19

	Prepared By	Checked BY	Approved By
	RAJEEV KUMAR	ANUJ JAIN	R. PANJA



THERMAL INSULATION SCHEDULE FOR
TURBINE INTEGRAL PIPING
 TURBINE LAYOUT GROUP

BHEL DOC. NO.

412114W3000

REV. – 0

DATE: 14.01.2019

MATERIAL CODE: W90313146020

Project	Project Stage	SPEC DOC. NO.
2X800 MW UPPUR TPP	Contract	ST29005 Rev_04

Specifications are as below:

1. DESIGN PARAMETERS:

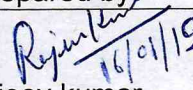
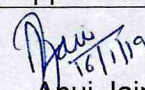
SI No	Description	Value
1	COLD FACE TEMPERATURE	60 DEG C
2	AMBIENT TEMPERATURE	40 DEG C
3	EMISSIVITY OF AL. SHEET	0.2
4	WIND VELOCITY	0.5 M/S
5	DESIGN HEAT LOSS AT CLADDING SURFACE	AS PER ASTM C-680

2. MATERIALS:

SI No	Description	Value
6	INSULATION MATERIAL	LIGHTLY RESIN BONDED ROCKWOOL AS PER IS: 8183
7	DENSITY	1. 100 KG/M3 FOR HOT FACE TEMP. UPTO 400°C 2. 150 KG/M3 FOR HOT FACE TEMP. ABOVE 400°C
8	CLADDING MATERIAL	ALUMINIUM SHEET AS PER IS: 737

3. SPECIAL INSTRUCTIONS:

- ENTIRE INSULATION MATERIAL SHALL BE ASBESTOS FREE.

Prepared by  Rajeev kumar Sr Engineer- STE-TL	Approved by  Anuj Jain DGM- STE-TL
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**Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	MAG10BR100	TUBE/PIPE	300	1219	3.5									
2		ELBOW	300	1219	-	1								
3		FLANGE	507.6	168.3	-				1					
4		WELDOLET	507.6	1219	-								3	
5		TUBE/PIPE	507.6	114.3	0.5									
6		TUBE/PIPE	507.6	168.3	0.5									
7		CAP	507.6	114.3								1		
8		CAP	507.6	1219								1		
9	MAG10BR101	TUBE/PIPE	507.6	1219	5.5									
10		ELBOW	507.6	323.9	-	2								
11		TUBE/PIPE	507.6	323.9	1.5									
12	MAG10BR102	TUBE/PIPE	80	323.9	12.5									
13		ELBOW	80	323.9		1								
14		TEE	80	323.9			1							
15		FLANGE	80	323.9					2					
16	MAG10BR110	TUBE/PIPE	300	1219	1.5									
17		ELBOW	300	1219	-	1								
18		FLANGE	507.6	168.3	-				1					
19		WELDOLET	507.6	1219	-								3	
20		TUBE/PIPE	507.6	114.3	0.5									
21		TUBE/PIPE	507.6	168.3	0.5									
22		CAP	507.6	114.3								1		
23		CAP	507.6	1219								1		
24	MAG10BR111	TUBE/PIPE	507.6	1219	5.5									
25		ELBOW	507.6	323.9	-	2								
26		TUBE/PIPE	507.6	323.9	1.5									
27	MAG10BR112	TUBE/PIPE	80	323.9	12.5									
28		ELBOW	80	323.9		1								
29		TEE	80	323.9			1							
30		FLANGE	80	323.9					2					
31	MAL01BR001	ELBOW	608	323.9	-	1								
32		CAP	608	323.9	-							1		
33		TUBE/PIPE	608	323.9	3.0									
34		TUBE/PIPE	608	33.4	0.5									
35		WELDOLET	608	323.9	-								4	

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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	MAL02BR002	ELBOW	608	323.9	-	1								
37		CAP	608	323.9	-							1		
38		TUBE/PIPE	608	323.9	2.5									
39		TUBE/PIPE	608	33.4	0.5									
40	MAL03BR003	WELDOLET	608	323.9	-								3	
41		ELBOW	608	323.9	-	2								
42		CAP	608	323.9	-							1		
43		TUBE/PIPE	608	323.9	4.5									
44	MAL04BR004	WELDOLET	608	323.9	-								7	
45		ELBOW	608	323.8	-	3								
46		CAP	608	323.8	-							1		
47		TUBE/PIPE	608	33.4	0.5									
48	MAL11BR001	TUBE/PIPE	608	323.8	4.5									
49		WELDOLET	608	323.8	-								6	
50		TEE	608	60.3	-		2							
51		CAP	608	60.3	-							1		
52	MAL12BR002	BEND	608	60.3	-						13			
53		VALVE	608	60.3	-					2				
54		TUBE/PIPE	608	60.3	23.5									
55		TUBE/PIPE	608	73	0.5									
56	MAL14BR001	BEND	608	33.4	-						2			
57		VALVE	608	33.4	-					3				
58		TUBE/PIPE	608	33.4	1.5									
59		TEE	608	60.3	-		2							
60	MAL12BR001	CAP	608	60.3	-							1		
61		BEND	608	60.3	-						7			
62		TUBE/PIPE	608	60.3	26.0									
63		TUBE/PIPE	608	73	0.5									
64	MAL12BR002	VALVE	608	60.3	-					2				
65		BEND	608	33.4	-						2			
66		TUBE/PIPE	608	33.4	2.0									
67		VALVE	608	33.4	-					3				
68	MAL14BR001	VALVE	499	48.3	-					2				
69		TEE	499	48.3	-		2							
70		CAP	499	48.3	-							1		
71		BEND	499	48.3	-						8			
72		TUBE/PIPE	499	48.3	17.5									
73		TUBE/PIPE	499	60.3	0.5									



**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
74	MAL14BR002	BEND	499	33.4	-						2			
75		TUBE/PIPE	499	33.4	2.0									
76		VALVE	499	33.4	-					3				
77		CAP	608	60.3	-							1		
78	MAL19BR001	TEE	608	60.3	-		2							
79		VALVE	608	60.3	-					2				
80		BEND	608	60.3	-						12			
81		TUBE/PIPE	608	73	0.5									
82		TUBE/PIPE	608	60.3	20.5									
83		VALVE	608	33.4	-					3				
84	MAL19BR002	BEND	608	33.4	-						2			
85		TUBE/PIPE	608	33.4	1.5									
86		CAP	549	60.3	-							1		
87	MAL20BR001	TEE	549	60.3	-		2							
88		BEND	549	60.3	-						6			
89		TUBE/PIPE	549	73	0.5									
90		TUBE/PIPE	549	60.3	17.0									
91		VALVE	549	60.3	-					2				
92	MAL20BR002	BEND	549	33.4	-						2			
93		TUBE/PIPE	549	33.4	2.0									
94		VALVE	549	33.4	-					3				
95		TEE	548	60.3	-		3							
96		REDUCER	548	60.3				1						
97	MAL22BR001	CAP	548	60.3								1		
98		BEND	548	60.3							8			
99		VALVE	548	60.3						2				
100		TUBE/PIPE	548	73	0.5									
101		TUBE/PIPE	548	60.3	14.0					3				
102		BEND	548	48.3	-						8			
103	MAL22BR002	TUBE/PIPE	548	48.3	5.0					3				
104		BEND	548	48.3	-						5			
105	MAL22BR003	TUBE/PIPE	548	48.3	4.0									
106		BEND	548	33.4	-						2			
107	MAL22BR004	TUBE/PIPE	548	33.4	2.0									
108		VALVE	548	33.4	-					3				

