Annexure-5

Enquiry No. B/4066/8/4005/V2

PRE-QUALIFICATION REQUIREMENTS

Bidders are required to meet the pre-qualification requirements (PQR) for supply of Thermal Insulation of TIP required for Maitree-1&2 (Bangladesh) project as per criteria stipulated below:

Sl. No.	Pre-Qualification Requirements	Vendor's confirmation Indicating page no. where documents are placed
1.	Vendor should have an experience in Design, Supply & Application of Thermal Insulation of Hot Pipes (as per ASTM C 680-89/IS 14164:2008) of at least 2 Steam turbine power plants sets greater or equal to 200 MW rating, and satisfying the criteria as below - Minimum Pipe Size = Nb400 mm. Temperature of Operating Fluid = 350^0C and above.	
2.	Vendor should furnish the following documents satisfying criteria in clause 1 above- a. Purchase Order copy along with all Technical Annexures like BOM, Site Data conditions, calculations with K values etc. This Purchase Order should not be older than 5 years, as on the date of bid opening. b. Vendor to furnish end user certificate (EUC) for any one project mentioning that vendor has supplied and applied Thermal Insulation of Piping and is working successfully at _____(Name of Site) and rating _____MW. EUC shall be on the letterhead of end-user and shall be original ink signed by an authority not less than manager rank. EUC shall contain details of signing authority such as Name, designation, contact number, email address etc.	
3.	Those vendors who have already received Purchase Orders from BHEL Haridwar for Thermal Insulation of TIP as per sl. No. 1 above, need to furnish only the Purchase Order number and date. They need not furnish the cross referred documents pertaining to Sl. No. 2 above.	
4.	BHEL reserves the right to ask for more information / documents/ clarifications. Vendor's offer shall not be considered if vendor fails to furnish the document / information / clarifications as mentioned above or vendor doesn't meet the acceptance criteria as mentioned above.	
5.	In case of information / data furnished by the vendor found false/incorrect, BHEL reserves the right to reject the offer for the above item.	

Notes:

1. BHEL would consider the offers and open the price bids of only those bidders, who fulfill the Pre-Qualification requirements (PQRs).

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
		ITEM : SUB-SYSTEM:	QP NO.: REV. NO.: DATE: PAGE: .... OF....	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / B					M	C	B	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, B: BIFPCL P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: BIFPCL SHALL IDENTIFY IN COLUM "B" AS ' W"		DOC. NO.: REV..... CAT.....		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR BIFPCL USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

ENGG. DIV./QA&I

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	THERMAL INSULATION SCHEDULE FOR TURBINE INTEGRAL PIPING	BHEL DOC. NO. 412114V7000	
		REV. – 0	DATE: 30.10.2018
		MATERIAL CODE: W99313199041	

Specifications are as below:

SECTION 1:

DESIGN PARAMETERS:

Sl No	Description	Value
1	COLD FACE TEMPERATURE	60 DEG C
2	AMBIENT TEMPERATURE	40 DEG C
3	EMISSIVITY OF AL. SHEET	0.2
4	WIND VELOCITY	0.5 M/S
5*	SPECIFICATION DOCUMENT NO.	1. ST29005 & 2. ANNEXURE – 1 (CUSTOMER SPEC.)
6	DESIGN HEAT LOSS AT CLADDING SURFACE	AS PER ASTM C-680

SECTION 2:

MATERIALS:

Sl No	Description	Value
7	INSULATION MATERIAL	LIGHTLY RESIN BONDED ROCKWOOL AS PER ASTM C-592 OR EQUIVALENT.
8	DENSITY	120 KG/M^3
9	CLADDING MATERIAL	ALUMINIUM SHEET AS PER EN 485/ASTM B-209 OR THEIR EQUIVALENT.

SECTION 3:

SPECIAL INSTRUCTIONS -

- ENTIRE INSULATION MATERIAL SHALL BE ASBESTOS FREE
- USE OF INDIAN/CHINESE STANDARDS IS NOT ALLOWED
- AGAINST SL NO 5* ABOVE, ANNEXURE-1 SUPERSEDES ST29005 WHEREVER REQUIREMENTS ARE DIFFERENT.

30.10.2018.

नवनीत चक्रपाणि
Navneet Chakrapani
व. अभि., पी.ई.डी./ Sr. Engineer, P.E.D.
बी.एच.ई.एल., हरिद्वार
BHEL, Haridwar

B0.6.17.4 Thermal insulation

General

The thermal insulation shall be designed and installed in accordance with AGI, VDI and DIN or equivalent standards, considering the following minimum requirements:

Insulation shall be provided for personnel protection, heat conservation, noise reduction and for prevention of the formation of condensation on all pipework and equipment whose external surface temperature exceeds 60 °C.

For personnel protection all surfaces with a temperature above 50 °C and which are within the reach of personnel shall be provided with protection insulation and the maximum insulation surface temperature shall be 60 °C.

- All insulation material has to be made from non-asbestos materials.

Following design criteria for insulation shall apply: Design ambient temperature:

- Inside buildings: Ambient temperature of 40°C and wind speed of 0.5 m/s
- Outside buildings: Ambient temperature of 45°C and wind speed of 0.25 m/s

Thickness of the insulation shall be calculated according to ASTM C-680. The Emissivity of the cladding shall be 0.2.

Type of insulation materials

The mats shall be stable in shape, chemically inert, free of sulfur and alkali, resistant to water and steam, non-flammable and capable of withstanding continuous exposure to the pipe design temperature. The mats used for insulation of stainless steel equipment shall have a chloride content of less than 0.15%. Under no circumstances may asbestos or asbestos containing materials be used.

The material will have the following physical/chemical properties (± 10% allowance):

- service temperature up to 650 °C
- density 120 kg/m^3
- water adsorption 0.5% weight
- specific heat capacity 0.84 kJ/kg °C
- compressive strength 20 kPa
- conductivity versus temperature:

Average temperature	Blanket (W/m °C)
0	0.034
50	0.040
100	0.048

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Average temperature	Blanket (W/m °C)
150	0.058
200	0.070
250	0.083
300	0.100

For temperatures above 300°C the conductivity required shall be determined by linearly extrapolation of the values presented in the above table.

- conductivity allowance is limited to + 5%.

For special purposes such as for turbines, boilers, etc. spray type insulation or insulation brickwork (for example calcium silicate) may also be applied. The special insulation materials shall be stated by the Contractor and their design shall match the overall design and guarantee the requirements stated in the specifications.

Type of insulation setting materials
The surface cladding shall be made of aluminium sheets, manufactured in sheets with the following minimum thickness:

- Outer insulation diameter up to 150 mm — Sheet thickness 0.7 mm
- Outer insulation diameter up to 450 mm — Sheet thickness 0.9 mm
- Tanks and other large equipment — Sheet thickness 1.2 mm

Tank tops shall be provided with insulation strong enough to support a man's weight.

The sheets shall be secured and connected at the longitudinal seams with at least five stainless steel self-tapping screws per meter run.

Plain sheets for flat surfaces shall not exceed 1 meter square and shall be stiffened by crimping.

At the longitudinal and circumferential joints, the sheets shall overlap by at least 50 mm so as to drain off the liquid and not to trap the liquid in the insulation.

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Places at which the metal sheets are penetrated for pipe hangers, thermometer sockets, etc. shall be sealed with funnel-shaped recesses or sheet metal rims.

The seams and penetrations of any sheet metal insulating jacket installed outdoors as well as in the boiler and turbine house in areas with risk of water spray etc., shall be sealed against penetration of water by means of a suitable silicon based sealant.

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In the case of pipe insulation thicknesses greater than 60 mm, where insulation blankets are used spacers shall be provided at maximum intervals of 950 mm to ensure a uniform insulating thickness on all sides and a perfectly circular shape of the sheet metal jacket. The sheet metal jacket shall be supported by support webs (for pipe diameters below 100 mm) and enclosed support rings (for pipe diameters 100 mm and above). If the enclosed support rings are not provided with ceramic spacers, the spacers made of steel shall be insulated with one heat insulation strip in the case of operating temperatures of up to 200 °C, and with two heat insulation strips where the operating temperature exceeds 200 °C.

To provide protection against contact corrosion, the external circumference of the support ring shall be fitted with heat insulation tape 1 mm thick with two woven edges.

Insulation of flanges, valves and fittings
All flanges, valves and fittings shall be provided with two-piece or multi-part caps made of aluminium sheet of the specified thickness. Each piece or part shall be double jacketed and the various parts shall be held together by quick release clamps or lever hooks to facilitate assembly and disassembly.

All caps of the welded-in fittings shall be made longer by approximately twice the insulation thickness so that the welding seams will be exposed after removal of the cap.

All manholes shall be provided with heavy duty hinged covers which are to be protected from overheating and corrosion. Such covers shall be secured with easily accessible clamps. In addition, metallic stand-offs shall be provided for personnel protection.

Insulation of tanks and process equipment
Tanks and process equipment shall be insulated in the same way as pipes, except that the insulating material shall not be attached by wire but by using strong galvanized steel bands.

Spacers shall be welded to process equipment only if this is essential for satisfactory retention of the insulation. Welding of spacers to process equipment is subject to approval by its manufacturer in writing.

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Insulation for personnel protection
Wherever insulation is necessary only for the protection of personnel, it shall be applied around that portion of the pipeline length or to that surface of the equipment that is located within 2.50 m above the passage way floor, or within 1.20 m horizontally to the side or at the end of any floor, platform, walkway, stair or ladder.

Where necessary, drain lines and valves shall be provided with a contact guard of minimum 30 mm thickness against accidental contact, and this shall be installed in the same way as the other insulation.

Where insulation is provided for heat conservation it shall reduce the heat loss to an economic minimum. The maximum heat loss shall be 200 W/m^2 at an ambient temperature acceptable at 30 °C and a wind speed of 2 m/s. For personnel protection all surfaces with a temperature above 50 °C and which are within the reach of personnel shall be provided with protection insulation. The maximum insulation surface temperature shall be 60 °C.

B0.6.17.5 Vessels

All vessels shall be designed in accordance with the applicable standards and regulations.

The Contractor is held responsible for the correct design and dimensioning of the apparatus.

Connections shall be provided for all pipework, together with connection and tapping points for instrumentation. Manholes, vents, drains, safety devices and any platforms necessary for safe operation and easy maintenance have to be included in design and supply.

If under any operation conditions vacuum can occur in the vessels, they shall be designed for max. pressure and full (= 100%) vacuum.

The welding factor for all vessels is fixed to v = 1.0. The minimum wall thickness should not be less than 10 mm, and an appropriate corrosion allowance based upon the particular material, but not less than 1 mm.

Instrumentation and control equipment shall be provided according to the safe service requirements. A minimum requirement is to equip each vessel with a local level indicator, a temperature and a pressure indicator.

Manholes shall be provided as follows:

1. manholes (minimum nominal bore 600 mm) for vessels of 1.0 meter diameter and above
2. handholes (minimum size 200 mm) for vessels below 1.0 meter diameter

All nozzles shall be provided with flanges and shall be so arranged that practical pipe connections are possible. The stub length for all stub pipes shall be at least 200 mm, measured from the tank wall to the flange sealing surface. In the case of insulated vessels, the length shall be chosen so that there will be a clear space of at least 100 mm between the cover of the insulation and the underside of the flange. Nozzles below DN 25 are not acceptable.

For insulated vessels, provisions must be made for fixing and supporting the insulation.

