MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING	QP. NO.:	QA/BE/QP/316/SQP	
				REV. NO.:	00	
		DRG. NO.:	AS PER DRWAING			
		REV. NO.:	AS PER DRWAING			
		SPEC. NO.:	ST 29005			
		REV. NO.:	04	Page 1 of 2		

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11
1.0	Material												
1..0	Bonded mineral / Rockwell mattresses	**NOTE: NTPC approved Insulation Material Supplier are - M/s Lloyd Insulation - Daman/ Durgapur/ Jamshedpur, M/s Minwool Rock Fibre, – Rajnandgaon / Hyderabad, M/s Rockwool India – Medak & M/s Lapninus Rockwool - Malanpur**											
1.1	Routine tests												
1.1.1		Chemical Composition	Major	Chemical	1 Sample/lot	Vendor's Std	Vendor's Std	TC	√	P	-	-	
1.1.2		Bulk Density	Major	Physical	Sample As Per IS 8183	IS 3144	IS 8183	TC	√	P	W	-	
1.1.3		Recovery After Compression	Major	Physical	-do-	IS 8183	IS 8183	TC	√	P	W	-	
1.1.4		Shot Content	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	W	-	
1.1.5		Moisture Content and Moisture Absorption	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	W	-	
1.1.6		Incombustibility	Major	Thermal	-do-	IS 3144	IS 8183	TC	√	P	W	-	
1.1.7		Thermal Conductivity or K - Value	Major	Thermal	Sample As Per IS 3144	IS 3346	IS 8183	TC	√	P	W	-	Refer Note:1
1.1.8		Sulphur Content	Major	Chemical	Sample As Per IS 8183	IS 3144	IS 8183	TC	√	P	W	-	
1.1.9		Dimensional check	Major	Measurement	-do-	IS 3144	IS 8183	IR	√	P	W	-	
1.1.10		Fibre Diameter	Major	Measurement	-do-	IS 3144	IS 8183	IR	√	P	W	-	
1.1.11		Resistance to Vibration	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	V	-	
1.1.12		Heat Resistance	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	V	-	
1.1.13		Alkalinity	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	V	-	
1.1.14		Corrosive Attack / Chloride Content	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	V	-	
2.0	Sheathing Material-Aluminium Sheet (Gr.19000)												
2.1		Chemical Composition	Major	Analysis	Sample As Per IS 737	IS 737	IS 737	TC	√	P	V	-	
2.2		Tensile Test & Elongation	Major	Physical	-do-	IS 737	IS 737	TC	√	P	V	-	
2.3		Bend test	Major	Physical	-do-	IS 737	IS 737	TC	√	P	V	-	
2.4		Gauging / Thickness	Major	Measurement	-do-	ST 29005	ST 29005 / Appd BOM	IR	√	P	V	-	
3.0	Galvanised Steel / Stainless Steel Wire for Netting, Binding, Stitching & Lacing												
3.1		Chemical Composition	Major	Analysis	Sample As Per IS 6528 / IS 280	IS 6528/IS 280	IS 6528 / IS 280	TC	√	P	V	-	

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/SUBCONTRACTOR		RECORDS IDENTIFIED WITH (√) 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER 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 25.01.17

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING	QP. NO.:	QA/BE/QP/316/SQP		
				REV. NO.:	00		
		DRG. NO.:	AS PER DRWAING				
		REV. NO.:	AS PER DRWAING				
		SPEC. NO.:	ST 29005				
		REV. NO.:	04		Page 2 of 2		

