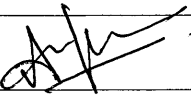
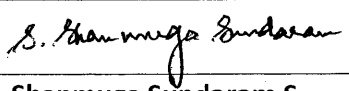
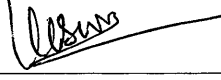

TECHNICAL SPECIFICATION FOR RUBBER LINING OF ABSORBER

CUSTOMER : BIFPCL BANGLADESH
PROJECT : MAITREE 2X660 MW



MAI:PRL:ABR:R00

Prepared	Checked	Approved
		
Arun Kumar SE/FGD	Shanmuga Sundaram S DM/FGD	V Kesavan DGM/FGD
R00 dated 16-05-2020		

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A) DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

Sl. No.	Description	Purpose
1	Performance certificate from end user for meeting the qualification requirement	Qualification requirement for considering the offer
2	Reference list / experience list as per Annexure-III	Qualification requirement for considering the offer
3	Completely filled, sealed & signed Sub-supplier Questionnaire – Annexure IV	Qualification requirement for considering the offer
4	All pages of specification and all filled annexures duly signed & sealed	Technical evaluation
5	Write-up on technical features of rubber lining offered along with Catalogues, adhesive composition, drawings etc.	Technical evaluation
6	Data sheets of the Rubber lining material as per enclosed format	Technical evaluation
7	Surface preparation & sequence of rubber lining Procedure zone wise. Detailed flow chart from start to finish of the lining to be furnished.	Technical evaluation
8	Vendor should clearly indicate the price (for both material and application) of Rubber lining per square meter	Commercial evaluation
9	Priced offer	Commercial evaluation

B) DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

Sl. No.	Description	Purpose	Delivery Time
1	List of datasheets/documents to be submitted for review, approval and information with submission dates	CUSTOMER/BHEL approval to start manufacturing	1 week
2	Catalogue/Datasheets for the Rubber, Primer, Adhesive and any other chemical used for Rubber Lining.	CUSTOMER/BHEL approval to start manufacturing	2 week
3	Manufacturing Quality Assurance Plan for rubber sheet and adhesive to be submitted for approval.	CUSTOMER/BHEL approval to start manufacturing	2 week
4	Field quality plan for surface preparation and lining application procedure along with testing	CUSTOMER/BHEL approval to start manufacturing	2 week
5	Repair and rectification procedure for rubber lining	CUSTOMER/BHEL approval to start manufacturing	2 week

1.0 PROJECT INFORMATION	
a) Owner	BIFPCL Bangladesh
b) Buyer	BHEL, Ranipet
c) Process / application	Wet Lime Stone FGD system

1.1 SITE CONDITIONS	
1.	Ambient Temperature and Relative Humidity
a.	Average Site Condition ASC
	Ambient Temperature : 27.3 deg C
	Ambient Humidity : 87%
	Ambient Pressure : 1007.6 mbar
b.	Summer Site condition SSC
	Ambient Temperature : 36.9 deg C
	Ambient Humidity : 60%
	Ambient Pressure : 1007.9 mbar
c.	Winter Site condition WSC
	Ambient Temperature : 12.2 deg C
	Ambient Humidity : 100 %
	Ambient Pressure : 1017.2 mbar
d.	Reference Site condition RSC
	Ambient Temperature : 31 deg C
	Ambient Humidity : 88%
	Ambient Pressure : 1007 mbar
2.	Design ambient conditions for Equipments
a.	Maximum Design temperature (outdoor) : 45 deg C

b.	Maximum daily average ambient shade temperature	:	38 deg C
c.	Maximum monthly average temperature (in the shade)	:	34.6 deg C
d.	Maximum annual average temperature (in the shade)	:	27.3 deg C
e.	Maximum design temperature of the electrical equipment installed indoors in air conditioned rooms	:	40 deg C
f.	Maximum design temperature of the electrical equipment installed indoors in non-air conditioned rooms	:	45 deg C
g.	Minimum design temperature	:	0 deg C