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**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
109	MAL23BR001	BEND	608	60.3	-						12			
110		CAP	608	60.3	-							1		
111		TEE	608	60.3	-		2							
112		VALVE	608	60.3	-					2				
113		TUBE/PIPE	608	73	0.5									
114	MAL23BR002	TUBE/PIPE	608	60.3	21.0									
115		BEND	608	33.4	-						2			
116		VALVE	608	33.4	-					3				
117		TUBE/PIPE	608	33.4	2.0									
118		BEND	608	60.3	-						10			
119	MAL24BR001	CAP	608	60.3	-							1		
120		TEE	608	60.3	-		2							
121		TUBE/PIPE	608	73	0.5									
122		VALVE	608	60.3	-					2				
123		ELBOW	608	60.3	-	1								
124	MAL24BR002	TUBE/PIPE	608	60.3	26.0									
125		BEND	608	33.4	-						2			
126		TUBE/PIPE	608	33.4	2.0									
127		VALVE	608	33.4	-					3				
128		BEND	452	48.3	-						10			
129	MAL25BR001	VALVE	452	48.3	-					2				
130		CAP	452	48.3	-							1		
131		TEE	452	48.3	-		1							
132		TUBE/PIPE	452	60.3	0.5									
133		TUBE/PIPE	452	48.3	22.0									
134	MAL26BR001	BEND	608	60.3							12			
135		CAP	608	60.3								1		
136		TEE	608	60.3			2							
137		TUBE/PIPE	608	73	0.5									
138		TUBE/PIPE	608	60.3	17.0									
139	MAL26BR002	VALVE	608	60.3						2				
140		BEND	608	33.4	-									
141		TUBE/PIPE	608	33.4	2.0						2			
142		VALVE	608	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
143	MAL27BR001	BEND	608	60.3							10	1		
144		CAP	608	60.3										
145		ELBOW	608	60.3		1								
146		TEE	608	60.3			2							
147		TUBE/PIPE	608	60.3	21.0									
148		TUBE/PIPE	608	73	0.5									
149	MAL27BR002	VALVE	608	60.3						2				
150		BEND	608	33.4	-						2			
151		TUBE/PIPE	608	33.4	2.0									
152		VALVE	608	33.4	-					3				
153	MAL31BR001	BEND	608	60.3	-						10			
154		TUBE/PIPE	608	73	0.5									
155		TUBE/PIPE	608	60.3	17.5									
156		TEE	608	60.3			3							
157		VALVE	608	60.3						2				
158		REDUCER	608	60.3				1						
159		CAP	608	60.3	-							1		
160	MAL31BR002	TUBE/PIPE	608	33.4	10.5									
161		BEND	608	33.4	-						9			
162	MAL31BR003	BEND	608	33.4							3			
163		TEE	608	33.4			1							
164		TUBE/PIPE	608	33.4	4.0									
165	MAL31BR004	BEND	608	33.4	-									
166		TUBE/PIPE	608	33.4	2.0						2			
167		VALVE	608	33.4	-					3				
168		CAP	445	60.3								1		
169	MAL41BR001	BEND	445	60.3							6			
170		TEE	445	60.3			2							
171		VALVE	445	60.3						2				
172		TUBE/PIPE	445	73	0.5									
173		TUBE/PIPE	445	60.3	11.5									
174	MAL41BR002	BEND	445	48.3	-						3			
175		TUBE/PIPE	445	48.3	2.0									
176		ELBO	445	48.3	-	1								
177		BEND	445	33.4	-						2			
178	MAL41BR003	TUBE/PIPE	445	33.4	2.5									
179		VALVE	445	33.4	-					3				

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**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
180	MAL45BR001	CAP	491	60.3								1		
181		TEE	491	60.3			1							
182		BEND	491	60.3							6			
183		VALVE	491	60.3						2				
184		TUBE/PIPE	491	60.3	18.0									
185		TUBE/PIPE	491	73	0.5									
186	MAL47BR001	CAP	407	60.3								1		
187		BEND	407	60.3							8			
188		VALVE	407	60.3						2				
189		TEE	407	60.3			1							
190		TUBE/PIPE	407	60.3	18.0									
191	MAL51BR001	TUBE/PIPE	407	73	0.5									
192		CAP	281	60.3								1		
193		VALVE	281	60.3						2				
194		TEE	281	60.3			2				8			
195		BEND	281	60.3										
196	MAL51BR002	TUBE/PIPE	281	60.3	14.5									
197		TUBE/PIPE	281	73	0.5									
198		BEND	281	33.4	-						8			
199		TUBE/PIPE	281	33.4	13.0									
200		TEE	281	33.4	-		1							
201	MAL51BR003	TUBE/PIPE	281	33.4	5.5									
202		BEND	281	33.4	-						4			
203		BEND	155	60.3							11			
204		CAP	155	60.3								1		
205		TEE	155	60.3			1							
206	MAL54BR001	VALVE	155	60.3						2				
207		TUBE/PIPE	155	60.3	29.0									
208		TUBE/PIPE	155	73	0.5									
209		BEND	217.3	60.3							7			
210		CAP	217.3	60.3								1		
211	MAL55BR001	TEE	217.3	60.3			1							
212		VALVE	217.3	60.3						2				
213		TUBE/PIPE	217.3	60.3	15.0									
214		TUBE/PIPE	217.3	73	0.5									



**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	WELD/OLET	Insulation Thickness (mm) To be filled by vendor
215	MAL65BR001	BEND	393	60.3							9			
216		CAP	393	60.3								1		
217		TEE	393	60.3			2							
218		TUBE/PIPE	393	60.3	16.0									
219		TUBE/PIPE	393	73.0	0.5									
220	MAL65BR002	VALVE	393	60.3						2				
221		BEND	393	33.4	-						3			
222		TUBE/PIPE	393	33.4	2.0									
223		VALVE	393	33.4	-					3				
224		BEND	582	33.4							7			
225	MAL81BR001	CAP	582	33.4								1		
226		VALVE	582	33.4						2				
227		TEE	582	33.4			3							
228		TUBE/PIPE	582	33.4	14.5									
229		TUBE/PIPE	582	48.3	0.5									
230	MAL81BR002	TUBE/PIPE	582	33.4	4.5									
231		BEND	582	33.4	-						3			
232	MAL81BR004	BEND	582	33.4	-						1			
233		TUBE/PIPE	582	33.4	5.5									
234		VALVE	582	33.4	-					1				
235	MAL91BR001	BEND	600	33.4							10			
236		REDUCER	600	33.4				1				1		
237		VALVE	600	33.4						1				
238		TEE	600	33.4			1							
239		TUBE/PIPE	600	33.4	19.5									
240	MAL92BR001	BEND	600	33.4	-						5			
241		TUBE/PIPE	600	33.4	12.0									
242		REDUCER	600	33.4				1				1		
243		VALVE	600	33.4	-					1				
243			600	33.4										

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	LBC41BR001	BEND	393	114.3							9			
2		REDUCER	393	168.3/114.3				1						
3		TUBE/PIPE	393	114.3	11									
4		BEND	393	273							2			
5	LBC41BR002	TUBE/PIPE	393	273	3									
6		ELBO	393	273		2								
7		VALVE	393	273						1				
8		BEND	498	48.3							1			
9	MAM108R001	ELBO	498	48.3		6								
10		TUBE/PIPE	498	48.3	7									
11		BEND	498	48.3							9			
12		ELBO	498	48.3		1								
13	MAM108R002	TUBE/PIPE	498	48.3	18									
14		BEND	498	48.3							12			
15		ELBO	498	48.3		2								
16		REDUCER	498	73				1						
17	MAM108R003	TUBE/PIPE	498	48.3	20									
18		BEND	498	48.3							1			
19		TUBE/PIPE	498	48.3	6									
20		BEND	498	26.7							8			
21	MAM108R005	TUBE/PIPE	498	26.7	17									
22		ELBO	498	60.3							6			
23		CAP	498	60.3								1		
24		TEE	498	60.3			2							
25	MAM108R008	TUBE/PIPE	498	60.3	16									
26		BEND	498	60.3							5			
27		CAP	498	60.3								1		
28		TEE	498	60.3			2							
29	MAM108R010	TUBE/PIPE	498	60.3	18									
30		BEND	281	33.4							4			
31		TUBE/PIPE	281	33.4	3									
32		BEND	281	33.4							6			
33	MAM208R002	TUBE/PIPE	281	33.4	4									
34		BEND	445	48.3							5			
35	MAM208R003	TUBE/PIPE	445	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	445	88.9								1		
37		ELBOW	445	88.9		5								
38		WELDOLET	445	88.9									1	
39		TEE	445	88.9			1							
40	MAM20BR006	TUBE/PIPE	445	88.9	9									
41		BEND	498	48.3							5			
42		TUBE/PIPE	498	48.3	5									
43		BEND	498	48.3							6			
44	MAM20BR007	TUBE/PIPE	498	48.3	5									
45		CAP	498	114.3								1		
46		ELBOW	498	114.3		2								
47		TEE	498	114.3			4							
48	MAM20BR008	TUBE/PIPE	498	114.3	11									
49		BEND	498	48.3							4			
50		TUBE/PIPE	498	48.3	6									
51		BEND	498	48.3							6			
52	MAM30BR001	TUBE/PIPE	498	48.3	6									
53		BEND	582	42.2							7			
54		TUBE/PIPE	582	42.2	5									
55		BEND	582	42.2							16			
56	MAM30BR002	TUBE/PIPE	582	42.2	28									
57		BEND	582	42.2							18			
58		TUBE/PIPE	582	42.2	28									
59		BEND	582	42.2		6					7			
60	MAM30BR003	TUBE/PIPE	582	42.2	5									
61		CAP	582	60.3								1		
62		BEND	582	60.3		9								
63		TEE	582	60.3			2							
64	MAM30BR004	TUBE/PIPE	582	60.3	18									
65		CAP	582	60.3								1		
66		BEND	582	60.3										
67		TEE	582	60.3		5								
68	MAM30BR010	TUBE/PIPE	582	60.3	20									
							2							