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11
3.2		Dimensions (Size of netting & Dia / Gauge of Wire)	Major	Measurement	-do-	ST 29005	ST 29005 / Appd BOM	IR	√	P	V	-	
3.3		Tensile Test & Elongation	Major	Physical	-do-	IS 6528/ IS 280	IS 6528 / IS 280	TC	√	P	V	-	
3.4		Wrapping Test	Major	Physical	-do-	IS 6528/ IS 280	IS 6528 / IS 280	TC	√	P	V	-	
3.5		Bend Test	Major	Physical	-do-	IS 6528 / IS 280	IS 6528 / IS 280	TC	√	P	V	-	
3.6		Mass of Coating for GI Wire	Major	Measurement	-do-	IS 280	IS 280	TC	√	P	V	-	
4.0	Straps, Bands & Screws												
4.1		Dimensional	Major	Measurement	--	ST 29005	ST 29005	COC	-	P	-	-	
4.2		Visual	Major	Physical	--	ST 29005	ST 29005	COC	-	P	-	-	
5.0	Packing / Marking & Storage												
5.1		Identification (Batch no., Thickness, Density) & Marking	Major	Visual	100%	ST 29005	ST 29005	IR	-	P	-	-	
5.2		Packing & Despatch	Major	Visual	100%	ST 29005	ST 29005	IR	-	P	-	-	

NOTE: 1. Thermal Conductivity or 'K' Value test report on the samples identified and tested in last one year shall be reviewed by BHEL / BHEL nominated inspection agency and NTPC. However samples for Thermal Conductivity or 'K' Value test shall be identified by BHEL / BHEL nominated inspection agency and NTPC from **each lot** and test shall be conducted at (NTPC 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 & NTPC for review and acceptance.

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/SUBCONTRACTOR		RECORDS IDENTIFIED WITH (√) 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR'B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER 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		5.01.17 आरती मीना/Aarti Meena अभियन्ता/Engineer APPROVED BY गुणता आश्वासन/Quality Assurance बी. एच. ई. एल., हरिद्वार BHEL, Haridwar

Project Engineering Department
HEEP, Haridwar

DOC.NO. 412114V2000
REV.NO. 00
DATE: 17.07.2015

THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING

PROJECT: 660 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
- NO ASBESTOS USE IN INSULATION IS PERMITTED.

MATERIALS:

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

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

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

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	MAG10BR100	TUBE/PIPE	450	1016	4500								
2		TUBE/PIPE	450	114.3	150								
3		TUBE/PIPE	450	168.3	150								
4		FLANGE	450	168.3	-				1				
5		TUBE/PIPE	450	168.3	650								
6		TEE	450	168.3	-		1						
7		WELDOLET	450	33.4	-							2	
8		WELDOLET	450	168.3	-							1	
9		WELDOLET	450	323.9	-							2	
10		ELBOW	450	1016	-	1							
11		TUBE/PIPE	450	1016	2000								
12	MAG10BR101	ELBOW	450	323.9	-	2							
13		TUBE/PIPE	450	323.9	4000								
14	MAG10BR102	ELBOW	80	323.9	-	1							
15		FLANGE	80	323.9	-				1				
16		FLANGE	80	323.9	-				1				
17		TEE	80	323.9	-		1						
18		TUBE/PIPE	80	323.9	16500								
19	MAG10BR110	TUBE/PIPE	450	1016	4500								
20		TUBE/PIPE	450	114.3	150								
21		TUBE/PIPE	450	168.3	150								
22		FLANGE	450	168.3	-				1				
23		WELDOLET	450	323.9	-							2	
24		ELBOW	450	1016	-	1							
25		TUBE/PIPE	450	1016	2500								
26	MAG10BR111	ELBOW	450	323.9	-	2							
27		TUBE/PIPE	450	323.9	3800								