2.0 INTENT OF SPECIFICATION

- 1 This Specification defines the minimum requirements of Rubber Lining for Absorbers to be used in the process of Flue Gas Desulphurization (FGD) .
- 2 Rubber lining area of absorber tank, thickness of rubber lining required in various sections are given in Table 1 .
- 3 This specification covers the general design, selection of rubber materials, construction features, manufacture, shop inspection, testing at manufacturer's works and delivery at the destination as per purchase order, surface preparation, lining, inspection & testing of the lined surface at Maitree site.
- 4 It is the responsibility of the bidder to comply to the latest applicable statutes, regulation and safety codes in the locality where the lining are to be carried out.
- 5 The rubber lining shall conform to the latest applicable British/American/International Standards only.
- 6 Compliance to this specification shall not relieve the vendor of the responsibility of furnishing Rubber lining materials of proper design, materials and workmanship to meet the specified requirements.
- 7 In case of deviation, it shall be listed in the vendor's proposal under separate section titled as " list of deviations/exceptions to the enquiry documents".

3.0 QUALIFYING REQUIREMENTS(QR)

- (1) Lining material selected should have been used in Wet Limestone based FGD absorbers for minimum *two(2) separate coal fired power plants* for minimum **25000 hrs** operation reckoned as on/before the date of techno-commercial bid opening of the tender/enquiry.
- (2) The manufacturer should have been designed, manufactured, supplied and supervised the installation of rubber lining of the referred plants.
- (3) The site supervisor should have previous experience of installing similar lining in minimum two (2) Wet Limestone based FGD absorbers in at least two(2) separate coal fired power plants for minimum **25000 hrs** operation.
- (4) Any patch work/repair work will not be considered as experience/qualifying requirement.
- (5) Performance certificate from end user for meeting the above qualifying requirements altogether shall be provided by the bidder.

Lining material shall be supplied from such manufacturer who has got the proven material and meets the above Qualification requirements. Supervision of Rubber Lining application shall be done by the person who is meeting the above Qualification Requirements.

NOTE: Performance certificate from end user in their (end user's) letter pad, in their own country official language and a translated English copy by authorized English translator for 2 separate Coal fired Power Plants shall be submitted as mentioned. Performance certificate shall clearly state the name of the manufacturer who supplied material for the Project, material specification and that lining was carried out under the supervision of the Rubber manufacturer.

4.0 SCOPE OF SUPPLY

- 1 Design, manufacture, testing, supply of rubber lining material, surface preparation, application of rubber lining, inspection, testing & handing over of the absorber as per BHEL Purchase Order for the duty condition as specified in Table-2,3.
- 2 Surface preparation for lining surfaces, lining the surface to the satisfaction of the customer shall be under bidder's scope. Cost for Erection and Commission (i.e. Lining application) shall be included in the offer.
- 3 Any Tools required for blasting (air hose, copper slag hose conduit and blasting gun) & rubber lining are vendor's scope.
- 4 Sufficient number of human safety devices required while working inside the absorber, during blasting & rubber lining are vendor's scope.
- 5 Scaffolding shall be arranged by the vendor for rubber lining application work including surface preparation/ blasting/inspection/re-blasting/re-inspection, rubber lining pasting (on absorber roof, bottom, walls, internals, duct as per the attached drawing in the tender specification), testing (including joint inspection along with end customer), repair and any other activities till successful completion of rubber lining application, i.e., from starting of surface preparation to successful completion of the rubber lining application on absorber tank surfaces as well as absorber internals, Scaffolding shall be in vendor's scope.