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	CAP	499	114.3	-							1		
2		CAP	499	323.9	-							1		
3		ELBOW	499	1219	-	1								
4		FLANGE	499	285	-				1					
5		WELDOLET	499	1219	-								2	
6		TUBE/PIPE	499	114.3	0.5									
7		TUBE/PIPE	499	168.3	0.5									
8		TUBE/PIPE	499	1219	5.5									
9	MAG10BR101	ELBOW	80	323.9	-	1								
10		FLANGE	80	485	-				2					
11		TEE	80	323.8	-		1							
12		TUBE/PIPE	80	323.9	5.0									
13	MAG10BR102	TUBE/PIPE	499	323.9	2.5									
14	MAG10BR110	CAP	499	323.8	-							1		
15		CAP	499	114.3	-							1		
16		ELBOW	499	1219	-	1								
17		FLANGE	499	285	-				1					
18		WELDOLET	499	1219	-								2	
19		TUBE/PIPE	499	168.3	0.5									
20		TUBE/PIPE	499	114.3	0.5									
21		TUBE/PIPE	499	323.9	6.0									
22	MAG10BR111	ELBOW	80	323.9	-	1								
23		FLANGE	80	485					2					
24		TEE	80	323.8			1							
25		TUBE/PIPE	80	323.9	8.0									
26	MAG10BR112	TUBE/PIPE	499	323.9	2.5									
27	MAL01BR001	ELBOW	608	323.8	-	1								
28		CAP	608	323.8	-							1		
29		TUBE/PIPE	608	323.8	2.0									
30		WELDOLET	608	323.8	-								8	
36	MAL02BR001	ELBOW	608	323.8	-	1								
37		CAP	608	323.8	-							1		
38		TUBE/PIPE	608	323.8	1.8									
39		WELDOLET	608	323.8	-								6	

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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
40	MAL03BR001	ELBOW	608	323.8	-	1								
41		CAP	608	323.8								1		
42		TUBE/PIPE	608	323.8	4.5									
43		WELDOLET	608	323.8	-								7	
44	MAL04BR001	ELBOW	608	323.8	-	2								
45		CAP	608	323.8	-							1		
46		TUBE/PIPE	608	323.8	3.0									
47		WELDOLET	608	323.8	-								12	
48	MAL11BR001	TEE	601	60.3	-		2							
49		CAP	601	60.3	-							1		
50		BEND	601	60.3	-						7			
51		VALVE	601	60.3	-					2				
52		TUBE/PIPE	601	60.3	15.0									
53		TUBE/PIPE	601	73	0.5									
54	MAL11BR002	BEND	601	33.4	-						3			
55		VALVE	601	33.4	-					3				
56		TUBE/PIPE	601	33.4	1.5									
57	MAL12BR001	TEE	601	60.3	-		2							
58		CAP	601	60.3	-							1		
59		BEND	601	60.3	-						12			
60		TUBE/PIPE	601	60.3	14.0									
61		TUBE/PIPE	601	73	0.5									
62		VALVE	601	60.3	-					2				
63	MAL12BR002	BEND	601	33.4	-						3			
64		TUBE/PIPE	601	33.4	2.0									
65		VALVE	601	33.4	-					3				
66	MAL14BR001	VALVE	506	48.3	-					2				
67		TEE	506	48.3	-		2							
68		CAP	506	48.3	-							1		
69		BEND	506	48.3	-						8			
70		ELBOW	506	48.3	-	2								
71		TUBE/PIPE	506	48.3	22.5									
72		TUBE/PIPE	506	60.3	0.5									
73	MAL14BR002	BEND	506	33.4	-						2			
74		TUBE/PIPE	506	33.4	2.0									
75		VALVE	506	33.4	-					3				

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 (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
76	MAL19BR001	CAP	601	60.3	-							1		
77		TEE	601	60.3	-		2							
78		VALVE	601	60.3	-					2				
79		BEND	601	60.3	-						10			
80		TUBE/PIPE	601	73	0.5									
81		TUBE/PIPE	601	60.3	15.0									
82	MAL14BR002	BEND	601	33.4	-						2			
83		TUBE/PIPE	601	33.4	1.5									
84		VALVE	601	33.4	-					3				
85	MAL20BR001	CAP	537	60.3	-							1		
86		TEE	537	60.3	-		2							
87		BEND	537	60.3	-						4			
88		TUBE/PIPE	537	73	0.5									
89		TUBE/PIPE	537	60.3	16.0									
90		VALVE	537	60.3	-					2				
91	MAL20BR002	BEND	537	33.4	-						2			
92		TUBE/PIPE	537	33.4	2.0									
93		VALVE	537	33.4	-					3				
94	MAL22BR001	ELBOW	534	48.3	-	2								
95		REDUCER	534	60.3				1						
96		TUBE/PIPE	534	48.3	2.5					3				
97	MAL22BR002	ELBOW	534	48.3	-	2								
98		TUBE/PIPE	534	48.3	2.0					3				
99	MAL22BR003	CAP	534	60.3	-							1		
100		VALVE	534	60.3	-					2				
101		TEE	534	60.3	-		3							
102		BEND	534	60.3	-						8			
103		TUBE/PIPE	534	60.3	15.0									
104		TUBE/PIPE	534	73	0.5									
105	MAL22BR004	BEND	534	33.4	-						2			
106		TUBE/PIPE	534	33.4	2.0									
107		VALVE	534	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
108		BEND	608	60.3	-						13			
109		BEND	608	33.4	-						3			
110		CAP	608	60.3	-							1		
111		TEE	608	60.3	-		2							
112	MAL23BR001	VALVE	608	60.3	-					2				
113	MAL23BR002	TUBE/PIPE	608	33.4	2.0									
114		TUBE/PIPE	608	73	0.5									
115		TUBE/PIPE	608	60.3	20.0									
116		ELBOW	608	60.3		2								
117		VALVE	608	33.4	-					3				
118		BEND	608	60.3	-						9			
119		CAP	608	60.3	-							1		
120	MAL24BR001	TEE	608	60.3	-		2							
121		TUBE/PIPE	608	73	0.5									
122		VALVE	608	60.3	-					2				
123		TUBE/PIPE	608	60.3	28.0									
124		BEND	608	33.4	-						2			
125	MAL24BR002	TUBE/PIPE	608	33.4	1.0									
126		VALVE	608	33.4	-					3				
127		BEND	437	48.3	-						12			
128		VALVE	437	48.3	-					2				
129		CAP	437	48.3	-							1		
130	MAL25BR001	TEE	437	48.3	-		1							
131		TUBE/PIPE	437	60.3	0.5									
132		TUBE/PIPE	437	48.3	15.0									
133		ELBOW	608	60.3		15								
134		CAP	608	60.3								1		
135	MAL26BR001	TEE	608	60.3			2							
136		TUBE/PIPE	608	73	0.5									
137		TUBE/PIPE	608	60.3	19.0									
138		VALVE	608	60.3						2				
139		BEND	608	33.4	-						2			
140	MAL26BR002	TUBE/PIPE	608	33.4	2.0									
141		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
142	MAL27BR001	BEND	608	60.3							12			
143		CAP	608	60.3								1		
144		ELBOW	608	60.3	-	1								
145		TEE	608	60.3			2							
146		TUBE/PIPE	608	60.3	21.0									
147		TUBE/PIPE	608	73	0.5									
148		VALVE	608	60.3						2				
149	MAL27BR002	BEND	608	33.4	-						2			
150		TUBE/PIPE	608	33.4	1.5									
151		VALVE	608	33.4	-					3				
152	MAL31BR001	BEND	608	33.4	-						2			
153		TUBE/PIPE	608	33.4	10.5									
154		ELBOW	608	33.4	-	4								
155	MAL31BR002	TUBE/PIPE	608	33.4	3.0									
156		ELBOW	608	33.4	-	2								
157	MAL31BR003	BEND	608	60.3							6			
158		CAP	608	60.3								1		
159		REDUCER	608	60.3				1						
160		TEE	608	60.3			3							
161		VALVE	608	60.3						2				
162		TUBE/PIPE	608	60.3	10.5									
163		TUBE/PIPE	608	73	0.5									
164	MAL31BR004	BEND	608	33.4	-						3			
165		TUBE/PIPE	608	33.4	2.5									
166		VALVE	608	33.4	-					3				
167	MAL41BR001	CAP	434	60.3								1		
168		ELBO	434	60.3		5								
169		TEE	434	60.3			3							
170		VALVE	434	60.3						2				
171		TUBE/PIPE	434	73	0.5									
172		TUBE/PIPE	434	60.3	9.0									
173	MAL41BR002	BEND	434	48.3	-						1			
174		TUBE/PIPE	434	48.3	11.5									
175		ELBO	434	48.3	-	5								
176	MAL41BR003	BEND	434	33.4	-						2			
177		TUBE/PIPE	434	33.4	2.0									
178		VALVE	434	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
179	MAL45BR001	CAP	493	60.3								1		
180		TEE	493	60.3			1							
181		BEND	493	60.3							2			
182		VALVE	493	60.3						2				
183		ELBOW	493	60.3		2								
184		TUBE/PIPE	493	60.3	11.0									
185		TUBE/PIPE	493	73	0.5									
186	MAL47BR001	CAP	404	60.3								1		
187		ELBOW	404	60.3		4								
188		VALVE	404	60.3						2				
189		TEE	404	60.3			1							
190		TUBE/PIPE	404	60.3	5.5									
191		TUBE/PIPE	404	73	0.5									
192	MAL51BR001	CAP	280	60.3								1		
193		VALVE	280	60.3						2				
194		TEE	280	60.3			2							
195		ELBOW	280	60.3		5								
196		TUBE/PIPE	280	60.3	3.0									
197		TUBE/PIPE	280	73	0.5									
198	MAL51BR003	TUBE/PIPE	280	33.4	8.5									
199		BEND	280	33.4	-						4			
200	MAL51BR004	BEND	280	33.4	-						7			
201		TUBE/PIPE	280	33.4	13.0									
202		TEE	280	33.4	-		1							
203	MAL54BR001	BEND	147	60.3							9			
204		CAP	147	60.3								1		
205		ELBOW	147	60.3		1								
206		TEE	147	60.3			1							
207		VALVE	147	60.3						2				
208		TUBE/PIPE	147	60.3	34.0									
209		TUBE/PIPE	147	73	0.5									

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Bill of Materials for Thermal Insulation of TIP
Turbine Drainage 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
210	MAL55BR001	BEND	219	60.3							10			
211		CAP	219	60.3								1		
212		ELBOW	219	60.3		1								
213		TEE	219	60.3			1							
214		VALVE	219	60.3						2				
215		TUBE/PIPE	219	60.3	31.0									
216		TUBE/PIPE	219	73	0.5									
217	MAL65BR001	BEND	389	60.3							4			
218		CAP	389	60.3								1		
219		TEE	389	60.3			2							
220		ELBOW	389	60.3		3								
221		TUBE/PIPE	389	60.3	18.0									
222		VALVE	389	60.3						2				
223	MAL65BR004	BEND	389	33.4	-						4			
224		TUBE/PIPE	389	33.4	2.0									
225		VALVE	389	33.4	-					3				
226	MAL81BR001	BEND	580	33.4							8			
227		CAP	580	33.4								1		
228		VALVE	580	33.4						2				
229		TEE	580	33.4			3							
230		TUBE/PIPE	580	33.4	16.0									
231		TUBE/PIPE	580	48.3	0.5									
232	MAL81BR002	TUBE/PIPE	580	33.4	5.5									
233		BEND	580	33.4	-						7			
234	MAL81BR003	BEND	580	33.4	-						8			
235		TUBE/PIPE	580	33.4	11.5									
236		INST	580	33.4	-					3				

Seal and Signature of Vendor

Project Engineering Department
HEEP, Haridwar

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

BHEL DOC No: 412114V7001 REV_00

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	ELBOW	451	168.3		5								
2		VALVE	451	168.3						1				
3		TUBE/PIPE	451	273.1	9									
4	LBC41BR002	TUBE/PIPE	389	273.1	1									
5		ELBO	389	273.1		2								
6	MAM10BR001	BEND	486	48.3							9			
7		TUBE/PIPE	486	48.3	15									
8	MAM10BR002	BEND	486	48.3							9			
9		TUBE/PIPE	486	48.3	17									
10	MAM10BR003	BEND	486	48.3							10			
11		TUBE/PIPE	486	48.3	31									
12	MAM10BR004	BEND	486	48.3							5			
13		TUBE/PIPE	486	48.3	6									
14	MAM10BR005	BEND	486	26.7							11			
15		TUBE/PIPE	486	26.7	19.5									
16	MAM10BR008	BEND	486	60.3							7			
17		CAP	486	60.3								1		
18		TEE	486	60.3			2							
19		TUBE/PIPE	486	60.3	6									
20	MAM10BR010	BEND	486	60.3							7			
21		CAP	486	60.3								1		
22		TEE	486	60.3			2							
23		TUBE/PIPE	486	60.3	13.5									
24	MAM20BR001	BEND	278	33.4							5			
25		TUBE/PIPE	278	33.4	4									
26	MAM20BR002	BEND	278	33.4							5			
27		TUBE/PIPE	278	33.4	4									
28	MAM20BR003	BEND	434	48.3							5			
29		WELDOLET	434	48.3									1	
30		TUBE/PIPE	434	48.3	10									