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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDOLET	Insulation Thickness (mm) To be filled by vendor
28	MAG10BR112	ELBOW	80	323.9	-	1							
29		FLANGE	80	323.9	-				1				
30		FLANGE	80	323.9	-				1				
31		TEE	80	323.9	-		1						
32		TUBE/PIPE	80	323.9	17000								
33	MAL01BR001	ELBOW	593	323.8	-	1							
34		TUBE/PIPE	593	323.8	2600								
35		WELDOLET	593	33.4	-							1	
36		WELDOLET	593	73	-							4	
37	MAL02BR001	ELBOW	593	323.8	-	1							
38		TUBE/PIPE	593	323.8	2500								
39		WELDOLET	593	73	-							1	
40		WELDOLET	593	33.4	-							3	
41	MAL03BR001	ELBOW	593	323.8	-	1							
42		TUBE/PIPE	593	323.8	4600								
43		WELDOLET	593	114.3	-							1	
44		WELDOLET	593	48.3	-							1	
45		WELDOLET	593	60.3	-							3	
46		WELDOLET	593	73	-							2	
47	MAL04BR001	ELBOW	593	323.8	-	2							
48		TUBE/PIPE	593	323.8	3500								
49		WELDOLET	593	60.3	-							1	
50		WELDOLET	593	73	-							2	
51		WELDOLET	593	114.3	-							2	
52	MAL11BR001	TEE	565	60.3	-		1						
53		BEND	565	60.3	-						15		
54		VALVE	565	Nb50	-					1			
55		TUBE/PIPE	565	60.3	18000								
56		VALVE	565	Nb50	-					1			

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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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDOLET	Insulation Thickness (mm) To be filled by vendor
57	MAL12BR001	TEE	565	60.3	-		1						
58		BEND	565	60.3	-						3		
59		VALVE	565	Nb50	-					1			
60		BEND	565	60.3	-						7		
61		TUBE/PIPE	565	60.3	15000								
62		VALVE	565	Nb50	-					1			
63	MAL14BR001	VALVE	486	Nb40	-					1			
64		TEE	486	48.3	-		1						
65		VALVE	486	Nb40	-					1			
66		BEND	486	48.3	-						16		
67		TUBE/PIPE	486	48.3	26000								
68	MAL19BR001	TEE	565	60.3	-		1						
69		BEND	565	60.3	-						1		
70		VALVE	565	Nb50	-					1			
71		BEND	565	60.3	-						15		
72		TUBE/PIPE	565	60.3	22000								
73		VALVE	565	Nb50	-					1			
74	MAL20BR001	REDUCER	535	114.3	-			1					
75		TEE	535	60.3	-		1						
76		BEND	535	60.3	-						4		
77		VALVE	535	Nb50	-					1			
78		BEND	535	60.3	-						6		
79		TUBE/PIPE	535	60.3	22000								
80		VALVE	535	Nb50	-					1			
81	MAL22BR001	TUBE/PIPE	505	48.3	9000								
82		TUBE/PIPE	505	60.3	17000								
83		REDUCER	505	114.3	-			1					
84		BEND	505	114.3	-						7		
85		BEND	505	60.3	-						8		
86		VALVE	505	Nb50	-					2			
87		ELBOW	505	48.3	-	2							
88		REDUCER	505	60.3	-			1					
89		TEE	505	60.3	-		2						

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDOLET	Insulation Thickness (mm) To be filled by vendor
90	MAL23BR001	TUBE/PIPE	593	33.4	2000								
91		TEE	593	60.3	-		2						
92		BEND	593	33.4	-						3		
93		BEND	593	33.4	-						7		
94		VALVE	593	Nb50	-					5			
95		BEND	593	60.3	-						13		
96		TUBE/PIPE	593	60.3	21500								
97	MAL24BR001	TUBE/PIPE	593	33.4	1500								
98		TEE	593	60.3	-		2						
99		BEND	593	33.4	-						2		
100		BEND	593	33.4	-						5		
101		VALVE	593	Nb50	-					5			
102		BEND	593	60.3	-						9		
103		TUBE/PIPE	593	60.3	28000								
104	MAL25BR001	VALVE	439	Nb40	-					2			
105		TUBE/PIPE	439	48.3	16000								
106		BEND	439	48.3	-						11		
107		TEE	439	48.3	-		1						
108	MAL26BR001	TEE	593	60.3	-		1						
109		BEND	593	60.3	-						8		
110		VALVE	593	Nb50	-					2			
111		BEND	593	60.3	-						7		
112		TUBE/PIPE	593	60.3	16500								
113	MAL27BR001	TEE	593	60.3	-		1						
114		BEND	593	60.3	-						5		
115		VALVE	593	Nb50	-					2			
116		BEND	593	60.3	-						7		
117		TUBE/PIPE	593	60.3	22500								