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
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		BEND	335	88.9							1			
78		TEE	335	88.9			1							
79	MAW10BR101	TUBE/PIPE	335	88.9	1.5									
80		VALVE	335	88.9						1				
81		VALVE	335	273						1				
82		BEND	335	88.9							4			
83		REDUCER	335	168.3				1						
84	MAW10BR103	REDUCER	335	273				1						
85		TUBE/PIPE	335	88.9	2									
86		VALVE	335	88.9						1				
87		BEND	320	273							2			
88		TUBE/PIPE	320	273	2									
89	MAW10BR104	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	MAW20BR001	ELBOW	470	323.9		2								
95		REDUCER	470	323.9				1						
96		TEE	470	323.9			3							
97		ELBOW	360	273		2								
98		REDUCER	360	273				1						
99	MAW20BR003	TEE	360	273			3							
100		TUBE/PIPE	360	273	9									
101		FLANGE	360	219.1					2					
102		OLET	360	219.1									3	
103		TEE	360	219.1			2							
104	MAW20BR004	TUBE/PIPE	360	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
105	MAW20BR005	VALVE	360	21.3					3					
106		TUBE/PIPE	360	88.9	5									
107		TUBE/PIPE	360	33.4	1									
108		ELBOW	360	88.9		2								
109		BEND	360	33.4							3			
110		FLANGE	360	88.9					2					
111		REDUCER	360	33.4				3						
112	MAW21BR001	TUBE/PIPE	470	141.3	4									
113		TUBE/PIPE	470	114.3	2.5									
114		REDUCER	470	141.3				1						
115		FLANGE	470	114.3					2					
116		ELBOW	470	141.3		2								
117		ELBOW	470	114.3		1								
118		BEND	470	141.3							1			
119	MAW21BR002	BEND	470	114.3							3			
120		TUBE/PIPE	470	141.3	4									
121		TUBE/PIPE	470	114.3	2.5									
122		REDUCER	470	141.3				1						
123		FLANGE	470	114.3					2					
124		ELBOW	470	114.3		2								
125		BEND	470	141.3							2			
126	MAW21BR003	BEND	470	114.3							3			
127		TUBE/PIPE	470	219.1	5.5									
128		TEE	470	219.1			1							
129		REDUCER	470	219.1				1						
130		BEND	470	219.1							3			
131		TUBE/PIPE	470	219.1	6									
132		TEE	470	219.1			1							
133	MAW22BR001	REDUCER	470	219.1				1						
134		BEND	470	219.1							5			
135		TUBE/PIPE	470	141.3	2.5									
136		TUBE/PIPE	470	114.3	2.5									
137		REDUCER	470	141.3				1						
138		FLANGE	470	114.3					2					
139		ELBOW	470	114.3		2								

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

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



STE-TL Engineering Department
HEEP, Haridwar

**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

BHEL DOC NO: 412114W3001 REV_00
Dated : 24.01.2019

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
176	MAW24BR002	TUBE/PIPE	470	141.3	2.5									
177		TUBE/PIPE	470	114.3	1.5									
178		REDUCER	470	141.3				1						
179		FLANGE	470	114.3					2					
180		BEND	470	114.3							2			
181	MAW25BR001	BEND	470	141.3							3			
182		TUBE/PIPE	360	141.3	8									
183		TUBE/PIPE	360	114.3	2									
184		REDUCER	360	141.3				1						
185		FLANGE	360	141.3					2					
186	MAW26BR001	BEND	360	141.3							6			
187		BEND	360	114.3							2			
188		TUBE/PIPE	360	141.3	8									
189		TUBE/PIPE	360	114.3	2									
190		REDUCER	360	114.3				1						
191	MAW27BR001	FLANGE	360	141.3					2					
192		ELBOW	360	141.3		2								
193		BEND	360	114.3							2			
194		BEND	360	141.3							4			
195		BEND	360	141.3							5			
196	MAW28BR001	BEND	360	114.3							2			
197		ELBOW	360	141.3		2								
198		FLANGE	360	141.3					2					
199		REDUCER	360	141.3				1						
200		TUBE/PIPE	360	114.3	2									
201	MAW50BR003	TUBE/PIPE	360	141.3	8									
202		BEND	360	114.3							2			
203		BEND	360	141.3							3			
204		ELBOW	360	141.3		2								
205		FLANGE	360	141.3					2					
206	MAW50BR003	REDUCER	360	141.3				1						
207		TUBE/PIPE	360	114.3	2									
208		TUBE/PIPE	360	141.3	9									
209		TUBE/PIPE	530	219.3	0.5									
210		OLET	530	219.3			1						1	
211		FLANGE	530	219.3					2					

Seal and Signature of Vendor



**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
212	MAW508R001	VALVE	582	457						2				
213		TUBE/PIPE	582	457	3									
214		TEE	582	457			1							
215		OLET	582	457									3	
216		REDUCER	582	457				1						
217		BEND	582	457							4			
218		ELBOW	582	457		1								
219	MAW508R002	VALVE	582	457						1				
220		TUBE/PIPE	582	457	13									
221		TEE	582	457			1							
222		ELBOW	582	457		9								
223		BEND	582	457							4			
224		VALVE	582	457						1				
225		TUBE/PIPE	582	457	1.5									
226	MAW508R103	BEND	582	457		2								
227		ELBOW	582	457		3								
228		TUBE/PIPE	582	457	1									
229		TUBE/PIPE	510	114.3	2									
230		TUBE/PIPE	510	141.3	3									
231		REDUCER	510	141.3				1						
232		ELBOW	510	114.3		1								
233	MAW608R001	BEND	510	141.3							2			
234		TUBE/PIPE	510	114.3	2									
235		TUBE/PIPE	510	141.3	3									
236		REDUCER	510	141.3				1						
237		BEND	510	114.3							1			
238		ELBOW	510	114.3		1								
239		BEND	510	141.3							2			
240	MAW608R003	TUBE/PIPE	510	168.3	5.5									
241		TEE	510	168.3			2							
242		BEND	510	219.1							2			
243		ELBOW	510	168.3		1								
244		CAP	510	168.3								1		
244														



**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
245	MAW60BR004	TUBE/PIPE	510	114.3	2									
246		TUBE/PIPE	510	141.3	2.5									
247		REDUCER	510	141.3				1						
248		ELBOW	510	114.3		1								
249		BEND	510	114.3							2			
250		BEND	510	141.3							2			
251	MAW60BR005	TUBE/PIPE	510	114.3	2									
252		TUBE/PIPE	510	141.3	2.5									
253		REDUCER	510	141.3				1						
254		ELBOW	510	114.3		1								
255		BEND	510	114.3							2			
256		BEND	510	141.3							2			
257	MAW60BR006	TUBE/PIPE	510	168.3	3									
258		TEE	510	168.3			2							
259		BEND	510	168.3							1			
260		CAP	510	168.3								1		
261	MAW60BR007	TUBE/PIPE	510	219.1	2									
262		TEE	510	219.1			2							
263		CAP	510	219.1								1		
264	MAW60BR008	TUBE/PIPE	452	48.3	0.5									
265		TUBE/PIPE	452	219.1	13.5									
266		OLET	452	219.1									2	
267		TEE	452	219.1			1							
268		BEND	452	219.1							4			
269		ELBOW	452	219.1		5								
270		CAP	452	114.3								1		
271		VALVE	220	355.6						1				
272	MAW80BR001	TUBE/PIPE	220	141.3	2									
273		TUBE/PIPE	220	355.6	34.5									
274		TEE	220	355.6			3							
275		REDUCER	220	355.6				2						
276		BEND	220	141.3							3			
277		ELBOW	220	355.6		5								

[Signature]



**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
278	MAW80BR002	TUBE/PIPE	320	323.8	5									
279		TUBE/PIPE	320	141.3	9.5									
280		TEE	320	323.8			2							
281		BEND	320	323.8							1			
282	MAW80BR003	ELBOW	320	323.8		3								
283		TUBE/PIPE	320	273	4									
284		REDUCER	320	273				1						
285		TEE	320	273			2							
286	MAW80BR004	CAP	320	273								1		
287		TUBE/PIPE	220	33.4	0.5									
288		TUBE/PIPE	220	273	10									
289		TEE	220	273			3							
290	MAW80BR005	FLANGE	220	60.3					2					
291		ELBOW	220	273		7								
292		TUBE/PIPE	220	33.4	3									
293		TEE	220	33.4			1							
294	MAW80BR006	REDUCER	220	33.4				2						
295		ELBOW	220	33.4		8								
296		TUBE/PIPE	220	33.4	3									
297		TEE	220	33.4			1							
298	MAW80BR007	REDUCER	220	33.4				1						
299		BEND	220	33.4		4								
300		ELBOW	220	168.3		3								
301		TUBE/PIPE	220	168.3	3									
302	MAW80BR008	VALVE	220	168.3						1				
303		TUBE/PIPE	220	168.3	3									
304		TEE	220	168.3			1							
305		FLANGE	220	168.3					2					
306	MAW80BR009	ELBOW	220	168.3		4								
307		VALVE	220	168.3						1				
308		TUBE/PIPE	220	168.3	3									
309		ELBOW	220	168.3		3								
310	MAW80BR010	FLANGE	220	168.3					2					
311		TUBE/PIPE	220	219.1	0.5									
312		REDUCER	220	219.1				1						



