1. INTRODUCTION:

This guidance covers the minimum requirements for the design and fabrication of carbon steel vessels, equipments and pipes for rubber lining.

2. GENERAL:

2-1 : Structure of steel constructions should be designed to withstand mechanical shocks under transportation and service. Particularly, hard rubber lined vessels should be paid full attention because these vessels are liable to cause cracks when transported or installed.

2-2 : As the lining process is done manually, any constructions (except pipe) inaccessible by hands should be split into accessible one, as shown in Fig. 1.

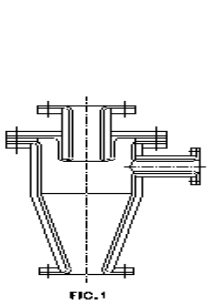


FIG.1

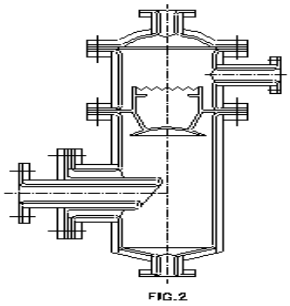


FIG.2

2-3 : The parts tend to wear must be designed to be able to dismount and check or exchange easily as shown in Fig.2

2-4 : All lining surface should be designed as simple as possible and reinforcement must be provided on the side not to be lined as shown in Fig.3.

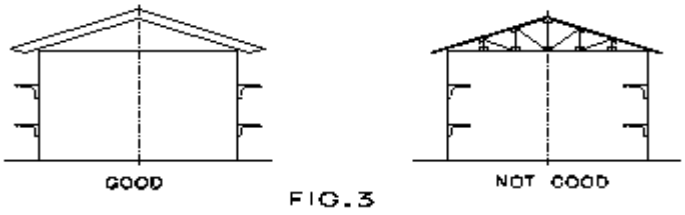


FIG.3

2-5 : When heating is necessary, care must be taken not to raise the temperature partially too high as shown in Fig.5 (b), or not to contact with rubber directly. It is recommended to design as shown in Fig. 5(a) and keep the hating pipe at least 100 mm apart from the lining.

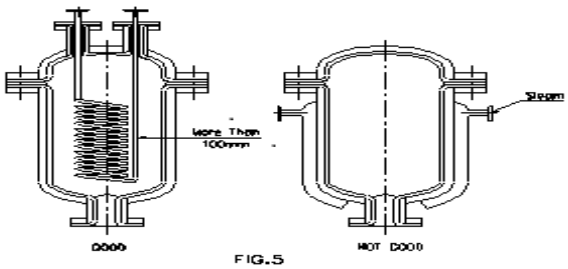


FIG.5

2-6 : When it is necessary to insert nozzles in vessels special attention should be paid to dimensions securing enough room at overlap of rubber lining as illustrated in Fig. 6.

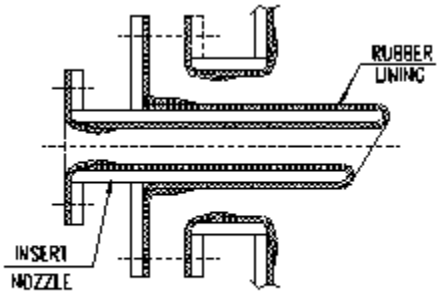


FIG.6

3. WELDING AND FINISHING:

In order to get the optimum adhesion between the base metal and rubber sheet, or to prevent pinholes or other defects, designers and manufacturers of pipes, vessels and other steel constructions are requested to give proper consideration to the following points.

3-1 : Welds and flush on the side to be lined shall be ground smoothly and must be free of cracks, undercuts, overlaps, pinholes and blowholes.

3-2 : Butt joint is preferable and overlap joint is not recommended for lining vessels. Welding must be generally made from both sides as shown in Fig. 7.

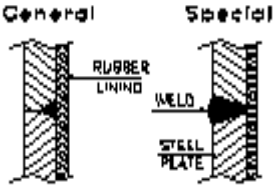


FIG.7

3-3 : All corners should have the curvature of at least 3 mmR for convex surface and at least 10 mmR for concave surface as shown in Fig. 8.

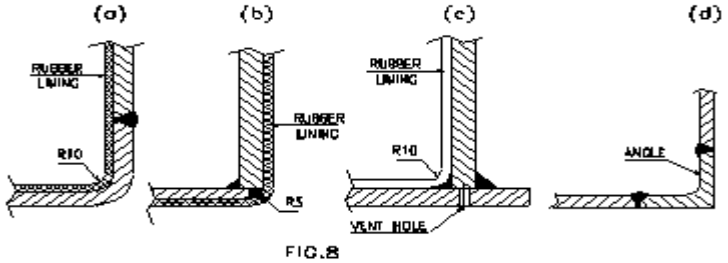


FIG.8

3-4 : All welds for lining vessels should be continuous as shown in Fig. 9.