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDOLET	Insulation Thickness (mm) To be filled by vendor
118	MAL31BR001	TUBE/PIPE	593	33.4	21000								
119		REDUCER	593	60.3	-			1					
120		TEE	593	60.3	-		2						
121		BEND	593	33.4	-						9		
122		BEND	593	60.3	-						7		
123		VALVE	593	Nb50	-					2			
124		WELDOLET	593	21.3	-							1	
125		TUBE/PIPE	593	60.3	10500								
126	MAL41BR001	TEE	410	60.3	-		1						
127		BEND	410	60.3	-						8		
128		VALVE	410	Nb50	-					2			
129		TUBE/PIPE	410	60.3	11500								
130	MAL45BR001	TUBE/PIPE	492	60.3	19000								
131		BEND	492	60.3	-						10		
132		VALVE	492	Nb50	-					2			
133		TEE	492	60.3	-		1						
134	MAL47BR001	TUBE/PIPE	432	60.3	6500								
135		BEND	432	60.3	-						5		
136		VALVE	432	Nb50	-					2			
137		TEE	432	60.3	-		1						
138	MAL51BR001	TUBE/PIPE	313	33.4	20500								
139		TUBE/PIPE	313	60.3	5500								
140		TEE	313	33.4	-		1						
141		BEND	313	33.4	-						14		
142		TEE	313	60.3	-		1						
143		VALVE	313	Nb50	-					2			
144	MAL54BR001	VALVE	180	Nb80	-					2			
145		TUBE/PIPE	180	88.9	23000								
146		BEND	180	88.9	-						6		
147		TEE	180	88.9	-		1						

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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELDO LET	Insulation Thickness (mm) To be filled by vendor
148	MAL55BR001	VALVE	125	Nb80	-					2			
149		TUBE/PIPE	125	88.9	30000								
150		BEND	125	88.9	-						10		
151		TEE	125	88.9	-		1						
152	MAL65BR001	TEE	369	60.3	-		1						
153		BEND	369	60.3	-						6		
154		VALVE	369	Nb50	-					2			
155		ELBOW	369	60.3	-	1							
156		TUBE/PIPE	369	60.3	23000								
157	MAL81BR001	VALVE	540	Nb25	-					2			
158		TUBE/PIPE	540	33.4	30000								
159		BEND	540	33.4	-						18		
160		TEE	540	33.4	-		3						
161	MAL91BR001	TUBE/PIPE	593	33.4	32000								
162		REDUCER	593	60.3	-			1					
163		TEE	593	33.4	-		1						
164		BEND	593	33.4	-						19		
165	MAL92BR001	TUBE/PIPE	593	33.4	2500								
166		REDUCER	593	60.3	-			1					
167		BEND	593	33.4	-						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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
1	LBC41BR001	ELBOW	369	150	-	5							
2		TUBE/PIPE	369	150	11000								
3		VALVE	369	250	-					1			
4		BEND	369	150	-						2		
5	LBC41BR002	ELBOW	369	250	-	2							
6		TUBE/PIPE	369	250	4000								
7		BEND	369	250	-						2		
8	MAM10BR001	TUBE/PIPE	525	40	5500								
9		BEND	525	40	-						1		
10		BEND	525	40	-						5		
11	MAM10BR002	TUBE/PIPE	525	40	20000								
12		BEND	525	40	-						1		
13		BEND	525	40	-						9		
14	MAM10BR003	TUBE/PIPE	525	40	34500								
15		BEND	525	40	-						1		
16		BEND	525	40	-						9		
17	MAM10BR004	TUBE/PIPE	525	40	7000								
18		BEND	525	40	-						6		
19	MAM10BR005	TUBE/PIPE	525	20	21000								
20		BEND	525	20	-						11		
21	MAM10BR008	TUBE/PIPE	525	50	17000								
22		BEND	525	50	-						8		
23		TEE	525	50	-		2						
24	MAM10BR010	TUBE/PIPE	525	50	16000								
25		BEND	525	50	-						6		
26		TEE	525	50	-		2						
27	MAM20BR001	TUBE/PIPE	313	25	4700								
28		BEND	313	25	-						5		