- 6 BHEL will take approximately 2 months for fixing of absorber internals after rubber lining on absorber roof, walls and duct (as per tender drawing), for which vendor's scaffolding shall be used. Hence vendor has to include scaffolding charges for this period also in the price bid.
- 7 Rubber sheets, adhesives, solvents, primer and all other rubber lining material are to be brought by vendor from qualified source as per specification.
- 8 Delivery of material upto Maitree site office is vendor's responsibility. BHEL responsibility at Maitree site are unloading the container from the vehicle at site, providing space for the container and identifying the power supply location.
- 9 Any covering required during rubber lining shall be arranged by the vendor on their own.
- 10 Vendor has to arrange cables from the identified power source location to container location for air conditioning, if required.
- 11 Vendor has to arrange cables from the identified power source location to absorber location for running the compressor. In case of electric driven compressor, BHEL will provide power supply free of cost. In case of diesel compressor, diesel shall be arranged by the vendor at their cost. Reimbursement for diesel cost shall not be entertained by BHEL.
- 12 Project items to be brought in Bangladesh in the name of Maitree Project shall be exempted from custom duty in Bangladesh. Returnable Project items (such as tools and tackles, dehumidifiers, compressors, blasting units and blowers etc...) to be brought by the vendor in the name of Maitree Project shall be exempted from custom duty. However, vendor has to arrange necessary arrangement/permits by themselves during return of material. BHEL shall help in arrangement of gate passes for all returnable tools/equipments (which are used in rubber lining work).
- 13 VISA Invitation letter will be arranged by BHEL Dhaka office on request from the vendors.
- 14 Labour laws applicable in Bangladesh to permit foreign /inland workers to work at site is available on internet and same to be followed. Suitable registration formalities with Bangladesh Investment Development Authority (BIDA) shall be complied by vendors.
- 15 Tentative date of readiness of site will be informed by M/s BHEL based on the project progress.
- 16 **(A) Vendor has to make arrangements for delivery up to Maitree site including supply of rubber and adhesives in returnable / non-returnable – AC / non-AC containers, custom clearance, de-stuffing, re-stuffing at site, transportation & storage in AC /non-AC container depending on the vendor's product storage requirement to ensure shelf life of rubber products to the required temperature till the completion of rubber lining on the absorber tank surfaces at Maitree site. Vendors to quote on square meter basis, all-inclusive as above. Customs Duty is NIL for items brought in Bangladesh for Maitree Project.**

Any damage of rubber lining material stored in the container, caused due to malfunctioning of AC or any other cause and leaking of container, shall be to the account of the vendor only.

(B) If the vendor could not quote on FOR Maitree Site basis, they can also quote on CFR Mongala Port basis subject to the following:-

- (i) Rubber shall be supplied in non-returnable container only, as BHEL do not have de-stuffing / re-stuffing facility at Port / at Site.
 - (ii) Overseas Insurance, Inland insurance in Bangladesh & Freight charges from Mongala to Maitree will be loaded to vendor's account.
 - (iii) AC required, if any, to maintain the Shelf life of material during customs clearance / movement from Port to Site shall be arranged by vendor only.
- 17 Vendor may decide as per their convenience Returnable or Non-returnable container according to the above clause 15(A). In case of returnable containers (AC / Non-AC), this is vendor's responsibility to make arrangements for return. Customs Duty, if any & Freight for return of empty containers & for return of all tools and tackles shall be to vendor's account.
 - 18 Delivery and Storage of material at Maitree site office is vendor's responsibility. Also, vendor is responsible for arranging suitable containers at site for storing the Rubber/Adhesive/Primer material. BHEL responsibility at Maitree site are unloading the container from the vehicle at site, providing space for the container and identifying the power supply location.
 - 19 BHEL will identify the power supply location at Maitree site. All necessary accessories (e.g., Cables, Distribution Board, Fuses & Switches etc.) required to draw power supply for any equipment used for rubber lining work shall be arranged by vendor only.
 - 20 **Supervision of rubber lining application at Maitree site shall be under original rubber manufacturer's supervisor qualified as per tender specification clause #3.0 (3).**
 - 21 For rubber (pre-vulcanized)/adhesives/primers, vendor has to ensure shelf life till completion of rubber lining application work and guarantee for the performance as per clause 8.0 of this specification.
 - 22 Lighting arrangements required inside the absorber and relevant wiring are in vendor's scope.
 - 23 Exhaust and Man cooler fan required inside the absorber and relevant wiring are in vendor's scope.
 - 24 Material shifting from container to lining location or vice-versa on day-to-day basis shall be vendor's scope.
 - 25 Disposal of used copper slag and any other scrap to the identified location shall be vendor's scope.
 - 26 Boarding & lodging for vendor's crew including supervisor shall be bidder's scope.
 - 27 Daily conveyance from lodging to work spot or vice-versa for vendor's crew including supervisor shall be bidder's scope.
 - 28 Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. In addition, One (1) copy of operation and maintenance manuals shall be translated into "Bangla" and provided as paper copies and in electronic format by the vendor.