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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
31	MAM20BR005	CAP	434	88.9								1		
32		ELBOW	434	88.9		3								
33		BEND	434	33.4			2							
34		BEND	434	48.3			1							
35		TUBE/PIPE	434	33.4	0.5									
36		TUBE/PIPE	434	48.3	0.5									
37		TUBE/PIPE	434	88.9	9									
38	MAM20BR006	BEND	486	48.3							9			
39		WELDOLET	486	48.3									1	
40		TUBE/PIPE	486	48.3	7.5									
41	MAM20BR007	BEND	486	48.3							1			
42		ELBOW	486	48.3		7								
43		WELDOLET	486	48.3									1	
44		TUBE/PIPE	486	48.3	8.5									
45	MAM20BR008	CAP	486	114.3								1		
46		ELBOW	486	114.3		1								
47		BEND	486	114.3							1			
48		TEE	486	114.3			4							
49		TUBE/PIPE	486	114.3	9									
49	MAM20BR009	BEND	486	48.3							1			
50		ELBOW	486	48.3		9								
51		WELDOLET	486	48.3									1	
52		TUBE/PIPE	486	48.3	8.5									
53	MAM20BR010	BEND	486	48.3							9			
54		WELDOLET	486	48.3									1	
55		TUBE/PIPE	486	48.3	10									
56	MAM30BR001	BEND	580	42.2							9			
57		TUBE/PIPE	580	42.2	14									
58	MAM30BR002	BEND	580	42.2							15			
59		TUBE/PIPE	580	42.2	28									
60	MAM30BR003	BEND	580	42.2							17			
61		TUBE/PIPE	580	42.2	42.5									
62	MAM30BR004	BEND	580	42.2							1			
63		TUBE/PIPE	580	42.2	4.5									

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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
64	MAM30BR008	CAP	580	60.3								1		
65		BEND	580	60.3		4								
66		TEE	580	60.3			2							
67		TUBE/PIPE	580	60.3	8									
68	MAM30BR010	CAP	580	60.3								1		
69		BEND	580	60.3							4			
70		TEE	580	60.3			2							
71		ELBOW	580	60.3		2								
72		TUBE/PIPE	580	60.3	15									
73	MAW10BR001	ELBOW	335	114.3		2								
74		TEE	335	114.3			1							
75		TUBE/PIPE	335	114.3	1									
76		VALVE	335	114.3						1				
77		VALVE	335	219.1						1				
78	MAW10BR002	VALVE	320	219.1						1				
79		ELBOW	320	219.1		2								
80		BEND	320	219.1							3			
81		TEE	320	219.1			1							
82		TUBE/PIPE	320	219.1	2									
83	MAW10BR003	VALVE	335	114.3						2				
84		ELBOW	335	114.3		1								
85		BEND	335	114.3							3			
86		REDUCER	335	219.1				1						
87		TUBE/PIPE	335	114.3	1									
88	MAW10BR004	VALVE	320	219.1						1				
89		BEND	320	219.1							4			
90		TUBE/PIPE	320	219.1	1.5									
91	MAW20BR001	REDUCER	470	323.8				1						
92		ELBOW	470	273		3								
93		FLANGE	470	273					2					
94		TEE	470	273			2							
95		TUBE/PIPE	470	273	4									
96	MAW20BR002	BEND	470	323.8							5			
97		WELDOLET	470	323.8									1	
98		REDUCER	470	323.8				1						
99		TEE	470	323.8			3							
100		TUBE/PIPE	470	323.8	4									

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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
101	MAW20BR003	ELBOW	360	273		2								
102		FLANGE	360	273					2					
103		TEE	360	273			5							
104		TUBE/PIPE	360	273	13.5									
105	MAW20BR004	FLANGE	360	88.9					2					
106		WELDOLET	360	88.9									1	
107		BEND	360	88.9							1			
108		TUBE/PIPE	360	88.9	0.5									
109	MAW20BR005	VALVE	360	21.3					2					
110		TUBE/PIPE	360	21.3	0.5									
111		TUBE/PIPE	360	33.4	1									
112		TUBE/PIPE	360	88.9	4.5									
113		WELDOLET	360	88.9									2	
114		ELBOW	360	88.9		2								
115		CAP	360	88.9								1		
116		BEND	360	88.9							4			
117		REDUCER	360	33.4				2						
118	MAW21BR001	TUBE/PIPE	470	114.3	6									
119		FLANGE	470	141.3					2					
120		ELBOW	470	114.3		5								
121	MAW21BR002	TUBE/PIPE	470	114.3	7.5									
124		FLANGE	470	141.3					2					
125		ELBOW	470	114.3		5								
126	MAW21BR003	TUBE/PIPE	470	168.3	6.5									
127		TEE	470	168.3			1							
128		REDUCER	470	168.3				1						
129		BEND	470	168.3							3			
130	MAW22BR001	TUBE/PIPE	470	168.3	8									
131		TEE	470	168.3			1							
132		REDUCER	470	168.3				1						
133		ELBOW	470	168.3		4								

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Seal and Signature of Vendor

Project Engineering Department
HEEP, Haridwar

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

BHEL DOC No: 412114V7001 REV_00

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND		WELDOLET	Insulation Thickness (mm) To be filled by vendor
134	MAW22BR002	TUBE/PIPE	470	114.3	5.5									
135		BEND	470	114.3							1			
136		FLANGE	470	141.3					2					
137		ELBOW	470	114.3		4								
138	MAW22BR003	TUBE/PIPE	470	114.3	4.5									
139		FLANGE	470	141.3					2					
140		ELBOW	470	114.3		4								
141		BEND	470	114.3							1			
142	MAW23BR001	TUBE/PIPE	470	114.3	5.5									
143		FLANGE	470	141.3					2					
144		ELBOW	470	114.3		4								
145	MAW23BR002	TUBE/PIPE	470	114.3	6									
146		FLANGE	470	141.3					2					
147		ELBOW	470	114.3		3								
148	MAW23BR003	TUBE/PIPE	470	168.3	8.5									
149		TEE	470	168.3			1							
150		REDUCER	470	168.3				1						
151		ELBOW	470	168.3		5								
152	MAW24BR001	TUBE/PIPE	470	141.3	5									
153		REDUCER	470	141.3				1						
154		ELBOW	470	141.3		2								
155	MAW24BR002	TUBE/PIPE	470	141.3	4									
156		ELBOW	470	141.3		2								
157		REDUCER	470	141.3				1						
158	MAW24BR003	TEE	470	168.3			1							
159		TUBE/PIPE	470	168.3	8									
160		REDUCER	470	168.3				1						
161		ELBOW	470	168.3					5					
162	MAW24BR004	TUBE/PIPE	470	114.3	3									
163		ELBOW	470	114.3		2								
164		FLANGE	470	141.3					2					
165	MAW24BR005	TUBE/PIPE	470	114.3	2.5									
166		ELBOW	470	114.3		2								
167		FLANGE	470	141.3					2					

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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		WELDOLET	Insulation Thickness (mm) To be filled by vendor
168	MAW25BR001	BEND	360	114.3							6			
169		TUBE/PIPE	360	114.3	11.5									
170		FLANGE	360	141.3				2						
171		ELBOW	360	114.3		4								
172	MAW26BR001	TUBE/PIPE	360	114.3	10.5									
173		FLANGE	360	114.3					2					
174		ELBOW	360	114.3		4								
175		BEND	360	114.3							5			
176	MAW27BR001	BEND	360	114.3							3			
177		ELBOW	360	114.3		6								
178		FLANGE	360	114.3					2					
179		TUBE/PIPE	360	114.3	12									
180	MAW28BR001	BEND	360	114.3							8			
181		ELBOW	360	114.3		3								
182		FLANGE	360	114.3					2					
183		TUBE/PIPE	360	114.3	10									
184	MAW50BR003	ELBOW	580	457.2		1								
185		TUBE/PIPE	580	457.2	1		1						1	
186		VALVE	580	457.2						2				
187	MAW50BR002	VALVE	580	457.2						1				
188		TUBE/PIPE	580	457.2	13									
189		TEE	580	457.2			1							
190		ELBOW	580	457.2		9								
191	MAW50BR004	VALVE	580	457.2						1				
192		TUBE/PIPE	580	457.2	1									
193		ELBOW	580	457.2		4								
194	MAW50BR005	BEND	580	168.3		1								
195		FLANGE	580	168.3					2					
196		WELDOLET	580	168.3									1	
197		TUBE/PIPE	580	168.3	1									
198	MAW50BR005	ELBOW	580	457.2		2								
199		REDUCER	580	457.2				1						
200		TEE	580	457.2			1							
201		VALVE	580	457.2						2				
202		TUBE/PIPE	580	457.2	3									
203		TUBE/PIPE	580	406.4	0.5									

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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
204	MAW60BR002	TUBE/PIPE	510	114.3	0.5									
205		TUBE/PIPE	510	48.3	0.5									
206		CAP	510	141.3								1		
207	MAW60BR004	TUBE/PIPE	510	168.3	5.5									
208		TEE	510	168.3			2							
209		CAP	510	168.3								1		
210		BEND	510	168.3							1			
211		ELBOW	510	168.3		2								
212	MAW60BR005	TUBE/PIPE	510	114.3	4.5									
213		ELBOW	510	114.3		4								
214		BEND	510	114.3							1			
215	MAW60BR006	TUBE/PIPE	510	114.3	4.5									
216		ELBOW	510	114.3		2								
217		BEND	510	114.3							1			
218	MAW60BR007	TUBE/PIPE	510	219.1	15.5									
219		TEE	510	219.1			2							
220		WELDOLET	510	219.1									2	
221		BEND	510	219.1							3			
222		ELBOW	510	219.1		6								
223		CAP	510	219.1								1		
224	MAW60BR009	TUBE/PIPE	510	168.3	3									
225		TEE	510	168.3			2							
226		BEND	510	168.3							1			
227		ELBOW	510	168.3		2								
228		CAP	510	168.3								1		
229	MAW60BR010	TUBE/PIPE	510	114.3	5.5									
230		BEND	510	114.3							1			
231		ELBOW	510	114.3		5								
232	MAW60BR011	TUBE/PIPE	510	114.3	5.5									
233		BEND	510	114.3							1			
234		ELBOW	510	114.3		5								
235	MAW80BR001	VALVE	320	323.8						2				
236		TUBE/PIPE	320	323.8	53									
237		TUBE/PIPE	320	141.3	0.5									
238		TEE	320	323.8			3							
239		REDUCER	320	323.8				1						
240		FLANGE	320	141.3					1					
241		ELBOW	320	323.8		10								

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Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	ELBOW	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
242	MAW80BR002	TUBE/PIPE	320	273.1	4									
243		TEE	320	273.1			2							
244		REDUCER	320	273.1							1			
245		ELBOW	320	273.1		2								
246	MAW80BR003	TUBE/PIPE	320	219.1	3									
247		TEE	320	219.1			2							
248		CAP	320	219.1								1		
249	MAW80BR004	TUBE/PIPE	320	273	6									
250		TUBE/PIPE	320	60.3	0.5									
251		FLANGE	320	60.3					2					
252		ELBOW	320	273		5								
253	MAW80BR005	TUBE/PIPE	320	33.4	2.5									
254		TEE	320	33.4			1							
255		REDUCER	320	33.4				2						
256		BEND	320	33.4							6			
257		ELBOW	320	33.4		1								
258	MAW80BR006	TUBE/PIPE	320	33.4	3.5									
259		TEE	320	33.4			1							
260		REDUCER	320	33.4				2						
261		ELBOW	320	33.4		5								
262	MAW80BR008	VALVE	320	168.3						1				
263		TUBE/PIPE	320	168.3	8									
264		TEE	320	168.3			1							
265		FLANGE	320	168.3					2					
266		REDUCER	320	219.1				1						
267		CAP	320	168.3								1		
268		ELBOW	320	168.3		5								
269	MAW80BR009	VALVE	320	168.3						1				
270		TUBE/PIPE	320	168.3	1									
271		FLANGE	320	168.3					2					
272		REDUCER	320	219.1				1						
273		CAP	320	168.3								1		
274		ELBOW	320	168.3		2								