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
29	MAM20BR002	TUBE/PIPE	313	25	5000								
30		BEND	313	25	-						5		
31	MAM20BR003	TUBE/PIPE	411	40	12000								
32		BEND	411	40	-.						5	.	
33	MAM20BR005	OLET	313	80	-							1	
34		ELBOW	313	80	-	3							
35		TUBE/PIPE	313	25	250								
36		TUBE/PIPE	313	40	150								
37		TUBE/PIPE	313	80	9000								
38		BEND	313	25	-						2		
39		BEND	313	40	-						1		
40	MAM20BR006	TUBE/PIPE	525	40	9500								
41		BEND	525	40	-						9		
42	MAM20BR007	ELBOW	525	40	-	7							
43		TUBE/PIPE	525	40	8000								
44		BEND	525	40	-						1		
45	MAM20BR008	OLET	525	100	-							1	
46		ELBOW	525	100	-	1							
47		TUBE/PIPE	525	100	9500								
48		BEND	525	100	-						1		
49		TEE	525	100	-		4						
50	MAM20BR009	ELBOW	505	40	-	9							
51		TUBE/PIPE	505	40	8500								
52		BEND	505	40	-						1		
53	MAM20BR010	TUBE/PIPE	505	40	11000								
54		BEND	505	40	-						9		
55	MAM30BR001	TUBE/PIPE	587	32	7500								
56		BEND	587	32	-						6		

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
57	MAM30BR002	TUBE/PIPE	587	32	32000								
58		BEND	587	32	-						17		
59	MAM30BR003	TUBE/PIPE	587	32	48000								
60		BEND	587	32	-		15				17		
61	MAM30BR004	TUBE/PIPE	587	32	7000								
62		BEND	587	32	-						4		
63	MAM30BR008	TUBE/PIPE	587	50	22000								
64		BEND	587	50	-						10		
65		TEE	587	50	-		2						
66	MAM30BR010	ELBOW	587	50	-	2							
67		TUBE/PIPE	587	50	17000								
68		BEND	587	50	-						4		
69		TEE	587	50	-		2						
70	MAW10BR001	TUBE/PIPE	320	200	2000								
71		BEND	320	200	-						4		
72		ELBOW	320	200	-	1							
73		TEE	320	200	-		1						
74		VALVE	320	200	-					1			
75	MAW10BR101	TUBE/PIPE	335	100	1000								
76		BEND	335	100	-						1		
77		TEE	335	100	-		1						
78		VALVE	335	200	-					1			
79		VALVE	335	100	-					1			
80	MAW10BR103	ELBOW	335	100	-	1							
81		TUBE/PIPE	335	100	1000								
82		REDUCER	335	200	-			1					
83		BEND	335	100	-						2		
84		VALVE	335	100	-					1			

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
85	MAW10BR104	TUBE/PIPE	320	200	2000								
86		BEND	320	200	-						2		
87	MAW20BR001	TUBE/PIPE	470	300	300								
88		BEND	470	300	-						1		
89		ELBOW	470	250	-	3							
90		OLET	470	250	-							1	
91		FLANGE	470	273	-				2				
92		REDUCER	470	250	-			1					
93		TEE	470	250	-		2						
94		TUBE/PIPE	470	250	5000								
95	MAW20BR002	TUBE/PIPE	470	300	3000								
96		BEND	470	300	-						1		
97		OLET	470	300	-							2	
98		REDUCER	470	300	-			1					
99		TEE	470	300	-		3						
100	MAW20BR003	TEE	340	250	-		3						
101		ELBOW	340	250	-	2							
102		FLANGE	340	250	-				2				
103		OLET	340	250	-							4	
104		TUBE/PIPE	340	250	10500								
105	MAW20BR004	TUBE/PIPE	340	80	400								
106		FLANGE	340	80	-				2				
107		BEND	340	80	-						1		
108		OLET	340	80	-							1	
109	MAW20BR005	ELBOW	340	25	-	2							
110		TUBE/PIPE	340	15	200								
111		TUBE/PIPE	340	25	550								
112		TUBE/PIPE	340	80	5500								
113		REDUCER	340	15	-			2					