5.0 SURFACE PREPARATION

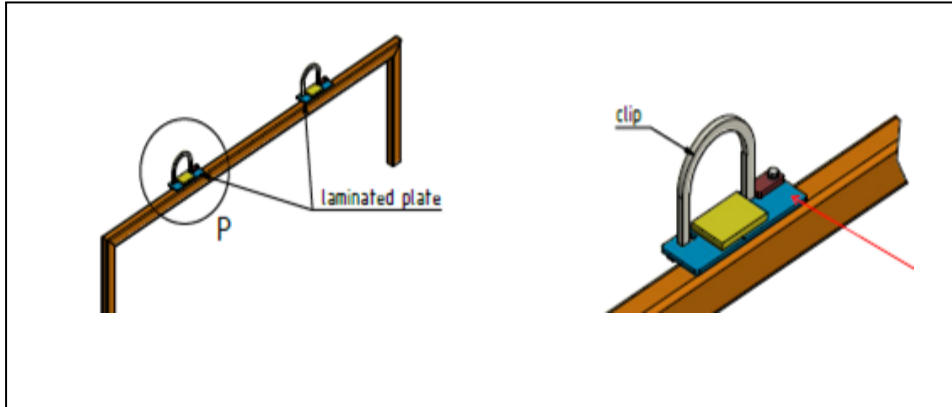
- 1 The absorber and internals to be lined are made of Carbon Steel HR plate SA/IS2062 E250 A/BR.
- 2 The walls are painted with minimum 50μ DFT of Epoxy zinc phosphate (rust proof primer), which is to be removed by vendor during blasting.
- 3 Bidder is requested to go through all sections of the GA drawing for rubber lining **1-FW-000-01036** enclosed. Construction and built up beams and as such condition of internals are furnished in the drawing with localized and enlarged views . Vendor may raise their observations in the **pre-bid query**. Any other new requirements brought forward during technical evaluation stage shall not be considered by BHEL.
- 4 External sharp corners shall be rounded off into convex to radius R3. All fillet welds have to be converted into concave with radius R7min (BHEL's scope).
- 5 Before handing over of absorber to vendor, BHEL and vendor have to jointly inspect the surface to be lined. Any sharp corners, weld spatters, crack, surface slag inclusions, blister, undercuts noticed during inspection shall be rectified by BHEL. In this regard, vendor may require to visit Maitree site 2-3 times, TA/DA has to be considered suitably in the offer.
- 6 The Absorber surface to be lined should be blasted by vendor to a bright grey metal finish (Sa 2½ requirement), free from rust, weld marks, oil and any other foreign matter. The blasting is carried out with the help of dry grit (copper slag) under dry air pressure of 7 Kg/cm² by Compressor.
- 7 After blasting, blasted surface shall be jointly inspected by vendor & BHEL. In case any defect is observed, the same shall be rectified by grinding , welding & grinding by the BHEL and re-blasting shall be vendor's scope. The rubber manufacturer's trained supervisor (qualified as per specification) shall visit the site along with BHEL. If any minor surface imperfection noticed, which is not possible to re-weld & ground, shall be filled with suitable rubber liquid primer by vendor (if their standard practice permits). Cost estimate in this regard shall be suitably taken care in the offer. Filler material such as resin, putties, fillers and low melting point solders and brazes shall not be used.
- 8 Primer and further rubber lining process shall be started after satisfactory concurrence from the qualified supervisor as specified in the QR.
- 9 After blasting of the absorber, the surface has to be cleaned by appropriate solvent, so as to ensure that all the small dust particles are removed. The blasted surface shall be applied with surface protecting primer to prevent the corrosion.
- 10 After this procedure suitable bonding agent and 3 to 4 coating of the specially formulated rubber adhesive should be applied for proper bonding of the Rubber Sheets to be lined.
- 11 Compressor, hose, gun and any other facilities required for grit \shot blasting shall be arranged by vendor. Any hoses provided in the compressed air line shall be tested with air before commencement of shot blasting job.

- 12 The grit\shot blasting machine should be provided with safety valve (safe trip) as a protection against over pressure.
- 13 Scaffolding shall be arranged by vendor. Any scaffolding shall be of steel only.