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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
275	MAW80BR012	TUBE/PIPE	320	33.4	0.5									
276		VALVE	320	219.1						1				
277		ELBOW	320	219.1		2								
278		FLANGE	320	219.1					2					
279		TUBE/PIPE	320	219.1	2.5									
280	MAW80BR013	TUBE/PIPE	320	33.4	0.5									
281		ELBOW	320	219.1		5								
282		TEE	320	219.1			1							
283		FLANGE	320	219.1					2					
284		VALVE	320	219.1						1				
285		TUBE/PIPE	320	219.1	9.5									
286	MAW80BR020	TUBE/PIPE	320	33.4	11									
287		BEND	320	33.4							6			
288	MAW80BR021	TUBE/PIPE	320	33.4	12									
289		BEND	320	33.4							6			
290	MAW81BR001	ELBOW	320	114.3		2								
291		BEND	320	114.3							1			
292		TUBE/PIPE	320	114.3	4									
293	MAW81BR002	ELBOW	320	114.3		3								
294		TUBE/PIPE	320	114.3	4.5									
295	MAW81BR003	VALVE	320	168.3						1				
296		BEND	320	168.3							1			
297		TUBE/PIPE	320	168.3	7.5									
298		TEE	320	168.3			1							
299		REDUCER	320	168.3				1						
300		ELBOW	320	168.3		2								
301		FLANGE	320	168.3					2					
302	MAW82BR001	ELBOW	320	114.3		3								
303		BEND	320	114.3							1			
304		TUBE/PIPE	320	114.3	4									
305	MAW82BR002	ELBOW	320	114.3		4								
306		TUBE/PIPE	320	114.3	4									
307	MAW82BR003	ELBOW	320	168.3		4								
308		TUBE/PIPE	320	168.3	7.5									
309		REDUCER	320	168.3				1						
310		FLANGE	320	168.3					2					
311		BEND	320	168.3							1			
312		TEE	320	168.3			1							
313		VALVE	320	168.3						1				

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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
314	MAW83BR001	FLANGE	320	114.3					2					
315		BEND	320	114.3							1			
316		ELBOW	320	114.3		6								
317		TUBE/PIPE	320	114.3	12.5									
318		VALVE	320	114.3						1				
319	MAW84BR001	FLANGE	320	141.3					2					
320		TUBE/PIPE	320	141.3	10.5									
321		REDUCER	320	141.3				1						
322		VALVE	320	141.3						1				
323		ELBOW	320	141.3		5								
324	MAW84BR002	BEND	320	141.3							2			
325		TUBE/PIPE	320	141.3	2.5									
326	MAW85BR001	ELBOW	190	88.9		5								
327		FLANGE	190	88.9					2					
328		VALVE	190	88.9						1				
329		TUBE/PIPE	190	88.9	6									
330	MAW86BR001	ELBOW	190	88.9		7								
331		FLANGE	190	88.9					2					
332		TUBE/PIPE	190	88.9	6									
333		VALVE	190	88.9						1				
334	MAW87BR001	ELBOW	190	88.9		7								
335		FLANGE	190	88.9					2					
336		VALVE	190	88.9						1				
337		TUBE/PIPE	190	88.9	6									
338	MAW88BR001	ELBOW	190	88.9		7								
339		FLANGE	190	88.9					2					
340		VALVE	190	88.9						1				
341		TUBE/PIPE	190	88.9	6.5									

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Seal and Signature of Vendor

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	593	219.1	12								
2		TUBE/PIPE	593	219.1	-								
3		WELDOLET	593	219.1	-							1	
4		ELBOW	593	219.1	-	7							
5	MAA14BR002	TUBE/PIPE	593	219.1	13								
6		BEND	593	219.1	-						6		
7		WELDOLET	593	219.1	-							7	
8	MAA14BR003	TUBE/PIPE	537	219.1	11								
9		REDUCER	537	219.1	-			1					
10		ELBOW	537	219.1	-	5							
11	MAA14BR004	TUBE/PIPE	537	219.1	18								
12		ELBOW	537	219.1	-	9							
13		REDUCER	537	219.1	-			1					
14	MAA14BR005	TUBE	537	168.3	3								
15		ELBOW	537	168.3	-	2							
16		VALVE	537	33.4	-					2			
17		WELDOLET	537	168.3	-							1	
18		REDUCER	537	33.4	-			1					
19		TUBE	537	33.4	1								
20	MAA14BR006	ELBOW	537	168.3	-	2							
21		TUBE/PIPE	537	168.3	3								
22		VALVE	537	33.4	-					2			
23		WELDOLET	537	168.3	-							1	
24		REDUCER	537	33.4	-			1					
25		TUBE/PIPE	537	33.4	1								

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

1. This BOM may vary by +/- 5%.

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 19 (Nineteen) pages. Turbine Drainage System = 7 Pages, Seal Steam System = 10 Pages & Overload Piping System = 2 Page.

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Seal and Signature of Vendor

SPECIAL INSTRUCTIONS:			
Checklist for Vendors	Sl No	BHEL REQUIREMENTS	VENDOR's CHECKPOINT (To be filled by Vendor) [YES/NO]
	1	*Vendor has indicated insulation thicknesses for all items covered in this document.*	
	2	*Vendor has considered design criteria as per doc no 412114V7000 , ST29005 REV_04 & Annexure-1 (Customer Spec.).*	
	3	*Vendor has furnished Sample Calculations for min 10 different cases.*	
	4	*Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 ^{0}C.*	
	5	*Vendor has furnished BOM containing breakup of quantity of mattresses (in 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 (AGM-PED)

	उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD	ST 29005 पृष्ठ 23 का 1 Page 1 of 23

BASED ON :
BHEL EXPERIENCE

SPECIFICATION FOR THERMAL INSULATION

FOR T.G.INTEGRAL PIPING SYSTEM

				NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
			अनुवादक TRANSLATED BY	-	-
QAX	S.S. CHAUHAN		निर्माणकर्ता WORKED BY	S.K.GUPTA	12.11.03
TSX	KISHAN LAL	12.11.03	जांचकर्ता CHECKED BY	S.K.GUPTA	12.11.03
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	V.K.GUPTA	12.11.03

स्वीकृति
APPROVED : (B.K. BHALLA) AGM (STE)

ST 8.20

REV.NO. 04
Dt. 04.02.05

निर्माण PREPARED : STE

जारी ISSUED : STE (TL)

दिनांक DATE : 1-6-89

हस्ताक्षर एवं दिनांक SIGN & DATE 1-12-03

सामग्री सूची संख्या INVENTORY NO. P-5788

1.0 INTRODUCTION

In a thermal power station, thermal insulation of all piping carrying hot fluids is essential for heat economy and protection of operating personnel. In any pipe which is at a temperature higher than its surroundings will loose heat and the amount of heat lost will depend upon the temperature of the fluid conveyed and the thermal conductivity of the piping material. The heat lost through bare pipes increases with:

(a) Increase in the temperature of fluid conveyed.

(b) Air velocity of the surroundings.

Providing proper and adequate insulation on to the facilities and equipments controls heat transfer and maintain the required skin temperatue. The use of high quality insulation can return 20% or more per year on the investment.

2.0 SCOPE

This specifications covers the design, technical requirements and essential particulars for the supply, application & finishing of the thermal insulation complete with all auxiliary materials for the integral piping systems for thermal power stations. Thermal insulation will be applied over integral steam piping having a rated operated temperature of above 60°c for the protection of the operating person & for energy conservation.

2.1 The scope of supply shall be defined in data sheet of the project.

(a) The description of the components to be insulated.
(b) Maximum continuous operating temperature of the components.
(c) Design ambient temperature.
(d) Type of insulation ordered.
(e) Cold face temperature of the insulation above ambient.
(f) Other instruction and notes concerning the design, manufacture and supply of insulation.

2.2 Attachment, devices & accessories shall form the part of the scope of supply.

2.3 Application of the insulation shall be done at site after consultation with or at the request of the chief of the erection group of BHEL at site.

2.4 In case the requirements specified in the data sheet for a particular project are different than what is given in this specification, the data sheet requirements shall be considered as final and binding for that project.

2.5 The pipe lengths given in data of the insulation schedule are inclusive of the equivalent length of tees/stub and reducer. The vertical / near vertical runs of piping are included in the pipe length given in the data of insulation schedule. Additional supporting arrangements are required for insulation on vertical / near vertical piping. The bidder should include the charges for these supporting arrangements in the contract cost based on his experience. No breakup of vertical and horizontal runs are to be furnished to the bidder.

2.6 Data furnished for the items to be insulated is based on pipe erection drawings. No physical measurement of insulation work will be done. The conversion factors for the valve and fittings will be taken from IS:14164.

3.0 DESIGN AND PERFORMANCE REQUIREMENTS

3.1 For the design of the insulation shall be assumed that the surface temperature of the equipment is taken equal to the temperature of the steam. Heat loss at the surface of insulation shall not exceed 180 Kcal / m^2h unless specified in data sheet.

3.2 In principal all the equipments operating above 60^0C shall be insulated. However the contractor shall be guided by BHEL regarding the scope as per clause No.2.

3.3 If the ambient temperature is not specified in the data sheet, the same shall be assumed as 40^0C.

3.4 Insulation thickness shall be completed based on the design parameters given in data sheet of the project. The thickness given in insulation schedule shall be reviewed by the bidder.

3.5 Insulation shall be supplied in thickness 25, 40, 50, 65 and 75mm. Higher thickness shall be made up in multiple layers from them. The breakup of thickness of multiple layers is given under the column insulation thickness in the insulation schedule.

4.0 MATERIALS

4.1 INSULATING MATERIALS

The insulating materials and protective covering shall be new and fresh, incombustible , non-hygroscopic and shall be guaranteed to withstand continuously and without deterioration the maximum temperature to which they will be subjected under the specified application. The insulation material and any component of the finished insulation job shall not react chemically by itself or in combination with water or moisture to form the substances which are more actively corrosive to the applied surfaces than water or moisture alone. The material shall not offer substance to fungus or vermin and must not pose a health hazard. The bidder shall submit with the bid the details of application of protective coatings or other methods he proposes to use for corrosion protection of insulated surface.

The material of insulation used for mattress shall be bonded mineral (rock) as per IS8183.

If preformed pipe section are used, it shall be as per IS9842.

4.2 SHEATHING MATERIAL

The sheathing material for all insulated piping & equipment shall be aluminium sheet confirming to IS 737. Unless otherwise specified in Data sheet, the thickness of aluminium sheathing to be used shall be as follows:

a)Pipes of 450 mm (18 inch.) and above; over outside diameter of insulation :- 1.219 mm (18 SWG).

b)Pipes of 150 mm (6inch)and above; over outside diameter of insulation :- 0.914 mm (20 SWG).

c)Pipes less than 150 mm (6inch); over outside diameter of insulation :- 0.711 mm (22SWG)

4.3 BINDING & LACING WIRE

Binding & lacing wire shall be 20 SWG galvanized steel wire. Where interface temperature is 400°C or more, the binding wire shall be 20 SWG stainless steel wire.

4.4 STRAPS & BANDS

All straps & bands shall be galvanized steel. For securing aluminium sheathing material, stainless steel or anodized aluminium bands shall be used. Bands shall be 20 mm wide & 0.6 mm thick.