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
114	MAW20BR005	BEND	340	25	-						2		
115		BEND	340	80	-						4		
116		VALVE	340	15	-					2			
117		OLET	340	80	-							2	
118	MAW21BR001	ELBOW	470	100	-	5							
119		TUBE/PIPE	470	100	6000								
120		FLANGE	470	114.3	-				2				
121	MAW21BR002	ELBOW	470	100	-	4							
122		TUBE/PIPE	470	100	7700								
123		FLANGE	470	114.3	-				2				
124	MAW21BR003	TUBE/PIPE	470	150	7700								
125		REDUCER	470	100	-			1					
126		BEND	470	150	-						3		
127		TEE	470	150	-		1						
128	MAW22BR001	ELBOW	470	150	-	3							
129		TUBE/PIPE	470	150	9000								
130		REDUCER	470	100	-			1					
131		TEE	470	150	-		1						
132	MAW22BR002	ELBOW	470	100	-	3							
133		TUBE/PIPE	470	100	6600								
134		BEND	470	100	-						1		
135		FLANGE	470	114.3	-				2				
136	MAW22BR003	ELBOW	470	100	-	3							
137		TUBE/PIPE	470	100	5500								
138		BEND	470	100	-						1		
139		FLANGE	470	114.3	-				2				
140	MAW23BR001	ELBOW	470	100	-	4							
141		TUBE/PIPE	470	100	5500								
142		FLANGE	470	114.3	-				2				

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
143	MAW23BR002	ELBOW	470	100	-	3							
144		TUBE/PIPE	470	100	6000								
145		FLANGE	470	114.3	-				2				
146	MAW23BR003	ELBOW	470	150	-	3							
147		TUBE/PIPE	470	150	9500								
148		REDUCER	470	150	-			1					
149		TEE	470	150	-		1						
150	MAW24BR001	ELBOW	470	125	-	2							
151		TUBE/PIPE	470	125	4700								
152		REDUCER	470	141.3	-			1					
153	MAW24BR002	ELBOW	470	125	-	2							
154		TUBE/PIPE	470	125	4000								
155		REDUCER	470	141.3	-			1					
156	MAW24BR003	ELBOW	470	150	-	7							
157		TUBE/PIPE	470	150	8500								
158		REDUCER	470	125	-			1					
159		TEE	470	150	-		1						
160	MAW24BR004	ELBOW	470	100	-	2							
161		TUBE/PIPE	470	100	3000								
162		FLANGE	470	100	-				2				
163	MAW24BR005	ELBOW	470	100	-	2							
164		TUBE/PIPE	470	100	2100								
165		FLANGE	470	100	-				2				
166	MAW25BR001	ELBOW	340	100	-	5							
167		TUBE/PIPE	340	100	10000								
168		BEND	340	100	-						2		
169		FLANGE	340	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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
170	MAW26BR001	ELBOW	340	100	-	7							
171		TUBE/PIPE	340	100	9500								
172		FLANGE	340	100	-				2				
173		OLET	340	100	-							1	
174	MAW50BR001	ELBOW	540	400	-	1							
175		TUBE/PIPE	540	400	2500								
176		REDUCER	540	400	-			2					
177		VALVE	540	400	-					2			
178		BEND	540	400	-						2		
179		OLET	540	26.67	-							1	
180		OLET	540	48.3	-							2	
181		OLET	540	168.3	-							1	
182		TEE	540	400	-		1						
183	MAW50BR002	ELBOW	540	450	-	9							
184		TUBE/PIPE	540	450	7000								
185		VALVE	540	450	-					1			
186		BEND	540	450	-						3		
187		TEE	540	450	-		1						
188		TUBE/PIPE	540	450	3000								
189	MAW50BR003	FLANGE	540	168.3	-	2							
190		TUBE/PIPE	540	150	500								
191		BEND	540	150	-						1		
192		OLET	540	168.3	-							1	
193	MAW50BR103	TUBE/PIPE	540	400	2000		1						
194		VALVE	540	400	-		1						
195		BEND	540	400	-		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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
196	MAW50BR104	ELBOW	540	450	-	1							
197		TUBE/PIPE	540	450	1500								
198		BEND	540	450	-						2		
199		REDUCER	540	450	-			1					
200	MAW60BR001	ELBOW	473	100	-	2							
201		TUBE/PIPE	471	100	4500								
202		BEND	471	100	-						1		
203	MAW60BR002	ELBOW	473	100	-	2							
204		TUBE/PIPE	471	100	4500								
205		BEND	471	100	-						1		
206	MAW60BR003	ELBOW	471	150	-	2							
207		TUBE/PIPE	471	150	5000								
208		BEND	471	150	-						1		
209		TEE	471	150	-		2						
210	MAW60BR004	ELBOW	473	100	-	5							
211		TUBE/PIPE	471	100	5500								
212		BEND	471	100	-						1		
213	MAW60BR005	ELBOW	473	100	-	5							
214		TUBE/PIPE	471	100	5500								
215		BEND	471	100	-						1		
216	MAW60BR006	ELBOW	471	150	-	2							
217		TUBE/PIPE	471	150	3000								
218		BEND	471	150	-						1		
219		TEE	471	150	-		2						
220	MAW60BR007	ELBOW	471	200	-	6							
221		BEND	471	200	-						3		
222		OLET	471	200	-							2	
223		TEE	471	200	-		2						
224		TUBE/PIPE	471	200	15500								