6.0 RUBBER LINING

- 1 The lining shall completely cover the roof, bottom, sides and internals of Absorber, Spray pipe supports, Mist Eliminator supports, insert plates, openings, Man Hole / Inspection / Flange & nozzle openings, baffle/middle walls etc. as per drawing enclosed.
- 2 The rubber used for the lining shall be of high grade **Bromo Butyl Rubber (Pre- vulcanized)** and shall be proven material meeting the qualification requirements as per specification.
- 3 After Rubber sheet is applied on the surface, rubber sheets should be systematically pressed to the metal surface by the help of mechanical tools like Rubber Rollers and metal thin rollers to remove the air between metal and rubber sheet. All rubber joints are to be properly overlapped (vendor to specify the overlapping width). All the joints shall be covered with suitable size of rubber strip (vendor to specify the size of strip and their practice).
- 4 Vendor shall specify the shelf life of the rubber material/adhesive/primer being supplied.
For rubber (pre-vulcanized)/adhesives/primers, vendor has to ensure shelf life till completion of rubber lining application work considering the Maitree site conditions.
- 5 Vendor shall submit the sequence of operation & time requirement for surface preparation and rubber linings for top, bottom, side walls, partisan walls, baffle walls, mist eliminator support beam & structure and spray header support beam & tie brazing, internal supports.
- 6 Lining material shall be brought to site by vendor in batches as per lining schedule considering the shelf life.
- 7 Separate lining procedure shall be submitted for each zone (top, bottom, mist eliminator section, absorber spray zone, wet dry interface, RC pump baffle plates) of absorber during technical bid submission.
- 8 After completing blasting & lining of two layers of top, side walls and duct BHEL requires approximately 2 months for fixing the internals of absorber.
- 9 After internals fixing vendor to carry out rubber lining of baffle walls and bottom of the absorber.

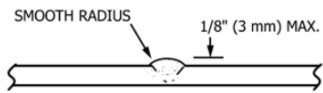
- 10 All nozzles and internals shall be lined with for 4mm thickness.
- 11 Gluing of laminated plates on rubber surface for mist eliminator spray pipe clip is in vendor's scope.



- 12 Vendor to furnish period of time required for curing along with the precautions to be taken during curing.
- 13 In case of any mechanical damage of rubber lining due to BHEL's erection work/internals fixing, repair procedure shall be submitted by the vendor for review & approval and cost of re-lining shall be paid by BHEL on actual square meter basis and it should not exceed the rate per square meter as per the PO.
- 14 Rubber lining procedure for nozzle, flanges and manhole door shall be provided by the vendor.
- 15 Absorber internals with closed chamber, box beam, square hollow etc are provided with vent dia 10mm through exterior absorber wall. Vendor has to specify the location suitably for their rubber lining requirements.

6.1 RUBBER LINING METHOD RECOMMENDED

- a) Butt weld with smooth radius with level of rise 3mm max (ASTM D4618)



- b) DN 14879-1 table 3

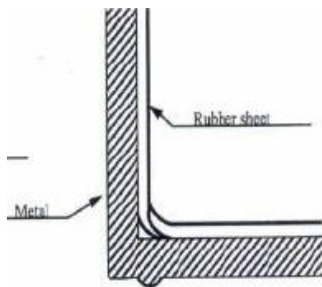
Rubber lining of butt weld



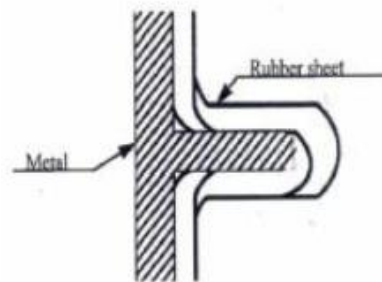
- c) Rubber lining of butt weld with change in wall thickness (DN 14879-1 table 3)



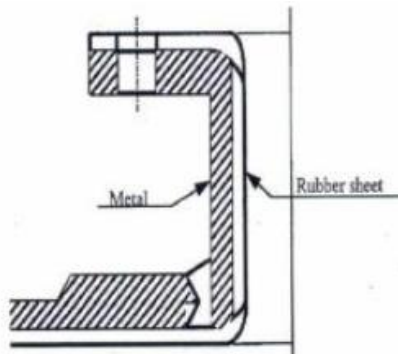
- d) Rubber lining of corner



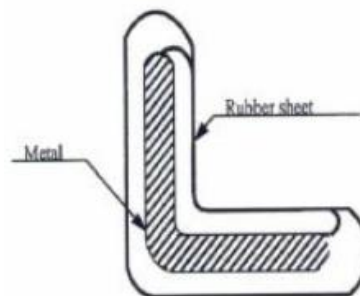
- e) Rubber lining of Mist Eliminator Support plate