4.5 SCREWS

Screws shall be of self tapping type &shall be cadmium/zinc plated.

5.0 APPLICATION OF INSULATION

5.1 GENERAL

The application of thermal insulation is highly skilled job contrary to the general belief. Badly fitted/laid insulation can lead to greater heat loss or surface

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temperature than that estimated & also to constant maintenance. Ample provision shall be made for maximum possible thermal movement & the insulation shall be applied in a manner which will avoid breaking or telescoping due to alternate periods of expansion & contraction. A single layer of insulation shall not be more than 75 mm thick.

The following are some of the points to be considered in the application of insulation

a) Surfaces must be clean, dry, & free from grease, loose scale, moisture etc. before application of insulation.

b) Insulation thickness on flanges & valves should be equal to that of the adjacent/associated pipes.

c) Where contamination by chemicals or oil spillage is possible, it is important that precaution be taken to avoid contamination of insulation.

d) Pipe hangers & supports and any penetrations should be covered in such a way that moisture cannot penetrate.

e) The bare insulation must be stored in a proper place (indoor) to avoid contamination which will lead to change in weight & thermal conductivity values.

f) Rigid sections should have staggered joints where more than one layer is involved & they must be held in close contact with pipe & fitting face by means of wire or bands.

5.2 PIPING :-

5.2.1 For insulation of piping with preformed pipe sections the same shall be applied over the pipe and finally insulation shall be held in position with 15 mm wide aluminium band at not greater than 400 mm spacing.

5.2.2 For insulation of piping with mattresses having backing GI wire or SS wire netting, the required lengths & shapes are cut from the blankets & wrapped on the piping with edges pulled together tightly at the longitudinal joint and secured by lacing wire & this joint shall be at lower side.

If the interface temperature is 400°C or more the wire netting shall be from 20 SWG stainless steel wire and having hexagonal opening of 25 mm size. Otherwise each layer of mattress shall have GI wire netting from 20 SWG &having hexagonal opening of 25 mm size. The ends of all wire loops shall be firmly twisted together with pliers, bent over & carefully pressed into the surface of the insulation.

Preformed insulation & mattress insulation on vertical or near vertical piping must be supported in position by means of metal rings & at intervals as per enclosed sketches.

GI band/Aluminium bands are to be used for tightly securing the different layers of insulation.

5.2.3 Piping bends shall be insulated to the same specification as adjacent straight piping and should form a smooth external surface. Where preformed material is used, it

should be cut lobster back finish and wired or strapped into position.

5.2.4 All insulation shall be protected by an outer covering of aluminium sheathing. All insulation sheathing joints shall be sealed and made effectively weather & waterproof. All flat surfaces shall be adequately sloped to prevent pools of water collecting. The sheathing shall be protected internally with two coats of anti corrosive paint as per IS 158. The jackets shall be installed with the longitudinal lap joint at 45° below the horizontal for horizontal pipes and the joints sealed with sealing compound.

Arrangements for securing the metal finish over the insulation shall ensure that direct metal contact between the insulated surface and outer metal cladding is avoided. 4 mm thick asbestos board packing shall be used as interfaces to thermally isolate the metal covering from supporting arrangements. There shall be over lapping of 50 mm on both longitudinal & circumferential joints. The screws shall be provided at not greater than 150 mm spacing. Sealing compound is to be applied at all sheathing joints. The overlapping in outer casing should always be at the bottom for horizontal piping so that no rain water enters into the insulation through the joints & the lapping must be done so that water will have a natural drainage. In case of vertical & inclined piping, circumferential overlapping is made such that no rain water enters into the insulation through the joints by proper lapping sequence.

5.2.5 All joints in the insulation shall be staggered. For multiple layers of insulation the different layers shall be applied so that the butt joints of one layer do not coincide with those of the other layer.

6.0 VALVES & FLANGES INSULATION

The insulation on all valves & flanged joints shall be enclosed in a removable jacketing so that it may be removed without disturbing the concerned equipment or piping. The thickness of insulation shall be same as that of the pipe line in which these valves and fittings are located. A typical arrangements shown in drawing at sheet no 15.

7.0 GENERAL INSTRUCTIONS FOR ERECTION OF INSULATION

a) Persons doing the actual job can alter the method of fixing of sheet metal as and when necessary, only after consulting the concerned field engineer.

b) Care shall be taken to see that the flexible insulation mattresses are not unduly compressed.

c) The day to day insulation works are covered by sheathing or with suitable protective materials to prevent the rain water entry.

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d) The indicated insulation thickness are minimum requirements which should be maintained, and are based on LRB mattresses. If the bidder desires to use pipe section or combination of pipe section & LRB mattresses, the same should be done after prior approval of design engineer.

e) Where junctions between bodies of different diameter occur and difference of insulation thickness is specified, the greater thickness is to be continued for a length equal to one diameter of the smaller body and then smoothly tapered to the required smaller thickness over a length equal to two diameters of the smaller body.

f) Once the insulation is laid walking on the insulated pipe should be avoided. Suitable scaffoldings are to be used. Similarly slinging of pipes over the insulation should be avoided.

g)The layers** of wool mattresses to be adopted, to obtain the specified insulation thickness, are as per table below unless otherwise specified

Thickness of insulation(mm)	Ist layer	IInd layer	IIIrd layer	IVth layer
80	40	40	- -	- -
100	50	50	- -	- -
110	65	50	- -	- -
120	75	50	- -	- -
130	65	40	25	- -
140	75	65	- -	- -
150	75	75	- -	- -
200	75	75	50	- -

**If the mattress thickness combination are indicated in the insulation schedule, the above instruction is to be ignored. The necessary guide lines of fixing arrangement for pipe section & mattresses are given in the drawings at sheet nos 10 & 11.

h) Insulation Fixing Arrangements:-
Typical fixing arrangements for insulation of pipes & pipe fittings are shown vide drawings listed below;

i)Fixing arrangement pipe section and lightly bonded mattresses/ mattresses at sheet nos. 10,12 & 13.

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ii) Fixing arrangements for lightly banded mattress at sheet nos 11,12 & 13.
iii) Lugs at sheet no 14.
iv) Flats at sheet no. 15.
v) Fixing of insulation on valves at sheet no. 16.
vi) Insulation of tee at sheet no. 17.
vii) Insulation of elbow at sheet no. 18.
viii) Pipe clamp carbon steel at sheet no. 19.
ix) Pipe clamp alloy steel at sheet no. 20.

8.0 PROTECTION OF MATERIALS DURING STORAGE

The supplier shall protect the insulation materials from weather at all times from delivery to finish. Decking & covering tarpaulins alone are not adequate for any length of time & shall not be allowed except in extreme emergencies and only for short periods. Stacking of insulating materials directly on ground shall not be done.

9.0 GUARANTEES

The supplier shall guarantee that if the specified maximum surface temperatures are exceeded on actual measurement, the supplier shall either replace the insulation with a superior material or provide additional insulation thickness at the BHEL'S/ site engineers discretion at no extra cost to the BHEL.

The supplier shall also guarantee the quality of the materials used & workmanship for a period of 18 months from the date of commissioning. Any defects arising from faulty materials or workmanship during this period shall be rectified by the supplier at no extra cost to BHEL.

10.0 INSPECTION & TESTING

10.1 Thermal insulating material :-

Supplier shall arrange for carrying out all the tests for establishing thermal conductivity values, physical & chemical properties as required by relevant IS & or BS codes and standards. The tests shall be done on representative samples drawn from each lot of insulation material to be supplied under this specification & prior intimation shall be given so that BHEL can depute their representative to witness any or all the tests. For thermal conductivity values, test certificates from independent authorized testing agency (subject to BHEL'S approval) shall be furnished to BHEL for approval.

10.2 Other materials :-

For other materials i.e. cladding sheet, wire netting, binding wires, stitching & lacing wires etc., manufacturers correlated test certificates as per relevant codes & standards shall be furnished. In case correlating test certificates are not available, the supplier shall arrange to carry out necessary tests in presence of BHEL'S representative.

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All test certificates shall be furnished & written approval shall be taken from BHEL before commencement of the supply of material.

11.0 DOCUMENTS TO BE SUBMITTED

Two copies of the following pre-approval documents shall be submitted by the bidder along with the offer :-

(i) Thermal conductivity values of the insulating materials at various mean temperatures not older than 2 years for densities 100, 120 & 150 Kg / m^3 from government approved lab for information.

(ii) Manufacturer's descriptive and illustrative literature for insulating materials offered with complete properties as per relevant standards.

(iii) Quality plan duly signed on BHEL format for approval.

(iv) Total bill of material of each item, giving the material specification, density / size / thickness, quantity and the wastage allowance considered shall be indicated in Data Sheet / Insulation schedule, alongwith its thickness calculation.

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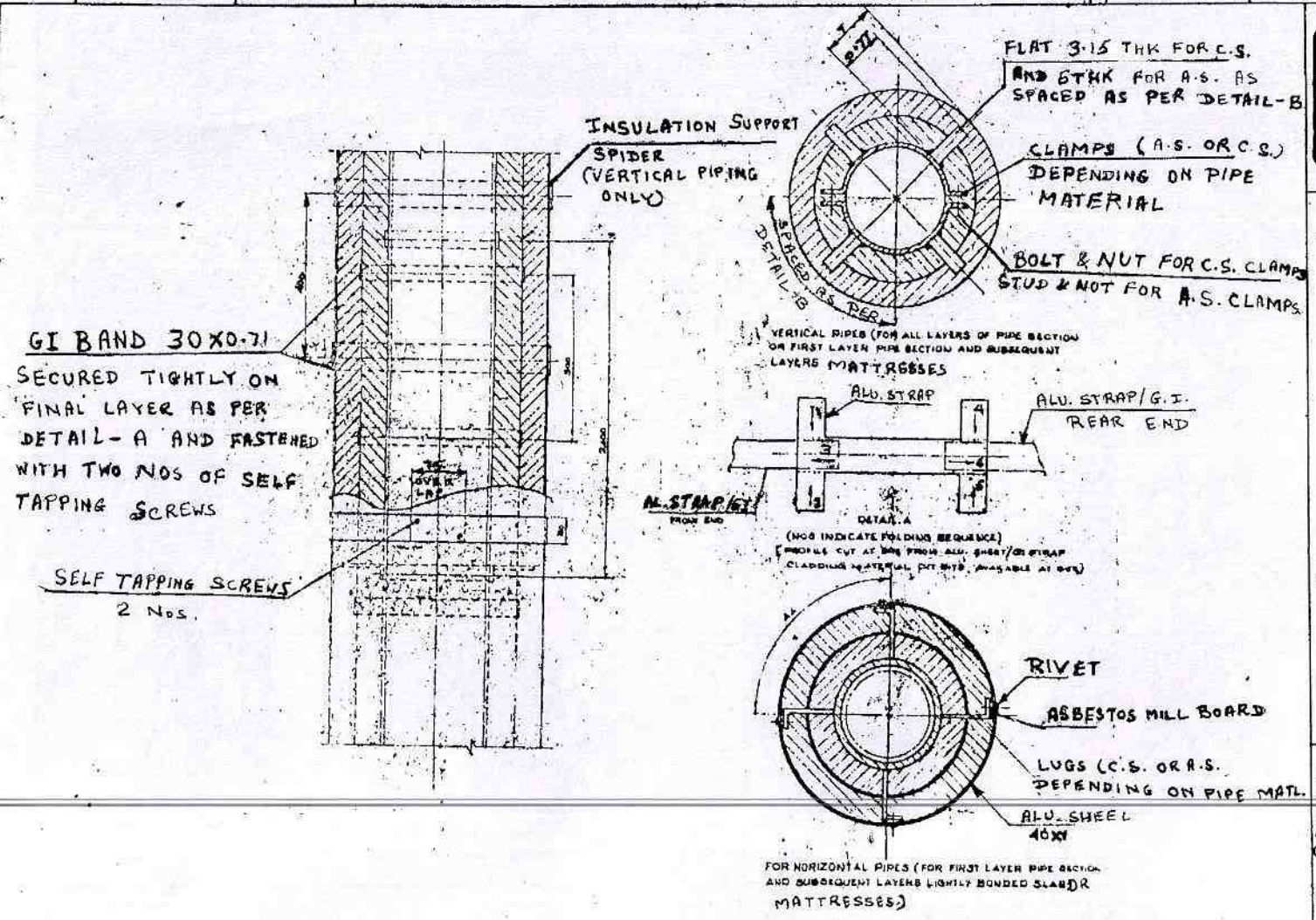