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
225	MAW60BR008	TUBE/PIPE	471	100	100								
226		TEE	471	100	-		1						
227	MAW80BR001	TUBE/PIPE	310	80	500								
228		BEND	310	80	-						2		
229		FLANGE	310	150	-				1				
230		TUBE/PIPE	310	150	500								
231		REDUCER	310	300	-			1					
232		TEE	310	300	-		1						
233		VALVE	310	300	-					2			
234		ELBOW	310	300	-	9							
235		TEE	310	300	-		2						
236		TUBE/PIPE	310	300	38000								
237	MAW80BR002	TUBE/PIPE	310	250	6500								
238		REDUCER	310	250	-			1					
239		TEE	310	250	-		2						
240	MAW80BR003	TUBE/PIPE	310	200	2500								
241		TEE	310	200	-		2						
242	MAW80BR004	FLANGE	310	50	-				2				
243		TUBE/PIPE	310	25	250								
244		TUBE/PIPE	310	50	200								
245		BEND	310	250	-						1		
246		ELBOW	310	250	-	5							
247		TUBE/PIPE	310	250	6000								
248	MAW80BR005	ELBOW	310	25	-	1							
249		TUBE/PIPE	310	25	3000								
250		REDUCER	310	25	-			2					
251		BEND	310	25	-						6		
252		TEE	310	25	-		1						

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
253	MAW80BR006	ELBOW	310	25	-	5							
254		TUBE/PIPE	310	25	3000								
255		REDUCER	310	25	-			2					
256		TEE	310	25	-		1						
257	MAW80BR007	ELBOW	100	150	-	3							
258		TUBE/PIPE	100	150	3500								
259	MAW80BR008	ELBOW	100	150	-	1							
260		TUBE/PIPE	100	150	550								
261		FLANGE	100	150	-				2				
262		VALVE	100	150	-					1			
263	MAW80BR009	ELBOW	100	150	-	4							
264		TUBE/PIPE	100	150	4500								
265		FLANGE	100	150	-				2				
266		BEND	100	150	-						2		
267		TEE	100	150	-		1						
268		VALVE	100	150	-					1			
269	MAW80BR010	FLANGE	100	200	-				1				
270		REDUCER	100	150	-			1					
271		TUBE/PIPE	100	200	116								
272	MAW80BR011	FLANGE	100	200	-				1				
273		REDUCER	100	150	-			1					
274		TUBE/PIPE	100	200	116								
275	MAW80BR012	TUBE/PIPE	100	25	13000								
276		BEND	100	25	-						6		
277		ELBOW	100	200	-	2							
278		FLANGE	100	200	-				3				
279		VALVE	100	200	-					1			
280		BEND	100	200	-						1		
281		TUBE/PIPE	100	200	2500								