STE-TL Engineering Department
HEEP, Haridwar

**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

BHEL DOC NO: 412114W3001 REV_00
Dated : 24.01.2019

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
313	MAW80BR011	TUBE/PIPE	220	219.1	0.5									
314		REDUCER	220	219.1				1						
315		TUBE/PIPE	220	33.4	12									
316	MAW80BR012	TEE	220	219.1			1							
317		BEND	220	33.4							5			
318		ELBOW	220	219.1		2								
319		FLANGE	220	219.1					2					
320		TUBE/PIPE	220	219.1	4									
321	MAW80BR013	TUBE/PIPE	220	33.4	12									
322		TEE	220	219.1			1							
323		BEND	220	33.4							5			
324		ELBOW	220	219.1		4								
325		FLANGE	220	219.1					2					
326		VALVE	220	219.1						1				
327		BEND	220	219.1							1			
328		TUBE/PIPE	220	219.1	10									
329	MAW80BR014	TUBE/PIPE	220	355.6	2									
330		VALVE	220	355.6						1				
331		TEE	220	355.6			1							
332		BEND	220	355.6							1			
333		ELBOW	220	355.6		2								
334	MAW80BR015	TUBE/PIPE	220	33.4	1.5									
335		REDUCER	220	33.4				1						
336		BEND	220	33.4							3			
337	MAW81BR001	ELBOW	320	114.3		1								
338		BEND	320	168.3							2			
339		REDUCER	320	168.3				1						
340		TUBE/PIPE	320	114.3	2									
341		TUBE/PIPE	320	168.3	2.5									

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
342	MAW81BR002	ELBOW	320	114.3		1								
343		ELBOW	320	168.3		1								
344		TUBE/PIPE	320	168.3	2.5									
345		TUBE/PIPE	320	114.3	2									
346		REDUCER	320	168.3				1						
347		BEND	320	168.3							1			
348	MAW81BR003	VALVE	320	219.1						1				
349		BEND	320	219.1							3			
350		TUBE/PIPE	320	219.5	6									
351		TEE	320	219.1			1							
352		REDUCER	320	219.1				1						
353		FLANGE	320	219.1					2					
354	MAW82BR001	ELBOW	320	114.3		1								
355		ELBOW	320	168.3		1								
356		BEND	320	114.3							2			
357		REDUCER	320	168.3				1						
358		BEND	320	168.3							2			
359		TUBE/PIPE	320	114.3	1.5									
360		TUBE/PIPE	320	168.3	1.5									
361	MAW82BR002	BEND	320	114.3							3			
362		BEND	320	168.3							2			
363		ELBOW	320	114.3		1								
364		REDUCER	320	168.3				1						
365		TUBE/PIPE	320	114.3	1.5									
366		TUBE/PIPE	320	168.3	1.5									
367	MAW82BR003	ELBOW	320	219.1		2								
368		TUBE/PIPE	320	219.1	7									
369		REDUCER	320	219.1				1						
370		FLANGE	320	219.1					2					
371		BEND	320	219.1							2			
372		TEE	320	219.1			1							
373		VALVE	320	219.1						1				

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**Bill of Materials for Thermal Insulation of TIP
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
374	MAW83BR001	FLANGE	320	168.3					2					
375		BEND	320	114.3							2			
376		BEND	320	141.3							5			
377		REDUCER	320	141.3				1						
378		TUBE/PIPE	320	141.3	5.5									
379		TUBE/PIPE	320	114.3	1.5									
380	MAW84BR001	VALVE	320	141.3						1				
381		FLANGE	320	141.3					2					
382		TUBE/PIPE	320	141.3	7									
383		TUBE/PIPE	320	114.3	1.5									
384		REDUCER	320	141.3				1						
385		VALVE	320	141.3						1				
386	MAW85BR001	BEND	320	141.3							2			
387		BEND	220	88.9							3			
388		TUBE/PIPE	220	88.9	2									
389		BEND	220	141.3							3			
390	MAW85BR002	FLANGE	220	141.3					2					
391		REDUCER	220	141.3				1						
392		TUBE/PIPE	220	141.3	1									
393		VALVE	220	141.3						1				
394	MAW86BR001	TUBE/PIPE	220	88.9	1.5									
395		BEND	220	88.9							5			
396		REDUCER	220	141.3				1						
397		FLANGE	220	141.3					2					
398	MAW86BR002	VALVE	220	141.3						1				
399		TUBE/PIPE	220	141.3	1									
400		BEND	220	141.3							1			
401		BEND	220	88.9							3			
402	MAW87BR001	TUBE/PIPE	220	88.9	1.5									
403	MAW87BR002	ELBOW	220	141.3		1								
404		FLANGE	220	141.3					2					
405		VALVE	220	141.3						1				
406		REDUCER	220	141.3				1						
407		TUBE/PIPE	220	88.9	1									
408		TUBE/PIPE	220	141.3	2									

[Handwritten Signature]



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
409	MAW88BR001	BEND	220	88.9							3			
410		TUBE/PIPE	220	88.9	1									
411	MAW88BR002	REDUCER	220	141.3				1						
412		FLANGE	220	141.3					2					
413		VALVE	220	141.3						1				
414		TUBE/PIPE	220	141.3	1.5									
415		BEND	220	141.3							2			



**Bill of Materials for Thermal Insulation of TIP
Overload Piping System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (m)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	OLET	Insulation Thickness (mm) To be filled by vendor
1	MAA14BR001	TUBE/PIPE	600	219.1	22.0								
2		BEND	600	219.1							7		
3		TUBE/PIPE	600	60.3	0.5							1	
4		Weldolet	600	60.3									
5		ELBOW	600	60.3	-	1							
6	MAA14BR002	TUBE/PIPE	600	219.1	19.5								
7		TEE	600	219.1			1						
8		TUBE/PIPE	600	219.1							7		
9		ELBOW	600	60.3		1							
10		Weldolet	600	60.3	1.0							1	
11	MAA14BR003	TUBE/PIPE	549	168.3	3.5								
12		ELBOW	549	168.3		2							
13		Weldolet	549	168.3	-							1	
14		TUBE/PIPE	549	219.1	10.0			1					
15		ELBOW	549	219.1		5							
16	MAA14BR004	REDUCER	549	219.1				1					
17		VALVE	549	33.4	-					2			
18		Weldolet	549	33.4	-							1	
19		REDUCER	549	33.4	-			1					
20		TUBE/PIPE	549	33.4	1.0								
21	MAA14BR004	VALVE	549	33.4	-					2			
22		Weldolet	549	33.4								1	
23		REDUCER	549	33.4				1					
24		TUBE/PIPE	549	33.4	1.0								
25		TUBE/PIPE	549	168.3	3.5	3						1	
26	MAA14BR004	BEND	549	219.1							1		
27		REDUCER	549	219.1				1					
28		TUBE/PIPE	549	219.1	14.0	7							

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**Bill of Materials for Thermal Insulation of TIP
Overload Piping System**

SI 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
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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 22 (Twenty Two) pages. Turbine Drainage System = 7 Pages, Seal Steam System = 13 Pages & Overload Piping System = 2 Page.

Checklist for Vendors		SPECIAL INSTRUCTIONS:		VENDOR's CHECKPOINT (To be filled by Vendor)	
SI No	BHEL REQUIREMENTS				
1	Vendor has indicated insulation thicknesses for all items covered in this document.				
2	Vendor has considered design criteria as per doc no 412114W3000 , ST29005 REV_0.				
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: RAJEEV KUMAR (Sr Engr-PEET)

APPROVED BY: Sh ANUJ JAIN (DGM-PEET)

(STE-TL)

28/1/19

(STE-TL)



THERMAL INSULATION SCHEDULE FOR
TURBINE INTEGRAL PIPING
 TURBINE LAYOUT GROUP

BHEL DOC. NO.