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PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

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INVENTORY No.	SIGN & DATE
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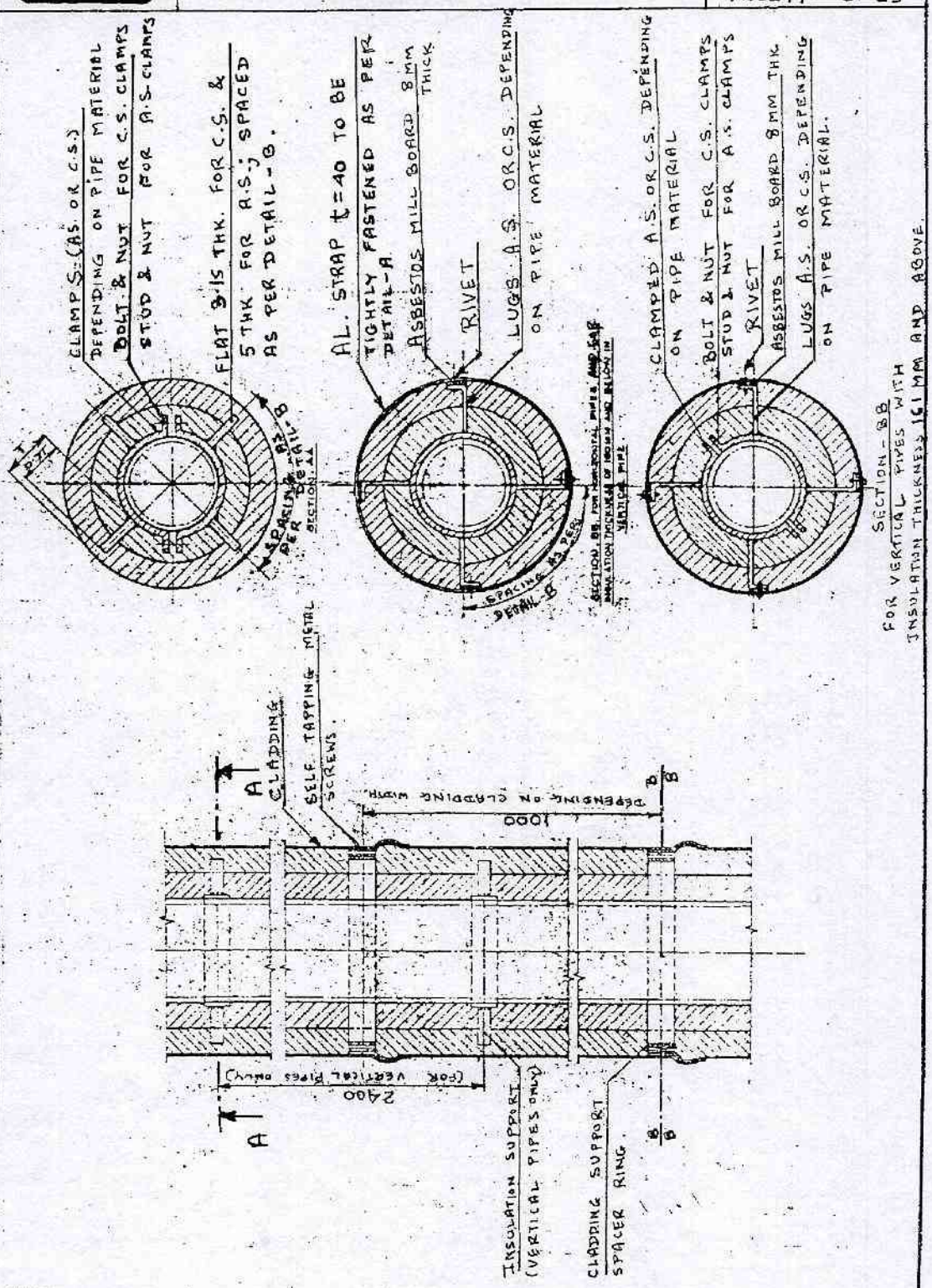

WORKED BY:— Rigan

CHECKED BY:—

NOTES ON ERECTION :-

A. (ONLY PIPE SECTION)

1.Fix support spider on vertical pipes. Bottom most spider at tangent point of bend/tee.
2.Commence insulation of all layers except last layers of insulation, from support spider level in vertical pipes.
3.Fit each layer of insulation and secure with 30 x 0.71 GI bands at spacing as shown. Secure it tightly by cutting the alu. sheet as per detail-A.
4.Secure last layer of insulation and fasten it at a GI band 30 x0.71 (as detail-A).
5.Fix cladding sheet and apply sealant.
6.For horizontal pipes use GI bands 30 x0.71 and secure it as per detail-A.

B. FIRST LAYER PIPE SECTION AND SUBSEQUENT LAYERS LRB MATTRESSES OR MATTRESSES.

1.For horizontal pipes secure tightly the first layer of pipe section using 30 x 0.71 GI bands and as per detail-A.
2.Insert lugs for horizontal pipes and secure it tightly using alu. sheet 40 x1 as per detail-A.
3.Fit in asbestos mill board and rivet.
4.Insert the LRB mattresses or mattresses with field cut slots from edge in felt and wire netting to clear lugs.
5.Fix cladding sheet and apply sealant.
6.For fixing of insulation in vertical pipes follow the same as the one for pipe section.

C. GENERAL

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

D. NOTES ON APPLICATION

1.Fix insulation support spiders on vertical pipes. Bottom most spider at tangent point of bend/tee at bottom.
2.Fix cladding support spacer ring at specified intervals by using aluminium strap tightly (as per detail-A).
3. Commence insulation on all layers of insulation except last layer from support spider level in vertical pipes.
4. Insert insulation at support spacer rings locations with field cut slots from edge in felt and wire netting to clean lugs/projection.
5. Stitch wire netting together at all edges and field cuts.

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CHECKED BY:-

6. Adjacent layers of insulation to be disposed to result in 50 mm overlap.
7. Fit last layer of insulation.
8. All gaps in insulation to be filled with cuttings & finished.
9. Provide and fix cladding with sealing compound.
10. Lugs and flats are issued for standard height. It has to be cut at site depending on insulation thickness (refer insulation schedule for the thickness of insulation).
11. This is applicable for LRB mattresses or mattresses (both for horizontal and vertical piping).

DETAIL-B

OUTER DIA. OF PIPE	NO.OFF
Upto 219	4
273 to 406	6
Above 406	8

E. Inspection at site during and after application of insulation shall be carried out as stipulated in the enclosed field quality plan.

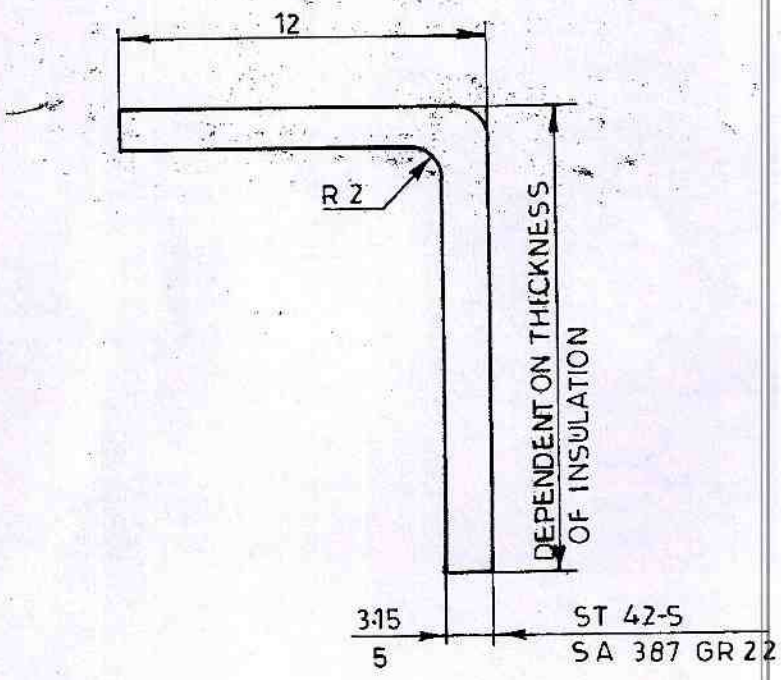
F. CROSS REFERRED STANDARDS :-

IS:737

IS:8183

IS:9842

IS:14164



LUGS

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STEAM TURBINE ENGINEERING

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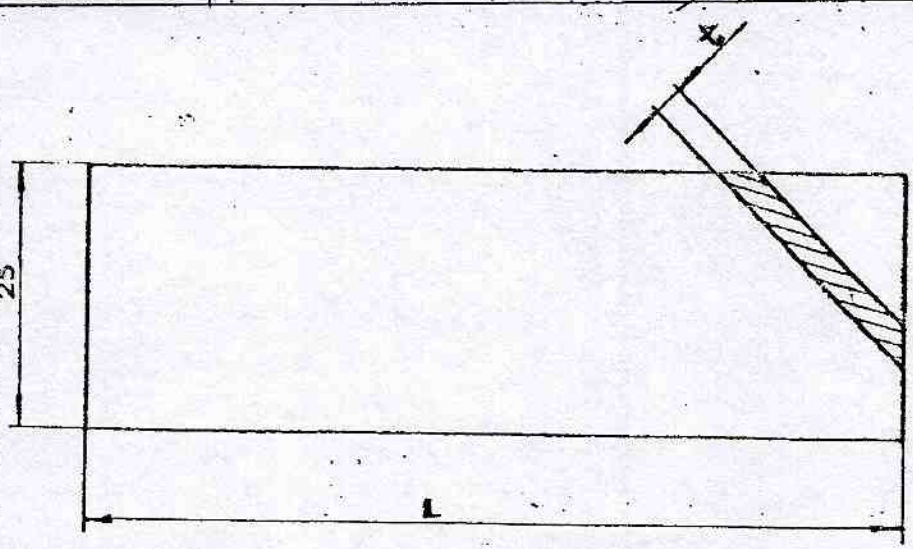

NOTE:-

1. 'L' = 0.7 x INSULATION THICKNESS
2. 't' = 3.15 THK FOR CARBON STEEL (VAR.01)
   5 THK FOR ALLOY STEEL (VAR.02)

VARIANT No.	DESCRIPTION	STD	MATL CODE / MATL SPEC	A/C	UNIT	UNIT WT / QTY.
02	PLATE-5mm Thk.		15 142 285 / SA 387 GR 22			1
01	PLATE-3/5mm-Thk		[illegible] / ST A2-S			1