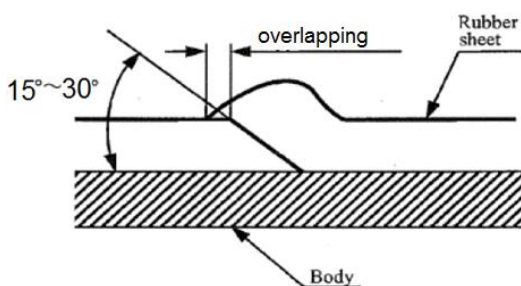
- f) Rubber lining of Nozzle and Flanges



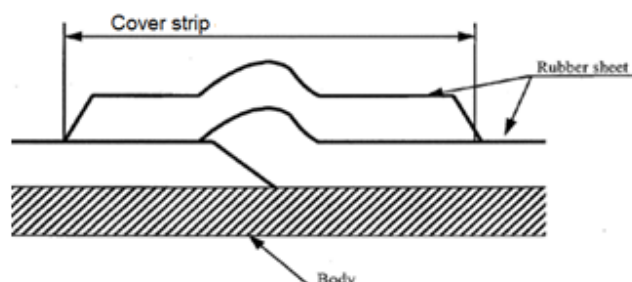
- g) Rubber lining of Angles



- h) Rubber lining joint with overlap (vendor to specify minimum overlap)



- i) Rubber lining joint with overlap and additional cover strip (vendor to specify their practice and size)



7.0 INSPECTION AND TESTING OF RUBBER LINING

A) Stages of inspection prior to lining

1. Joint inspection by vendor and BHEL as fabricated condition (vendor to visit site along with qualified supervisor)
2. Joint inspection after blasting (by vendor along with qualified supervisor & BHEL). Reference photographs or plate shall be used to establish the level of surface cleanliness.
3. Before application, all material to be used in the lining process are visually examined and where appropriate, physically and practically tested to confirm that they are in an acceptable condition.

B) After the completion of lining, tests shall be conducted by the vendor to assess the quality of rubber lined surfaces.

- 1 Ageing Test : 70°C for 24 hrs.
Change in Tensile Strength: $\pm 5\%$
Elongation at break : $\pm 10\%$
- 2 Abrasion Test : Wt. loss – Max. 25%ss
- 3 Sound Testing for blister or less adhesion : Vendor to specify.
- 4 Tensile Strength : $\geq 35 \text{ kg/cm}^2$ (min) .
- 5 Elongation at break : $\geq 300\%$ minimum for 4mm thk rubber specimen
- 6 Peeling strength as per EN14879-4 : $\geq 3 \text{ N/mm}$ upto service temperature 60°C
- 7 Hardness : $55 \pm 5^\circ$ Shore A
- 8 Spark Test : 3-4 KV/ mm (Vendor to specify voltage & sweeping speed)
- 9 Lining shall be visually inspected to ensure free from any visible imperfection, i.e., blistering inclusions, discontinuity, cracks, or mechanical damage, weed out fibers, entrapped air and exposed fires. More attention shall be paid to edges, corners, flange facings and joints. Imperfections in the lining of joints shall be suitably marked and it shall be subjected to additional testing. Defects are to be repaired by the vendor to the satisfaction of BHEL/Customer as per approved repair procedure.
- 10 Measurement of lining thickness after lining application: Vendor to specify the measurement method. Lining thickness less than 10% of the nominal thickness is not be permitted.
- 11 Final inspection and testing of the rubber lining & finishing shall be as per customer approved field quality plan.
- 12 After installation, the Rubber lining shall be subjected to testing at site as per relevant standards. If the performance is found not to meet the requirements as specified, the Rubber lining shall be rectified or replaced by the Vendor without any extra cost to the Purchaser.
- 13 Spark test shall be carried out in the presence of customer/BHEL for continuity by high frequency high voltage spark tester. If there is any puncture, they are to be checked and rectified as per approved field quality plan.