412114V6000

REV. - 0

DATE: 14.01.2019

MATERIAL CODE: W90313146012

Project	Project Stage	SPEC DOC. NO.
1X800 MW NORTH CHENNAI TPP	Contract	ST29005 Rev_04

Specifications are as below:

1. DESIGN PARAMETERS:

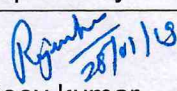
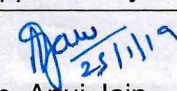
SI No	Description	Value
1	COLD FACE TEMPERATURE	60 DEG C
2	AMBIENT TEMPERATURE	40 DEG C
3	EMISSIVITY OF AL. SHEET	0.2
4	WIND VELOCITY	0.5 M/S
5	DESIGN HEAT LOSS AT CLADDING SURFACE	AS PER ASTM C-680

2. MATERIALS:

SI No	Description	Value
6	INSULATION MATERIAL	LIGHTLY RESIN BONDED ROCKWOOL AS PER IS: 8183.
7	DENSITY	1. 100 KG/M3 FOR HOT FACE TEMP. UPTO 400°C. 2. 150 KG/M3 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 Sr Engineer- STE-TL	 Sh. Anuj Jain DGM- STE-TL



STE-TL Engineering Department
HEEP, Haridwar

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

BHEL DOC NO: 412114V6001 REV_00
Dated : 16.01.2019

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	TUBE/PIPE	300	1219	3.5									
2		ELBOW	300	1219	-	1								
3		FLANGE	507.6	168.3	-				1					
4		WELDOLET	507.6	1219	-								3	
5		TUBE/PIPE	507.6	114.3	0.5									
6		TUBE/PIPE	507.6	168.3	0.5									
7		CAP	507.6	114.3								1		
8		CAP	507.6	1219								1		
9	MAG10BR101	TUBE/PIPE	507.6	1219	5.5									
10		ELBOW	507.6	323.9	-	2								
11		TUBE/PIPE	507.6	323.9	1.5									
12	MAG10BR102	TUBE/PIPE	80	323.9	12.5									
13		ELBOW	80	323.9		1								
14		TEE	80	323.9			1							
15		FLANGE	80	323.9					2					
16	MAG10BR110	TUBE/PIPE	300	1219	1.5									
17		ELBOW	300	1219	-	1								
18		FLANGE	507.6	168.3	-				1					
19		WELDOLET	507.6	1219	-								3	
20		TUBE/PIPE	507.6	114.3	0.5									
21		TUBE/PIPE	507.6	168.3	0.5									
22		CAP	507.6	114.3								1		
23		CAP	507.6	1219								1		
24		TUBE/PIPE	507.6	1219	5.5									
25		ELBOW	507.6	323.9	-	2								
26	MAG10BR111	TUBE/PIPE	507.6	323.9	1.5									
27		TUBE/PIPE	80	323.9	12.5									
28	MAG10BR112	ELBOW	80	323.9		1								
29		TEE	80	323.9			1							
30		FLANGE	80	323.9					2					
31		ELBOW	608	323.9	-	1								
32	MAL01BR001	CAP	608	323.9	-							1		
33		TUBE/PIPE	608	323.9	3.0									
34		TUBE/PIPE	608	33.4	0.5									
35		WELDOLET	608	323.9	-								4	

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STE-TL Engineering Department
HEEP, Haridwar

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

BHEL DOC NO: 412114V6001 REV_00
Dated : 16.01.2019

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	MAL02BR002	ELBOW	608	323.9	-	1								
37		CAP	608	323.9	-							1		
38		TUBE/PIPE	608	323.9	2.5									
39		TUBE/PIPE	608	33.4	0.5									
40	MAL03BR003	WELDOLET	608	323.9	-								3	
41		ELBOW	608	323.9	-	2								
42		CAP	608	323.9	-							1		
43		TUBE/PIPE	608	323.9	4.5									
44	MAL04BR004	WELDOLET	608	323.9	-								7	
45		ELBOW	608	323.8	-	3								
46		CAP	608	323.8	-							1		
47		TUBE/PIPE	608	33.4	0.5									
48	MAL11BR001	TUBE/PIPE	608	323.8	4.5									
49		WELDOLET	608	323.8	-								6	
50		TEE	608	60.3	-		2							
51		CAP	608	60.3	-						13			
52	MAL12BR001	BEND	608	60.3	-									
53		VALVE	608	60.3	-					2				
54		TUBE/PIPE	608	60.3	23.5									
55		TUBE/PIPE	608	73	0.5									
56	MAL13BR002	BEND	608	33.4	-						2			
57		VALVE	608	33.4	-					3				
58		TUBE/PIPE	608	33.4	1.5									
59		TEE	608	60.3	-		2							
60	MAL14BR001	CAP	608	60.3	-							1		
61		BEND	608	60.3	-						7			
62		TUBE/PIPE	608	60.3	26.0									
63		TUBE/PIPE	608	73	0.5									
64	MAL15BR002	VALVE	608	60.3	-					2				
65		BEND	608	33.4	-						2			
66		TUBE/PIPE	608	33.4	2.0									
67		VALVE	608	33.4	-					3				
68	MAL16BR001	VALVE	499	48.3	-									
69		TEE	499	48.3	-		2							
70		CAP	499	48.3	-							1		
71		BEND	499	48.3	-						8			
72	MAL17BR002	TUBE/PIPE	499	48.3	17.5									
73		TUBE/PIPE	499	60.3	0.5									

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STE-TL Engineering Department
HEEP, Haridwar

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

BHEL DOC NO: 412114V6001 REV_00
Dated : 16.01.2019

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
74	MAL148R002	BEND	499	33.4	-						2			
75		TUBE/PIPE	499	33.4	2.0									
76		VALVE	499	33.4	-					3				
77	MAL198R001	CAP	608	60.3	-							1		
78		TEE	608	60.3	-		2							
79		VALVE	608	60.3	-					2				
80		BEND	608	60.3	-						12			
81		TUBE/PIPE	608	73	0.5									
82		TUBE/PIPE	608	60.3	20.5									
83	MAL198R002	VALVE	608	33.4	-					3				
84		BEND	608	33.4	-						2			
85		TUBE/PIPE	608	33.4	1.5									
86	MAL208R001	CAP	549	60.3	-							1		
87		TEE	549	60.3	-		2							
88		BEND	549	60.3	-						6			
89		TUBE/PIPE	549	73	0.5									
90		TUBE/PIPE	549	60.3	17.0									
91		VALVE	549	60.3	-					2				
92	MAL208R002	BEND	549	33.4	-						2			
93		TUBE/PIPE	549	33.4	2.0									
94		VALVE	549	33.4	-					3				
95	MAL228R001	TEE	548	60.3	-		3							
96		REDUCER	548	60.3				1						
97		CAP	548	60.3								1		
98		BEND	548	60.3							8			
99		VALVE	548	60.3						2				
100		TUBE/PIPE	548	73	0.5									
101		TUBE/PIPE	548	60.3	14.0					3				
102	MAL228R002	BEND	548	48.3	-						8			
103		TUBE/PIPE	548	48.3	5.0					3				
104	MAL228R003	BEND	548	48.3	-						5			
105		TUBE/PIPE	548	48.3	4.0									
106	MAL228R004	BEND	548	33.4	-						2			
107		TUBE/PIPE	548	33.4	2.0									
108		VALVE	548	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
109	MAL23BR001	BEND	608	60.3	-						12			
110		CAP	608	60.3	-							1		
111		TEE	608	60.3	-		2							
112		VALVE	608	60.3	-					2				
113		TUBE/PIPE	608	73	0.5									
114	MAL23BR002	TUBE/PIPE	608	60.3	21.0									
115		BEND	608	33.4	-						2			
116		VALVE	608	33.4	-					3				
117		TUBE/PIPE	608	33.4	2.0									
118		BEND	608	60.3	-						10			
119	MAL24BR001	CAP	608	60.3	-							1		
120		TEE	608	60.3	-		2							
121		TUBE/PIPE	608	73	0.5									
122		VALVE	608	60.3	-					2				
123		ELBOW	608	60.3	-	1								
124	MAL24BR002	TUBE/PIPE	608	60.3	26.0									
125		BEND	608	33.4	-						2			
126		TUBE/PIPE	608	33.4	2.0									
127		VALVE	608	33.4	-					3				
128		BEND	452	48.3	-						10			
129	MAL25BR001	VALVE	452	48.3	-					2				
130		CAP	452	48.3	-							1		
131		TEE	452	48.3	-		1							
132		TUBE/PIPE	452	60.3	0.5									
133		TUBE/PIPE	452	48.3	22.0									
134	MAL26BR001	BEND	608	60.3	-						12			
135		CAP	608	60.3	-							1		
136		TEE	608	60.3	-		2							
137		TUBE/PIPE	608	73	0.5									
138		TUBE/PIPE	608	60.3	17.0									
139	MAL26BR002	VALVE	608	60.3	-					2				
140		BEND	608	33.4	-						2			
141		TUBE/PIPE	608	33.4	2.0									
142		VALVE	608	33.4	-					3				