FLAT

SIGN & DATE 27/6/80

INVENTORY No. P 57888

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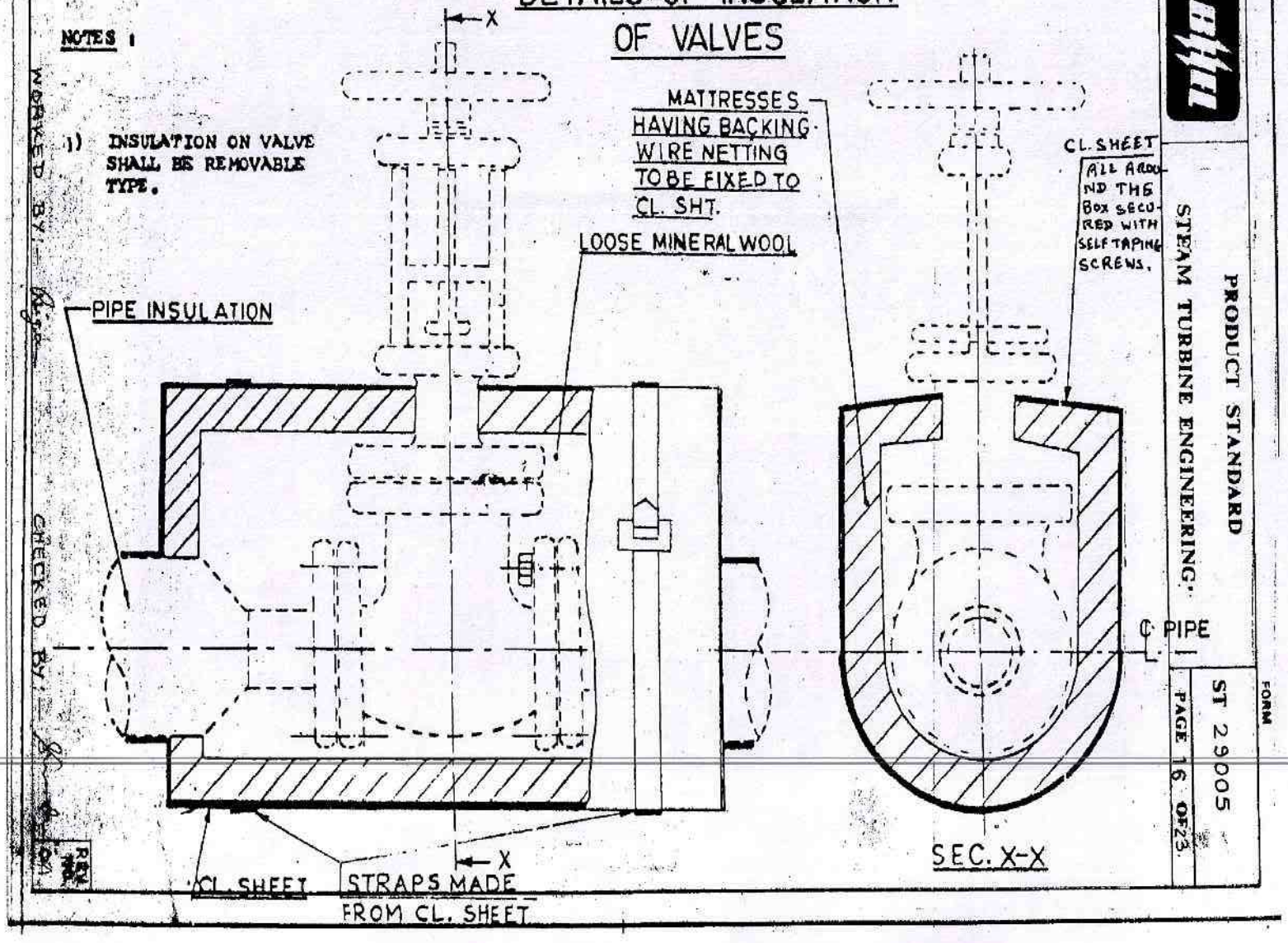
P-5788	22/6/89				

DETAILS OF INSULATION OF VALVES

NOTES :

1) INSULATION ON VALVE SHALL BE REMOVABLE TYPE.



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PRODUCT STANDARD
STEAM TURBINE ENGINEERING

ST 29005

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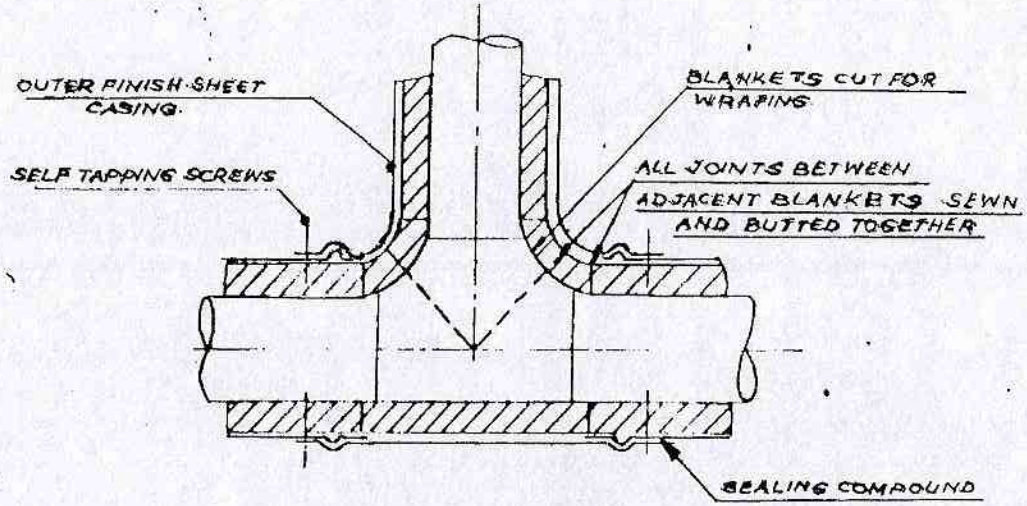
REV. NO. 04

FIXING OF INSULATION ON TEES



TEE INSULATION
(WITH MATTRESS INSULATION)

PRODUCT STANDARD
STEAM TURBINE ENGINEERING

FORM ST 29005

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P-5788	22/4/89				

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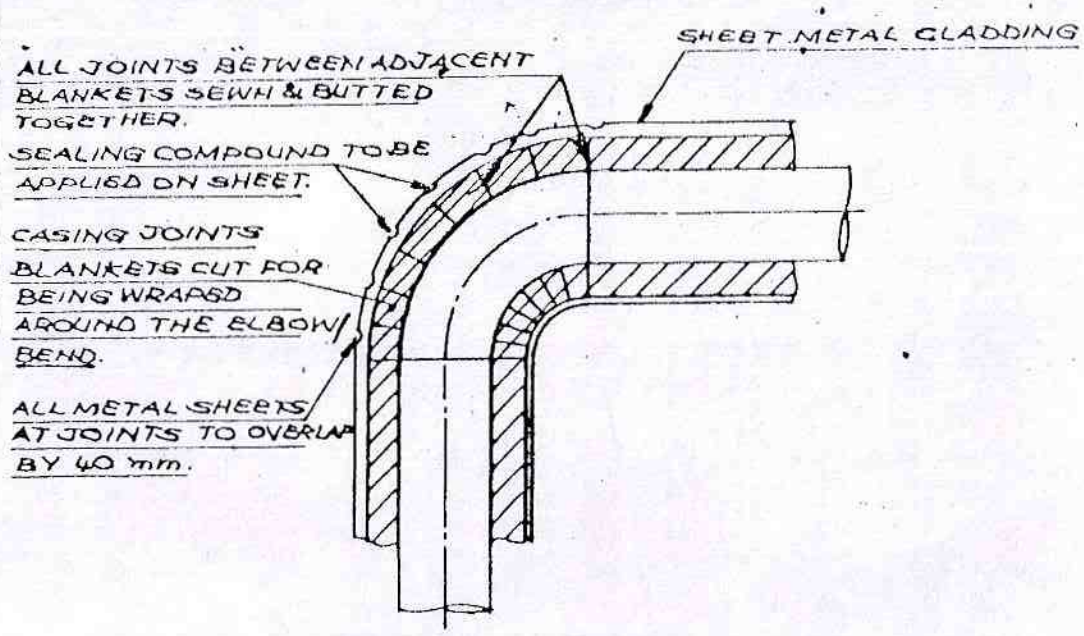
WORKED BY:— Rajan

CHECKED BY:— [signature]

FIXING OF INSULATION ON BENDS / ELBOWS



WITH MATTRESS

BHEL

PRODUCT STANDARD

STEAM TURBINE ENGINEERING

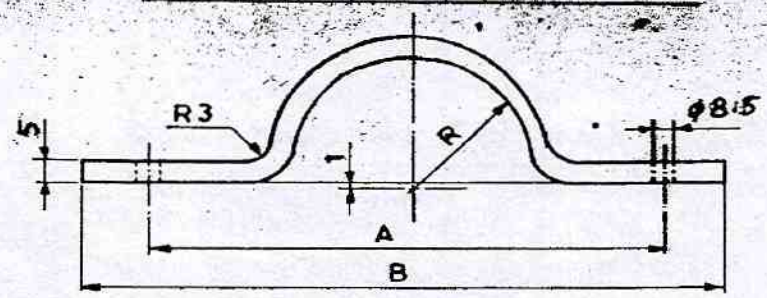
FORM ST 29005

BHEL

PRODUCT STANDARD
STEAM TURBINE ENGINEERING

ST 29005

PIPE CLAMPS (CARBON STEEL)



VAR	A	B	R	NB	DESCRIPTION	MATL SPCN.	UNIT WT.	
01	76	91	30	50	PL. 5X50X120	SJ 42-5/15226	0	240
02	88	103	37	65	PL 5X50X142		0	280
03	104	119	44	80	PL 5X50X166		0	320
04	129	144	57	100	PL. 5X50X210		0	45
05	183	198	84	150	PL. 5X50X288		0	570
06	234	249	110	200	PL. 5X50X371		0	730
07	288	303	137	250	PL. 5X50X455		0	900
08	339	354	162	300	PL. 5X50X534		1	050
09	371	386	178	350	PL. 5X50X584		1	150
10	421	436	203	400	PL. 5X50X663		1	300
11	473	488	229	450	PL. 5X50X746		1	400
12	523	538	254	500	PL 5X50X820		1	620
13	123	138	54	100	PL 5X50X200		0	400
14	174	189	80	150	PL 5X50X282		0	550
15	579	594	280	550	PL 5X50X910		1	800
16	156	171	70	125	PL 5X50X248	SJ 42-5/25226	0	480

REV. NO. 04

WORKED BY:— Rajan

CHECKED BY:— Sundar

SUPERSEDES INVENTORY No.

SIGN & DATE

INVENTORY NO. P 5788

SIGN & DATE 2-4-80

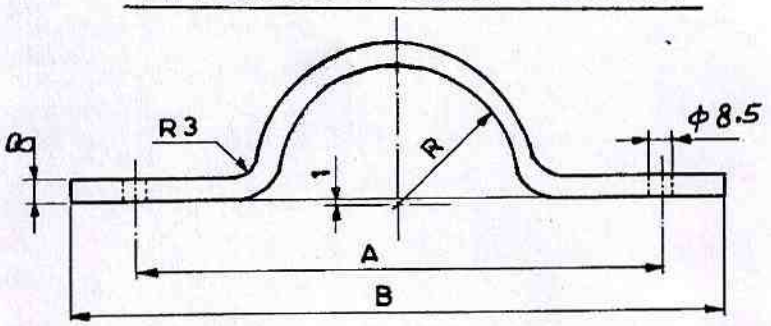
FORM

PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

PIPE CLAMPS (ALLOY STEEL)



VAR	A	B	R	NB	DESCRIPTION	MATL. SPCN.	UNIT WT.
01	76	91	30	50	PL. 8 X 50 X 125	13 Cr M044	0.400
02	88	103	37	65	PL 8X50X 150	↑	0.480
03	183	198	84	150	PL 8X50 X 295		0.920
04	234	249	110	200	PL 8X50X 380		1.200
05	288	303	137	250	PL 8X50X 460		1.450
06	371	306	178	350	PL.8X50X 590		1.850
07	421	436	203	400	PL. 8X50X 670		2.100
08	473	488	229	450	PL.8X50X 752		2.400
09	523	538	254	500	PL. 8X50X824		2.600
10	626	644	305	600	PL.8X50X 990		3.100
11	123	138	54	100	PL.8X50 X 200		0.630
12	129	144	57	100	PL.8X50 X 210		0.660
13	174	189	80	150	PL.8X50 X 282		0.900
14	339	354	162	300	PL. 8X50X540		1.700
15	365	380	175	350	PL.8X50X580		1.820
16	569	584	280	550	PL. 8X50X910		2.860
17	104	119	44	80	PL. 8X50X166		0.520
18	156	171	70	125	PL.8X50X248	↓	0.78
19	730	745	356	700	PL. 8X50X 1150	13 Cr Mo44	3.610

SUPERSEDES INVENTORY No.