7.1 REPAIRING PROCEDURE

Repair and rework procedure to be submitted by the vendor along with technical bid and after ordering also. Repairing procedure submitted after ordering shall be duly endorsed and stamped by qualified manufacturer as per specification clause #3.

8.0 PERFORMANCE GUARANTEE

The lining shall be guaranteed for uninterrupted minimum life of 25000 hrs. Performance parameters to be guaranteed by the vendor and tolerances permitted shall be as indicated in the data sheet. Rubber lining or any portion thereof is liable for rejection, if it fails to give any of the guaranteed performance parameters. During Guarantee period any defects noticed due to faulty material and workmanship, shall be rectified by vendor free of cost.

9.0 STAGE PAYMENT

In case of Stage payment :

- (1) Before starting rubber lining, blasted surface inspection certificates issued by qualified supervisor along with BHEL/Customer shall be enclosed.
- (2) After Rubber lining application all necessary certificates for inspection and all necessary tests, conducted on the lining as per specification clause #7 witnessed by qualified supervisor & BHEL/Customer, also to be enclosed.

Table -1

Absorber Rubber lining area Estimation for Maitree	
Rubber lining of absorber walls 8mm thickness (2layers of each 4mm thick)	Area (SM)per absorber
front side(below inlet)	137.2
front side (above inlet)	376.0
front side(top taper)	129.6
left side	284.3
right side	284.3
back side	605.9
back side(top taper)	129.6
top (roof)	239.1
outlet duct	175
bottom	208.9
total 8mm lining	2570.0
Rounded to	2570 SM
Rubber lining of internals (4 mm thickness)	Area(SM)per Absorber
Cross bracing	20.6
Beam at EL 33300 Cross beam	10.3
Beam at EL 33300	23.1
Beam at EL 28620	14.9
M/E wash pipe support frame	76.7
Beam at EL 24610 (M/E support-2)	115.5
Beam at EL 22700 (M/E support-1)	115.5
M/E support ring at EL 22700 & 24610	12.5
spray support plates at EL 12026 &13140	10.4
Beam at EL 13140 (spray support-2)	81.0
Beam at EL 12026 (spray support-1)	81.0
Beam at EL 6900	14.9
Beam at EL 4100	14.9
Partition wall	157.3
RC pump Grating wall inclined beam	99.6
RC pump Grating wall support	26.2
RC pump Grating wall horizontal supp	12.7
RC pump Grating wall horizontal supp	9.5
Nozzles & Manholes	65.3
Total 4mm lining	962.0
Rounded to	970 (SM)

Note : (1) Bidder should clearly indicate the price for Rubber lining (for both material cost & field application charges at Maitree site per Square meter. Area given in the above table is tentative. The actual area may vary +/- 5% of the above stated area. Payment will be as per the actual area for which rubber lining is carried out.

(2) **Thickness Tolerance** of semi-finished product to be used for lining : $\pm 10\%$ as per EN14879 .

Table -2 Process Parameters

Sl. No.	Parameter	Slurry
1	Slurry to be handled	Gypsum Slurry
2	Maximum solid particle size	150 mesh (140 micron)
3	Normal solid particle size,d50	325 mesh (43 micron)
6	Chloride concentration	27,000 ppm (max)
7	Hardness of particle	5-7 (Mho scale)
8	Slurry concentration	30 wt%
10	Sp. Gravity of Slurry	1.215
11	Viscosity	0.03 Pa.S
12	Slurry temperature	70 deg C

Note : Maitree FGD is without bypass system, rubber lining shall be designed for the severe service temperatures as following : **90 Deg.C (Continuous), 100 Deg.C (for 1 hour) and 120 Deg.C (for 5 minutes).**