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
282	MAW80BR013	TUBE/PIPE	100	25	12000								
283		TEE	100	200	-		1						
284		BEND	100	25	-						5		
285		ELBOW	100	200	-	11							
286		FLANGE	100	200	-				3				
287		VALVE	100	200	-					1			
288		BEND	100	200	-						1		
289		TUBE/PIPE	100	200	41000								
290	MAW81BR001	ELBOW	310	100	-	2							
291		TUBE/PIPE	310	100	4000								
292		BEND	310	100	-						1		
293	MAW81BR002	ELBOW	310	100	-	3							
294		TUBE/PIPE	310	100	4000								
295	MAW81BR003	ELBOW	310	150	-	2							
296		TUBE/PIPE	310	150	7500								
297		REDUCER	310	150	-			1					
298		FLANGE	310	150	-				2				
299		BEND	310	150	-						1		
300		TEE	310	150	-		1						
301		VALVE	310	150	-					1			
302	MAW82BR001	ELBOW	310	100	-	3							
303		TUBE/PIPE	310	100	4000								
304		BEND	310	100	-						1		
305	MAW82BR002	ELBOW	310	100	-	4							
306		TUBE/PIPE	310	100	4000								
307	MAW82BR003	ELBOW	310	150	-	4							
308		TUBE/PIPE	310	150	7500								
309		REDUCER	310	150	-			1					
310		FLANGE	310	150	-				2				
311		BEND	310	150	-						1		

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
312	MAW82BR003	TEE	310	150	-		1						
313		VALVE	310	150	-					1			
314	MAW83BR001	FLANGE	310	100	-				2				
315		ELBOW	310	100	-	6							
316		TUBE/PIPE	310	100	14000								
317		VALVE	310	100	-					1			
318		BEND	310	100	-						1		
319	MAW84BR001	FLANGE	310	125	-				2				
320		ELBOW	310	125	-	2							
321		TUBE/PIPE	310	125	10000								
322		REDUCER	310	125	-			1					
323		VALVE	310	125	-					1			
324		BEND	310	125	-						1		
325	MAW84BR002	TUBE/PIPE	310	100	2000								
326	MAW85BR001	FLANGE	310	80	-				2				
327		ELBOW	310	80	-	2							
328		TUBE/PIPE	310	80	3500								
329		BEND	310	80	-						2		
330		VALVE	310	80	-					1			
331	MAW86BR001	FLANGE	310	80	-				2				
332		TUBE/PIPE	310	80	3000								
333		BEND	310	80	-						3		
331		VALVE	310	80	-					1			

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 (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	WELD OLET	Insulation Thickness (mm) To be filled by vendor
1	MAA14BR001	TUBE/PIPE	565	219.1	12000						5	2	
2	MAA14BR002	TUBE/PIPE	565	219.1	12000						3	2	
3	MAA14BR003	TUBE/PIPE	520	141.3	16000	6		2					
4	MAA14BR004	TUBE/PIPE	520	168.3	22000	12		1					

Checklist for Vendors	Sl No	BHEL REQUIREMENTS	VENDOR's CHECKPOINT (To be filled by Vendor) [YES/NO]
	1	Vendor has indicated insulation thicknesses for all items covered in this document.	
	2	Vendor has considered design criteria as per doc no 412114U7000 & ST29005 REV_04.	
	3	Vendor has furnished Sample Calculations for min 10 different cases.	
	4	Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 ^{0}C.	
	5	Vendor has furnished BOM containing breakup of quantity of mattresses (in m^2) & aluminium (in kg, for 18,20 & 22 SWG separately) in their standard format.	

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 = 1 Page.

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