SIGN & DATE

INVENTORY NO. P-57688

SIGN & DATE 22/6/88

REV. NO. 04

WORKED BY :- Rajan

CHECKED BY :-

FIELD QUALITY PLAN :

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
01	STORAGE AND HANDLING	Damage in transit and handling	MA	Visual	100%	Specif. & IS 10556	Specif. & IS 10556	Log Sheet	No breakage and damage of insulating materials. No distortion or tearing off the packing.
		Storage location	MA	-do-	-do-	-do-	-do-	-do-	Stacked under covered shed.
		Storage space and surroundings.	MA	-do-	-do-	-do-	-do-	-do-	Free from damp, oil, fume and sulphur bearing gases.
		Stacking height	MA	-do-	-do-	-do-	-do-	-do-	2 M. for pipe sections and 3 M. for mattresses.
		Platform	MA	-do-	-do-	-do-	-do-	-do-	Concrete or wooden.

Contd. on page 22

WORKED BY :- Rigam

CHECKED BY :- [illegible]

REV. NO. 04

FIELD QUALITY PLAN :-

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
02	APLLICATION	Surface cleanliness	MA	Visual	Random	Specification	Specification	Log Sheet	Surface shall be from dirt, rust, scale, oil etc. and dried.
		Insulation material appearence.	MA	-do-	-do-	-do-	-do-	-do-	Material shall be uniform and free from cracks, voide etc.
		Binding wires/ Bands spacing	MA	-do-	-do-	Appd. drg & specif.	Appd. drg & specif.	-do-	
		Wire netting dimensions and location.	MA	-do-	-do-	-do-	-do-	-do-	
		Wire ends	MA	-do-	-do-	-do-	-do-	-do-	Wire ends shall be twisted and bent inside.
		Supports arrangements & spacing	MA	-do-	-do-	-do-	-do-	-do-	
		Expansion joints spacing.	MA	-do-	-do-	-do-	-do-	-do-	
		Insulation thickness test	MA	Physical	10%	IS 7413 & Specf.	IS 7413 & Specf.	-do-	
		Uniformity of thickness	MA	-do-	-do-	-do-	-do-	-do-	
		Bulk density test	MA	-do-	-do-	-do-	-do-	-do-	

Contd. on page 23

WORKED BY :- Rajan

REV. NO. 04

CHECKED BY :-

SIGN & DATE

SUPERSEDES INVENTORY No.

SIGN & DATE 22/6/88

INVENTORY No. 1-51788

FIELD QUALITY PLAN

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
03	FINISHING	Cladding material thickness	MA	Visual	Random	Appd. Drg & Specif.	Appd. Drg & Specif.	Log Sheet	
		ST Screws	MA	-do-	-do-	-do-	-do-	-do-	
		Grooving/ overlapping	MA	-do-	-do-	-do-	-do-	-do-	
		Joints Sealing	MA	-do-	-do-	-do-	-do-	-do-	
		Appearance	MA	-do-	-do-	-do-	-do-	-do-	Surfaces shall be uniform & free from cracks, dents etc.
04	PERFORMANCE TESTING This shall be conducted after commissioning the plant.	Ambient temperat.	MA	Physical	10%	Specif.	Specif.	Log sheet	Shall be measured at a distance of 1 M from the insulation surface
		Ambient air velocity	MA	-do-	-do-	-do-	-do-	-do-	-do-
		Cold face temperature	MA	-do-	-do-	-do-	-do-	-do-	Shall be measured at insulation cladding surface. This shall not be more than the specified value at the specified design conditions.

WORKED BY:- Rigan

REV. NO. 04

CHECKED BY:-

BHEL EVALUATION REPORT FOR SUB-SUPPLIER NO.

FICHTNER

PACKAGE & PROJECT :

EQUIPMENT / ITEM :

GENERAL INFORMATION

1. **PROPOSED SUB-SUPPLIER'S NAME & WORKSHOP ADDRESS** :

2. **CONTACT PERSON** :
   TELEPHONE (LAND LINE/MOB.) :
   FAX :
   E-MAIL :

3. **BRIEF SPEC. OF EQUIPMENT ITEM / MODEL / TYPE / RANGE / CAPACITY:**

4. **REFERENCE LIST (LIST OF PROJECTS THE EPC HAS PERFORMED TOGETHER WITH THE PROPOSED SUB-SUPPLIER FOR THE PROPOSED EQUIPMENT / ITEM / MODEL / RATING)**

CUSTOMER / LOCATION WITH ADDRESS AND CONTACT PERSON	TYPE, RATING & CAPACITY	DATE OF COMMISS-IONING.	NO. OF YRS. IN OPERA-TION	PERFORMANCE FEEDBACK

5. **COMPLIANCE WITH RESPECT TO TECHNICAL SPECIFICATION**

   CLAUSE WISE COMPLIANCE WITH RESPECT TO TECHNICAL SPECIFICATION OF BIFPCL FOR THE PROPOSED ITEM / MODEL INCLUDING PROVENNESS REQUIREMENT.

6. **CONCLUSION**

   BHEL CONFIRMS THAT SUB-SUPPLIER FULFILLS ALL REQUIREMENTS AS REQUESTED BY MFS AND IS DEEMED AS CAPABLE FOR ENVISAGED TASK.

NAME _____ **DESIGN** _____ **SIGN.:** _____

List of Encl. **Date:** _____

SUB-SUPPLIER QUESTIONNAIRE

FICHTNER

Name of the proposed Equipment / Item / Process with Model / Type / Rating / Capacity / Size / Tonnage etc. (As applicable):

_____

_____

1. **Name of Proposed Sub-Supplier**: _____

   Website: _____

2. **Address of Regd. Office:**

   _____

   _____

   _____

   Details of contact person:
   Name_____

   Mobile no._____

   Desig._____
   E-mail:

   - **Country of Head Office**

     _____

   - **Field of activitie**

     _____

3. **Address of Works where Item is being manufactured**

   _____

   _____

   _____

   Details of contact person:
   Name_____

   Mobile no._____

   Desig._____
   E-mail:

4. **Branch / Liaison office in Dhaka**

   _____

   _____

   _____

   Details of contact person:
   Name_____

   Mobile no._____

   Desig._____
   E-mail:

5. **Details of Proposed Works:**

a. Year of Establishment of present works: _____
b. Year of Commencement of: _____
Manufacturing at the above works

c. Details of change in works address in past, if any : _____
d. Total Covered Area : _____

e. Details of covered area like no. of sheds, : _____
Area of each shed etc.
f. Electric power- Connected load: _____
Electric power- Stand by load & system: _____

6. **Annual Turnover &** : _____
Profit in past three years _____
: _____

7. **Do you have in-house Department for**

a) Design Yes / No
b) Research & Development Yes / No
c) Quality control/Inspection Yes / No
d) After Sales Service Yes / No

If any of these items answered with "No", an explanation shall be provided.

8. **Shift works per day** One / Two / Three
Weekly day off

9. **Present Manpower Status:**

Division / Status	Graduate		Diploma	Skilled	Un-Skilled	Remarks
	Technical	Non-Technical				
Design						
Production						
Quality Control / Inspection						
After Sales Service						

a. Enclose organization chart of the proposed works (Y / N) _____

b. Enclose Organization chart of QA / QC Deptt. (Y / N) _____

c. Enclose List of Qualified Welders with process etc. (Y / N) _____

d. Enclose List of Qualified NDT personnel with area of specialization (Y / N) _____

10. **Trade Name of Product (if any)** _____

11. **Brief details of items manufactured:**

Sl. No.	Item & Material (Type / Size / Rating / Model / Tonnage, as applicable)	Installed Capacity	Annual Production Capacity	Annual Production for last Three years		
				I	II	III

12. **Details of foreign Collaboration, if any:**

Sl. No.	Product	Name & Address of Collaborator	Collaboration		
			Scope	Year	Valid upto

13. **Furnish Type Test report for the proposed product (if applicable).**

14. **Approval/Certification by National/International standards/accredited agency applicable for the proposed product (if applicable).**

15. **Furnish statutory/mandatory certification for proposed product (if applicable).**

16. **Furnish supply Experience list of the proposed product.**
List shall include Item description (Type / Size / Rating / Model / Tonnage, as applicable), Customer name, Quantity, Year of Supply, and Year of commissioning.

17. **Enclose End User's operational feedback certificate for the proposed product.**

18. **Enclose list of equipment & machinery specific to the proposed product.**
This should include name of equipment, capacity & nos. etc.:

19. **Enclose Process Flow Diagram indicating in-house & outsourced process.**

20. **General manufacturing facilities available:**

Sl. No.	Description of machine	Inhouse		Outsourced	
		Capacity	No.	Capacity	No.
a)	Material Handling Mobile Crane Fork Lift Over Head Cranes				
b)	Metal Cutting & Bending				
c)	Casting				
d)	Forging				
e)	Fabrication				
f)	Welding				
g)	Machining				
h)	Heat Treatment				
i)	Surface & Cleaning Sand Blasting Shot Blasting Pickling				
j)	Painting				
k)	Metal Coating				
l)	Packing				
m)	Other, if any				

21. **Enclose Testing & Inspection facilities specific to the proposed product:**

a. In-house _____

b. Outsourced _____

22. **Storage of finished goods (covered / open).** _____

23 **Enclose list of the source / make with location of major raw material, bought out items and out sourced process** _____

24. **Furnish details regarding local service support and spare parts availability in Bangladesh. process** _____

25. **Quality management**

25.1 General

25.1.1 Work Instruction for different processes available. (Y / N) _____

if yes, furnish list.

25.1.2 Evaluation system for raw material / bought out item's supplier is available. (Y / N) _____

25.1.3 Records generated during inspection maintained & available for review? (Y / N) _____

25.1.4 Statistical quality control techniques used? (Y/N) If yes please furnish details. (Y / N) _____

25.1.5 ISO certificate for the works available? (Y / N) _____

If yes, enclose copy of the certificate.

25.1.6 Quality & HSE Manual for the works available (Y / N) _____

If yes, enclose copy of the manual.

25.2 Corrective action

25.2.1 Specifically confirm whether System for identifying & disposition of Non Conformity in the process / product is available (Y / N) _____

25.2.2 Specifically confirm whether System for Customer complains & their satisfactory disposal is available. (Y / N) _____

25.3. Documentation Control

25.3.1 Procedure available for documentation control (Y / N) _____

25.4. Control of Inspection, measuring & testing equipments.

25.4.1 Procedure for calibration of testing & measuring instrument available. (Y / N) _____

27. **Certification of sub-supplier**

I CERTIFY THAT THE INFORMATION SUPPLIED HEREIN (INCLUDING ALL PAGES ATTACHED) IS CORRECT.

SEAL

M/S. _____
PLACE _____

DATE _____

SIGNATURE _____
NAME _____
DESIGNATION _____
MOBILE NO _____
EMAIL _____

LIST OF ENCLOSURE:

28. **Certification by Main Supplier:**

ABOVE INFORMATION HAVE BEEN VERIFIED AND FOUND IN ORDER TO COMPLY WITH TECHNICAL SPECIFICATION AS PER EPC-CONTRACT.

Name: _____ **Designation:** _____ **Signature:** _____ **Date:** _____

NOTE:

1. ***COLUMN SHALL NOT BE LEFT UNFILLED. IN CASE OF NOT APPLICABLE / NOT AVAILABLE, THE SAME SHALL BE INDICTED IN THE PROVIDED SPACE.***
2. ***IN CASE PROVIDED SPACE IS NOT ADEQUATE, INFORMATION SHALL BE PROVIDED AS AN ATTACHMENT.***
3. ***PRODUCT CATALOGUE FOR*** *THE PROPOSED EQUIPMENT / ITEM / PROCESS, IF AVAILABLE, SHALL BE ENCLOSED*

Attachment-3

Technical Compliance Sheet

Name of Item/ Package:

Name of Vendor:

#	Technical Clause Reference	Compliance (Y/N)	Remarks
1.			
2.			
3.			
4.			
5.			
6.			
7.			

It is certified that the above mentioned Vendor meets the Technical Criterion specified in the Contract.