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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
143	MAL27BR001	BEND	608	60.3							10	1		
144		CAP	608	60.3										
145		ELBOW	608	60.3		1								
146		TEE	608	60.3			2							
147		TUBE/PIPE	608	60.3	21.0									
148		TUBE/PIPE	608	73	0.5									
149		VALVE	608	60.3						2				
150	MAL27BR002	BEND	608	33.4	-						2			
151		TUBE/PIPE	608	33.4	2.0									
152		VALVE	608	33.4	-					3				
153	MAL31BR001	BEND	608	60.3	-						10			
154		TUBE/PIPE	608	73	0.5									
155		TUBE/PIPE	608	60.3	17.5									
156		TEE	608	60.3			3							
157		VALVE	608	60.3						2				
158		REDUCER	608	60.3				1						
159		CAP	608	60.3	-							1		
160	MAL31BR002	TUBE/PIPE	608	33.4	10.5									
161		BEND	608	33.4	-						9			
162	MAL31BR003	BEND	608	33.4							3			
163		TEE	608	33.4			1							
164		TUBE/PIPE	608	33.4	4.0									
165	MAL31BR004	BEND	608	33.4	-						2			
166		TUBE/PIPE	608	33.4	2.0									
167		VALVE	608	33.4	-					3				
168		CAP	445	60.3								1		
169	MAL41BR001	BEND	445	60.3							6			
170		TEE	445	60.3			2							
171		VALVE	445	60.3						2				
172		TUBE/PIPE	445	73	0.5									
173		TUBE/PIPE	445	60.3	11.5									
174		BEND	445	48.3	-						3			
175		TUBE/PIPE	445	48.3	2.0									
176	MAL41BR002	ELBO	445	48.3	-	1								
177		BEND	445	33.4	-						2			
178	MAL41BR003	TUBE/PIPE	445	33.4	2.5									
179		VALVE	445	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
180	MAL45BR001	CAP	491	60.3								1		
181		TEE	491	60.3			1							
182		BEND	491	60.3							6			
183		VALVE	491	60.3						2				
184		TUBE/PIPE	491	60.3	18.0									
185	MAL47BR001	TUBE/PIPE	491	73	0.5									
186		CAP	407	60.3								1		
187		BEND	407	60.3							8			
188		VALVE	407	60.3						2				
189		TEE	407	60.3			1							
190	MAL51BR001	TUBE/PIPE	407	60.3	18.0									
191		TUBE/PIPE	407	73	0.5									
192		CAP	281	60.3								1		
193		VALVE	281	60.3						2				
194		TEE	281	60.3			2							
195	MAL51BR002	BEND	281	60.3							8			
196		TUBE/PIPE	281	60.3	14.5									
197		TUBE/PIPE	281	73	0.5									
198		BEND	281	33.4	-						8			
199		TUBE/PIPE	281	33.4	13.0									
200	MAL51BR003	TEE	281	33.4	-		1							
201		TUBE/PIPE	281	33.4	5.5									
202		BEND	281	33.4	-						4			
203		BEND	155	60.3							11			
204		CAP	155	60.3								1		
205	MAL54BR001	TEE	155	60.3			1							
206		VALVE	155	60.3						2				
207		TUBE/PIPE	155	60.3	29.0									
208		TUBE/PIPE	155	73	0.5									
209		BEND	217.3	60.3							7			
210	MAL55BR001	CAP	217.3	60.3								1		
211		TEE	217.3	60.3			1							
212		VALVE	217.3	60.3						2				
213		TUBE/PIPE	217.3	60.3	15.0									
214		TUBE/PIPE	217.3	73	0.5									



STE-TL Engineering Department
HEEP, Haridwar

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

BHEL DOC NO: 412114V6001 REV_00
Dated : 16.01.2019

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
215	MAL65BR001	BEND	393	60.3							9			
216		CAP	393	60.3								1		
217		TEE	393	60.3			2							
218		TUBE/PIPE	393	60.3	16.0									
219		TUBE/PIPE	393	73.0	0.5									
220		VALVE	393	60.3						2				
221	MAL65BR002	BEND	393	33.4	-						3			
222		TUBE/PIPE	393	33.4	2.0									
223		VALVE	393	33.4	-					3				
224	MAL81BR001	BEND	582	33.4							7			
225		CAP	582	33.4								1		
226		VALVE	582	33.4						2				
227		TEE	582	33.4			3							
228		TUBE/PIPE	582	33.4	14.5									
229	MAL81BR002	TUBE/PIPE	582	48.3	0.5									
230		TUBE/PIPE	582	33.4	4.5						3			
231		BEND	582	33.4	-									
232	MAL81BR004	BEND	582	33.4	-						1			
233		TUBE/PIPE	582	33.4	5.5									
234		VALVE	582	33.4	-					1				
235	MAL91BR001	BEND	600	33.4							10			
236		REDUCER	600	33.4				1				1		
237		VALVE	600	33.4						1				
238		TEE	600	33.4			1							
239		TUBE/PIPE	600	33.4	19.5									
240	MAL92BR001	BEND	600	33.4	-						5			
241		TUBE/PIPE	600	33.4	12.0									
242		REDUCER	600	33.4				1					1	
243		VALVE	600	33.4	-					1				

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	LBC41BR001	BEND	393	114.3							9			
2		REDUCER	393	168.3/114.3				1						
3		TUBE/PIPE	393	114.3	11									
4	LBC41BR002	BEND	393	273							2			
5		TUBE/PIPE	393	273	3									
6		ELBO	393	273		2								
7		VALVE	393	273						1				
8	MAM10BR001	BEND	498	48.3							1			
9		ELBO	498	48.3		6								
10		TUBE/PIPE	498	48.3	7									
11		BEND	498	48.3							9			
12	MAM10BR002	ELBO	498	48.3		1								
13		TUBE/PIPE	498	48.3	18									
14		BEND	498	48.3							12			
15	MAM10BR003	ELBO	498	48.3		2								
16		REDUCER	498	73				1						
17		TUBE/PIPE	498	48.3	20									
18		BEND	498	48.3							1			
19	MAM10BR004	TUBE/PIPE	498	48.3	6									
20		BEND	498	26.7							8			
21		TUBE/PIPE	498	26.7	17									
22	MAM10BR008	ELBO	498	60.3							6			
23		CAP	498	60.3								1		
24		TEE	498	60.3			2							
25		TUBE/PIPE	498	60.3	16									
26	MAM10BR010	BEND	498	60.3							5			
27		CAP	498	60.3								1		
28		TEE	498	60.3			2							
29		TUBE/PIPE	498	60.3	18									
30	MAM20BR001	BEND	281	33.4							4			
31		TUBE/PIPE	281	33.4	3									
32	MAM20BR002	BEND	281	33.4							6			
33		TUBE/PIPE	281	33.4	4									
34	MAM20BR003	BEND	445	48.3							5			
35		TUBE/PIPE	445	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	445	88.9								1		
37		ELBOW	445	88.9		5								
38		WELDOLET	445	88.9									1	
39		TEE	445	88.9			1							
40	MAM20BR006	TUBE/PIPE	445	88.9	9									
41		BEND	498	48.3							5			
42		TUBE/PIPE	498	48.3	5									
43		BEND	498	48.3							6			
44	MAM20BR007	TUBE/PIPE	498	48.3	5									
45		CAP	498	114.3								1		
46		ELBOW	498	114.3		2								
47		TEE	498	114.3			4							
48	MAM20BR008	TUBE/PIPE	498	114.3	11									
49		BEND	498	48.3							4			
50		TUBE/PIPE	498	48.3	6									
51		BEND	498	48.3							6			
52	MAM20BR010	TUBE/PIPE	498	48.3	6									
53		BEND	582	42.2							7			
54		TUBE/PIPE	582	42.2	5									
55		BEND	582	42.2							16			
56	MAM30BR002	TUBE/PIPE	582	42.2	28									
57		BEND	582	42.2							18			
58		TUBE/PIPE	582	42.2	28									
59		BEND	582	42.2		6					7			
60	MAM30BR004	TUBE/PIPE	582	42.2	5									
61		CAP	582	60.3								1		
62		BEND	582	60.3		9								
63		TEE	582	60.3			2							
64	MAM30BR008	TUBE/PIPE	582	60.3	18									
65		CAP	582	60.3								1		
66		BEND	582	60.3		5								
67		TEE	582	60.3			2							
68	MAM30BR010	TUBE/PIPE	582	60.3	20									



**Bill of Materials for Thermal Insulation of TIP
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
69	MAW10BR001	BEND	320	273							3			
70		TEE	320	273			1							
71		OLET	320	273									1	
72		TUBE/PIPE	320	273	2									
73	MAW10BR002	VALVE	320	273						1				
74		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	MAW10BR103	VALVE	335	273						1				
82		BEND	335	88.9							4			
83		REDUCER	335	168.3				1						
84		REDUCER	335	273				1						
85	MAW10BR104	TUBE/PIPE	335	88.9	2									
86		VALVE	335	88.9						1				
87		BEND	320	273							2			
88		TUBE/PIPE	320	273	2									
89	MAW20BR001	REDUCER	470	323.8				1						
90		BEND	470	273							2			
91		FLANGE	470	273					2					
92		TEE	470	273			2							
93	MAW20BR002	TUBE/PIPE	470	273	4									
94		ELBOW	470	323.9		2								
95		REDUCER	470	323.9				1						
96		TEE	470	323.9			3							
97	MAW20BR003	ELBOW	360	273		2								
98		REDUCER	360	273				1						
99		TEE	360	273			3							
100		TUBE/PIPE	360	273	9									
101	MAW20BR004	FLANGE	360	219.1					2					
102		OLET	360	219.1									3	
103		TEE	360	219.1			2							
104		TUBE/PIPE	360	219.1	4									