Table: 3 Flue Gas Parameters at inlet and outlet**a) Normal Operation:**

DESCRIPTION / LOAD	Unit	FGD Design Point-FGD Inlet	FGD Design Point-FGD Outlet
FGD Outlet Flue Gas Flow	t/h	2780	3085.69
FGD Outlet Flue Gas Volume	m ³ /s	910.3	824.17
Flue Gas Temperature	°C	150	60
Flue Gas Density	kg/m ³	1.04	1.04
Humidity	(H ₂ O/Dry)	0.058	0.13
H ₂ O	Wt% (Wet)	9.00	11.30
SO ₂	Wt% (Wet)	0.014	0.014
SO ₃ (Gas)	ppm(Dry) @ actual O ₂	<1	<1
H ₂ SO ₄ mist	mg/Nm ³ (Dry)	-	73
CO ₂	Wt% (Wet)	19.72	16.98
O ₂	Wt% (Wet)	5.19	5.03
N ₂	Wt% (Wet)	69.4	66.7
HCl	ppm (Dry)	72	7.2
HF	ppm (Dry)	13	1.3
Dust	mg/Nm ³ (Dry)	<50	<50

b) Emergency Condition: Since Maitree FGD is without bypass system, rubber lining shall be designed to the severe service conditions. Emergency quench system is provided to quench the flue gas before it enters the absorber. **Rubber lining shall be designed for temperature 90 Deg.C (Continuous), 100 Deg.C (for 1 hour) and 120 Deg.C (for 5 minutes).**

c) Absorber base, bottom tank, spray area, agitator installed areas, and Oxidation Zone are subject to abrasion. Rubber lining inside absorber shall be selected considering anti-abrasion also.

Datasheet – Pre-Vulcanized Bromo Butyl Rubber:

(Vendor has to submit duly filled and sealed datasheet with technical offer)

Material	Bromine Butyl Rubber	
1) Physical Properties		
Properties	Unit	Bidder to specify/confirm
Hardness	Shore A Hardness	
Tensile Strength	kg/cm ²	
Elongation at break	%	
Specific Gravity	g/cc	
Adhesion to metal	N/mm	
Available Gauges	mm	
Design temperature	deg.C	90 (continuous)
	deg.C	100 (for 1 hour)
	deg.C	120 (for 5 minutes)
Available form	Pre-vulcanized sheets for site lining	
2) Brief formulation info:		
Polymer content	%	
Filler content	%	
3) Cure methods and time	Hours	
4) Shelf Life		
Pre-Vulcanized rubber sheet @ < 25°C	Years	
Pre-Vulcanized rubber sheet @ 25°C to 35°C	Years	
Pre-Vulcanized rubber sheet @ 35°C to 45°C	year	
Adhesive @ < 25°C	year	
Adhesive @ 25°C to 35°C	year	
Adhesive @ 35°C to 45°C	year	
Specify the item having minimum shelf life (Rubber/Adhesives/Primer/ other)	Item name and shelf life in years @ 25°C to 35°C	
5) For rubber (pre-vulcanized)/adhesives/primers, vendor has to ensure shelf life till completion of rubber lining application work considering the Maitree site conditions. Vendor to confirm.		
Note:		
1) Bidder to specify the storage requirements for the sheets, adhesive, primer, etc		
2) Bidder shall also provide the datasheet for adhesive and primer mentioning shelf life		

SIGNATURE OF BIDDER _____

NAME & Designation _____

ANNEXURE – I- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

S.no	Clause	Page	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

ANNEXURE – II- SCHEDULE OF GUARANTEES

We, _____, guarantee that the Rubber Lining proposed for this project will have an uninterrupted minimum life of **25000 hrs.**

The lining is guaranteed for faultless material and workmanship and also for a period as mentioned above from the date of handing over. During the Guarantee period any defects noticed due to faulty material and workmanship, the same shall be rectified by us free of cost.

SIGNATURE OF BIDDER (Rubber Manufacturer) -----

NAME -----

DESIGNATION -----

ANNEXURE – III**REFERENCE LIST as per format shown below.**

S. No.	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Absorber (Yes/No)	Year of Commissioning	Absorber Rubber Lining Area

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

ANNEXURE – IV**Sub-supplier Questionnaire**

Vendor to submit enclosed sub-supplier questionnaire duly filled, sealed & signed by the **rubber manufacturer**.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**BHEL EVALUATION REPORT
FOR SUB-SUPPLIER NO.
ANNEXURE - IV**

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: _____



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						



SUB-SUPPLIER QUESTIONNAIRE

FICHTNER

- 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**