**Bill of Materials for Thermal Insulation of TIP
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
105	MAW20BR005	VALVE	360	21.3					3					
106		TUBE/PIPE	360	88.9	5									
107		TUBE/PIPE	360	33.4	1									
108		ELBOW	360	88.9		2								
109		BEND	360	33.4							3			
110		FLANGE	360	88.9					2					
111	MAW21BR001	REDUCER	360	33.4				3						
112		TUBE/PIPE	470	141.3	4									
113		TUBE/PIPE	470	114.3	2.5									
114		REDUCER	470	141.3				1						
115		FLANGE	470	114.3					2					
116		ELBOW	470	141.3		2								
117		ELBOW	470	114.3		1								
118		BEND	470	141.3							1			
119		BEND	470	114.3							3			
120	MAW21BR002	TUBE/PIPE	470	141.3	4									
121		TUBE/PIPE	470	114.3	2.5									
122		REDUCER	470	141.3				1						
123		FLANGE	470	114.3					2					
124		ELBOW	470	114.3		2								
125		BEND	470	141.3							2			
126		BEND	470	114.3							3			
127	MAW21BR003	TUBE/PIPE	470	219.1	5.5									
128		TEE	470	219.1			1							
129		REDUCER	470	219.1				1						
130		BEND	470	219.1							3			
131		TUBE/PIPE	470	219.1	6									
132	MAW22BR001	TEE	470	219.1			1							
133		REDUCER	470	219.1				1						
134		BEND	470	219.1							5			
135		TUBE/PIPE	470	141.3	2.5									
136	MAW22BR002	TUBE/PIPE	470	114.3	2.5									
137		REDUCER	470	141.3				1						
138		FLANGE	470	114.3					2					
139		ELBOW	470	114.3		2								



**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
140	MAW22BR003	TUBE/PIPE	470	141.3	4									
141		TUBE/PIPE	470	114.3	2.5									
142		REDUCER	470	141.3				1						
143		FLANGE	470	114.3					2					
144		ELBOW	470	141.3		1								
145		ELBOW	470	114.3		2								
146		BEND	470	114.3							1			
147	MAW23BR001	TUBE/PIPE	470	141.3	6									
148		TUBE/PIPE	470	114.3	3									
149		REDUCER	470	141.3				1						
150		BEND	470	114.3							1			
151		BEND	470	141.3							1			
152		FLANGE	470	114.3					2					
153		ELBOW	470	141.3		1								
154		ELBOW	470	114.3		1								
155	MAW23BR002	TUBE/PIPE	470	141.3	1.5									
156		TUBE/PIPE	470	114.3	3.5									
157		REDUCER	470	141.3				1						
158		FLANGE	470	114.3					2					
159		ELBOW	470	114.3		1								
160		BEND	470	114.3							1			
161		BEND	470	141.3							2			
162	MAW23BR003	TUBE/PIPE	470	219.1	7.5									
163		TEE	470	219.1			1							
164		REDUCER	470	219.1				1						
165		BEND	470	219.1							4			
166		TUBE/PIPE	470	141.3	2.5									
167		TUBE/PIPE	470	114.3	1.5									
168	MAW24BR001	REDUCER	470	141.3				1						
169		FLANGE	470	114.3					2					
170		BEND	470	141.3							2			
171		BEND	470	114.3							2			
172		TUBE/PIPE	470	219.3	7.5									
173		TEE	470	219.3			1							
174	MAW24BR003	REDUCER	470	219.3				1						
175		BEND	470	219.3							6			



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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
176	MAW24BR002	TUBE/PIPE	470	141.3	2.5									
177		TUBE/PIPE	470	114.3	1.5									
178		REDUCER	470	141.3				1						
179		FLANGE	470	114.3					2					
180		BEND	470	114.3							2			
181		BEND	470	141.3							3			
182	MAW25BR001	TUBE/PIPE	360	141.3	8									
183		TUBE/PIPE	360	114.3	2									
184		REDUCER	360	141.3				1						
185		FLANGE	360	141.3					2					
186		BEND	360	141.3							6			
187		BEND	360	114.3							2			
188	MAW26BR001	TUBE/PIPE	360	141.3	8									
189		TUBE/PIPE	360	114.3	2									
190		REDUCER	360	114.3				1						
191		FLANGE	360	141.3					2					
192		ELBOW	360	141.3		2								
193		BEND	360	114.3							2			
194		BEND	360	141.3							4			
195	MAW27BR001	BEND	360	141.3							5			
196		BEND	360	114.3							2			
197		ELBOW	360	141.3		2								
198		FLANGE	360	141.3					2					
199		REDUCER	360	141.3				1						
200		TUBE/PIPE	360	114.3	2									
201	MAW28BR001	TUBE/PIPE	360	141.3	8									
202		BEND	360	114.3							2			
203		BEND	360	141.3							3			
204		ELBOW	360	141.3		2								
205		FLANGE	360	141.3					2					
206		REDUCER	360	141.3				1						
207		TUBE/PIPE	360	114.3	2									
208		TUBE/PIPE	360	141.3	9									
209	MAW50BR003	TUBE/PIPE	530	219.3	0.5									
210		OLET	530	219.3			1						1	
211		FLANGE	530	219.3					2					

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**Bill of Materials for Thermal Insulation of TIP
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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
212	MAW50BR001	VALVE	582	457						2				
213		TUBE/PIPE	582	457	3									
214		TEE	582	457			1							
215		OLET	582	457									3	
216		REDUCER	582	457				1						
217		BEND	582	457							4			
218	MAW50BR002	ELBOW	582	457		1								
219		VALVE	582	457						1				
220		TUBE/PIPE	582	457	13									
221		TEE	582	457			1							
222		ELBOW	582	457		9								
223		BEND	582	457							4			
224	MAW50BR103	VALVE	582	457						1				
225		TUBE/PIPE	582	457	1.5									
226		BEND	582	457		2								
227	MAW50BR104	ELBOW	582	457		3								
228		TUBE/PIPE	582	457	1									
229		TUBE/PIPE	510	114.3	2									
230	MAW60BR001	TUBE/PIPE	510	141.3	3									
231		REDUCER	510	141.3				1						
232		ELBOW	510	114.3		1								
233		BEND	510	141.3							2			
234	MAW60BR002	TUBE/PIPE	510	114.3	2									
235		TUBE/PIPE	510	141.3	3									
236		REDUCER	510	141.3				1						
237		BEND	510	114.3							1			
238		ELBOW	510	114.3		1								
239	MAW60BR003	BEND	510	141.3							2			
240		TUBE/PIPE	510	168.3	5.5									
241		TEE	510	168.3			2							
242		BEND	510	219.1							2			
243		ELBOW	510	168.3		1								
244		CAP	510	168.3								1		



STE-TL Engineering Department
HEEP, Haridwar

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Seal Steam System**

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
245	MAW60BR004	TUBE/PIPE	510	114.3	2									
246		TUBE/PIPE	510	141.3	2.5									
247		REDUCER	510	141.3				1						
248		ELBOW	510	114.3		1								
249		BEND	510	114.3							2			
250	MAW60BR005	BEND	510	141.3							2			
251		TUBE/PIPE	510	114.3	2									
252		TUBE/PIPE	510	141.3	2.5									
253		REDUCER	510	141.3				1						
254		ELBOW	510	114.3		1								
255	MAW60BR006	BEND	510	114.3							2			
256		BEND	510	141.3							2			
257		TUBE/PIPE	510	168.3	3									
258		TEE	510	168.3			2							
259		BEND	510	168.3							1			
260	MAW60BR007	CAP	510	168.3								1		
261		TUBE/PIPE	510	219.1	2									
262		TEE	510	219.1			2							
263		CAP	510	219.1								1		
264		TUBE/PIPE	452	48.3	0.5									
265	MAW60BR008	TUBE/PIPE	452	219.1	13.5									
266		OLET	452	219.1									2	
267		TEE	452	219.1			1							
268		BEND	452	219.1							4			
269		ELBOW	452	219.1		5								
270	MAW60BR001	CAP	452	114.3								1		
271		VALVE	220	355.6						1				
272		TUBE/PIPE	220	141.3	2									
273		TUBE/PIPE	220	355.6	34.5									
274		TEE	220	355.6			3							
275		REDUCER	220	355.6				2						
276		BEND	220	141.3							3			
277		ELBOW	220	355.6		5								

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**Bill of Materials for Thermal Insulation of TIP
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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
278	MAW80BR002	TUBE/PIPE	320	323.8	5									
279		TUBE/PIPE	320	141.3	9.5									
280		TEE	320	323.8			2							
281		BEND	320	323.8							1			
282	MAW80BR003	ELBOW	320	323.8		3								
283		TUBE/PIPE	320	273	4									
284		REDUCER	320	273				1						
285		TEE	320	273			2							
286		CAP	320	273								1		
287	MAW80BR004	TUBE/PIPE	220	33.4	0.5									
288		TUBE/PIPE	220	273	10									
289		TEE	220	273			3							
290		FLANGE	220	60.3					2					
291		ELBOW	220	273		7								
292	MAW80BR005	TUBE/PIPE	220	33.4	3									
293		TEE	220	33.4			1							
294		REDUCER	220	33.4				2						
295		ELBOW	220	33.4		8								
296		TUBE/PIPE	220	33.4	3									
297	MAW80BR006	TEE	220	33.4			1							
298		REDUCER	220	33.4				1						
299		BEND	220	33.4		4								
300		ELBOW	220	168.3		3								
301	MAW80BR007	TUBE/PIPE	220	168.3	3									
302		VALVE	220	168.3						1				
303		TUBE/PIPE	220	168.3	3									
304		TEE	220	168.3			1							
305	MAW80BR008	FLANGE	220	168.3					2					
306		ELBOW	220	168.3		4								
307		VALVE	220	168.3						1				
308		TUBE/PIPE	220	168.3	3									
309	MAW80BR009	ELBOW	220	168.3		3								
310		FLANGE	220	168.3					2					
311		TUBE/PIPE	220	219.1	0.5									
312	MAW80BR010	REDUCER	220	219.1				1						

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STE-TL Engineering Department
HEPP, Haridwar

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Seal Steam System**

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
313	MAW808R011	TUBE/PIPE	220	219.1	0.5									
314		REDUCER	220	219.1				1						
315		TUBE/PIPE	220	33.4	12									
316		TEE	220	219.1			1							
317	MAW808R012	BEND	220	33.4							5			
318		ELBOW	220	219.1		2								
319		FLANGE	220	219.1					2					
320		TUBE/PIPE	220	219.1	4									
321	MAW808R013	TUBE/PIPE	220	33.4	12									
322		TEE	220	219.1			1							
323		BEND	220	33.4							5			
324		ELBOW	220	219.1		4								
325		FLANGE	220	219.1					2					
326		VALVE	220	219.1						1				
327		BEND	220	219.1							1			
328		TUBE/PIPE	220	219.1	10									
329	MAW808R014	TUBE/PIPE	220	355.6	2									
330		VALVE	220	355.6						1				
331		TEE	220	355.6			1							
332		BEND	220	355.6							1			
333	MAW808R015	ELBOW	220	355.6		2								
334		TUBE/PIPE	220	33.4	1.5									
335		REDUCER	220	33.4				1						
336		BEND	220	33.4							3			
337	MAW818R001	ELBOW	320	114.3		1								
338		BEND	320	168.3							2			
339		REDUCER	320	168.3				1						
340		TUBE/PIPE	320	114.3	2									
341		TUBE/PIPE	320	168.3	2.5									

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
342	MAW81BR002	ELBOW	320	114.3		1								
343		ELBOW	320	168.3		1								
344		TUBE/PIPE	320	168.3	2.5									
345		TUBE/PIPE	320	114.3	2									
346		REDUCER	320	168.3			1							
347		BEND	320	168.3							1			
348	MAW81BR003	VALVE	320	219.1						1				
349		BEND	320	219.1							3			
350		TUBE/PIPE	320	219.5	6									
351		TEE	320	219.1			1							
352		REDUCER	320	219.1				1						
353		FLANGE	320	219.1					2					
354	MAW82BR001	ELBOW	320	114.3		1								
355		ELBOW	320	168.3		1								
356		BEND	320	114.3							2			
357		REDUCER	320	168.3				1						
358		BEND	320	168.3							2			
359		TUBE/PIPE	320	114.3	1.5									
360	MAW82BR002	TUBE/PIPE	320	168.3	1.5									
361		BEND	320	114.3										
362		BEND	320	168.3							3			
363		ELBOW	320	114.3		1					2			
364		REDUCER	320	168.3				1						
365		TUBE/PIPE	320	114.3	1.5									
366	MAW82BR003	TUBE/PIPE	320	168.3	1.5									
367		ELBOW	320	219.1		2								
368		TUBE/PIPE	320	219.1	7									
369		REDUCER	320	219.1				1						
370		FLANGE	320	219.1					2					
371		BEND	320	219.1							2			
372		TEE	320	219.1			1							
373		VALVE	320	219.1						1				

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
374	MAW83BR001	FLANGE	320	168.3					2					
375		BEND	320	114.3							2			
376		BEND	320	141.3							5			
377		REDUCER	320	141.3				1						
378		TUBE/PIPE	320	141.3	5.5									
379		TUBE/PIPE	320	114.3	1.5									
380	MAW84BR001	VALVE	320	141.3						1				
381		FLANGE	320	141.3					2					
382		TUBE/PIPE	320	141.3	7									
383		TUBE/PIPE	320	114.3	1.5									
384		REDUCER	320	141.3				1						
385		VALVE	320	141.3						1				
386	MAW85BR001	BEND	320	141.3							2			
387		BEND	220	88.9							3			
388		TUBE/PIPE	220	88.9	2									
389		BEND	220	141.3							3			
390		FLANGE	220	141.3					2					
391		REDUCER	220	141.3				1						
392	MAW86BR002	TUBE/PIPE	220	141.3	1									
393		VALVE	220	141.3						1				
394		TUBE/PIPE	220	88.9	1.5									
395		BEND	220	88.9							5			
396		REDUCER	220	141.3				1						
397		FLANGE	220	141.3					2					
398	MAW87BR001	VALVE	220	141.3						1				
399		TUBE/PIPE	220	141.3	1									
400		BEND	220	141.3							1			
401		BEND	220	88.9							3			
402		TUBE/PIPE	220	88.9	1.5									
403		ELBOW	220	141.3		1								
404	MAW87BR002	FLANGE	220	141.3					2					
405		VALVE	220	141.3						1				
406		REDUCER	220	141.3				1						
407		TUBE/PIPE	220	88.9	1									
408		TUBE/PIPE	220	141.3	2									

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**Bill of Materials for Thermal Insulation of TIP
Seal Steam System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
409	MAW88BR001	BEND	220	88.9							3			
410		TUBE/PIPE	220	88.9	1									
411		REDUCER	220	141.3				1						
412	MAW88BR002	FLANGE	220	141.3					2					
413		VALVE	220	141.3						1				
414		TUBE/PIPE	220	141.3	1.5									
415		BEND	220	141.3							2			



**Bill of Materials for Thermal Insulation of TIP
Overload Piping System**

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (m)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	OLET	Insulation Thickness (mm) To be filled by vendor
1	MAA14BR001	TUBE/PIPE	600	219.1	22.0								
2		BEND	600	219.1							7		
3		TUBE/PIPE	600	60.3	0.5								
4		Weldolet	600	60.3								1	
5		ELBOW	600	60.3	-	1							
6	MAA14BR002	TUBE/PIPE	600	219.1	19.5								
7		TEE	600	219.1			1						
8		BEND	600	219.1							7		
9		TUBE/PIPE	600	60.3	1.0								
10		ELBOW	600	60.3		1							
11		Weldolet	600	60.3								1	
12		TUBE/PIPE	549	168.3	3.5								
13		ELBOW	549	168.3		2							
14		Weldolet	549	168.3	-							1	
15		TUBE/PIPE	549	219.1	10.0			1					
16	MAA14BR003	ELBOW	549	219.1		5							
17		REDUCER	549	219.1				1					
18		VALVE	549	33.4	-					2			
19		Weldolet	549	33.4	-							1	
20		REDUCER	549	33.4	-			1					
21	MAA14BR004	TUBE/PIPE	549	33.4	1.0								
22		VALVE	549	33.4	-					2			
23		Weldolet	549	33.4								1	
24		REDUCER	549	33.4				1					
25		TUBE/PIPE	549	33.4	1.0								
26		TUBE/PIPE	549	168.3	3.5	3						1	
27		BEND	549	219.1							1		
28		REDUCER	549	219.1				1					
		TUBE/PIPE	549	219.1	14.0	7							

**Bill of Materials for Thermal Insulation of TIP
Overload Piping System**

BHEL DOC NO: 412114V6001 REV_00
Dated : 16.01.2019

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
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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 22 (Twenty Two) pages. Turbine Drainage System = 7 Pages, Seal Steam System = 13 Pages & Overload Piping System = 2 Page.

SPECIAL INSTRUCTIONS:

BHEL REQUIREMENTS		VENDOR'S CHECKPOINT (To be filled by Vendor)
Checklist for Vendors	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 412114V6000 , 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 °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: RAJEEV KUMAR (Sr Engr-PED)

APPROVED BY: SH ANUJ JAIN (DGM-PED)

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN				TO BE FILLED BY BHEL			TO BE FILLED BY BHEL		
BHEL	VENDOR'S NAME	ITEM	QP NO.		Page 1 of 1	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS			REMARKS
			DATED	S				B	C		
		DRG. NO.	AS PER PO					9	D		
		SPEC.	AS PER PO					8			
		REV						7			
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	7	8	9	D	10	11
1	2	3	4	5	6	7	8	9	D	10	11

[illegible]

		LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. S: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY C: CUSTOMER 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