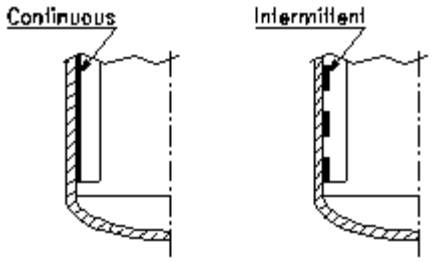


FIG.9

3-5 : When air pocket brought about by continuous welding cannot be avoided, air vent-hole or intermittent weld must be provided as shown in Fig. 10.

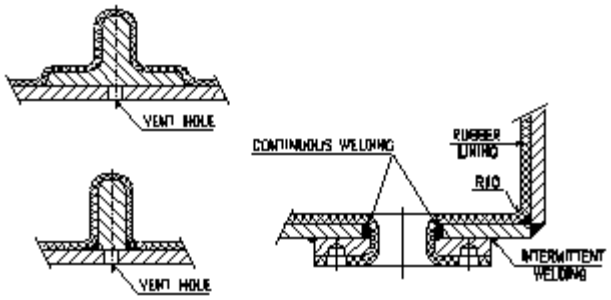


FIG.10

4. PIPES AND FITTINGS:

Pipes and Fittings should have smooth surface on the side to be lined. Lining on surfaces with sharp projection and irregularities should be avoided.

Flat-faced flanges shall be welded on square to pipes or fittings. The weld on the front face should be continuous and ground to a smooth convex surface not less than3 mm in radius.

Pipings should be designed to use standard pipes and fittings and complied with following requirement.

4-1 . STRAIGHT PIPES:

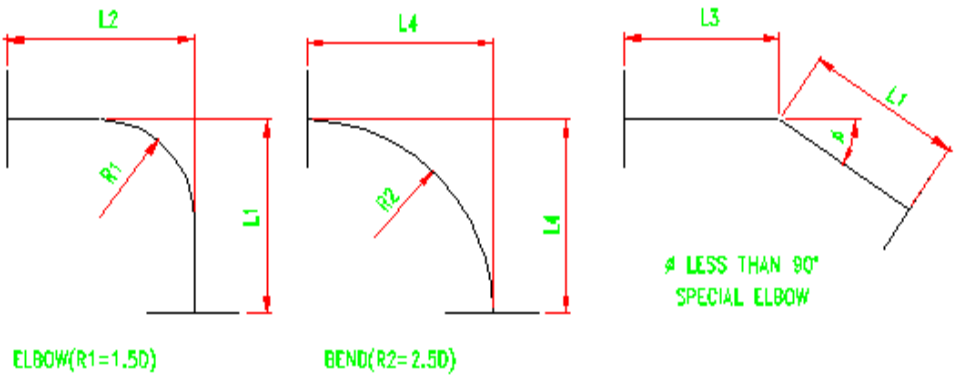
The maximum length of straight pipes, measured between flange face, which can be satisfactorily lined are given below:

Nominal diameter (mm)	Maximum length (mm)
Over 25 to 40	2750
Over 50 to 80	5500
Over 100 to 550	6000
Over 600	12000

4-2. STRAIGHT PIPES:

The dimensions of Elbows and Bends which can be satisfactorily lined are as below:

DIMENSIONS OF BENDS AND ELBOWS (STEEL) FOR RUBBER LINING FEASIBILITY :

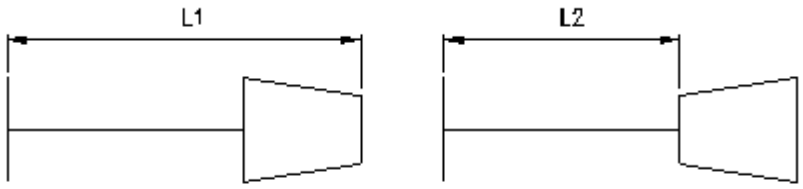


ALL DIMENSIONS IN MILLIMETRES:

NOM DIA.	MAX L1	MAX L2, L3	MAX. L4
25	90	300	175
32	95	300	210
40	100	300	250
50	115	500	280
65	130	2000	325
80	150	3000	400
90	170	3000	450
100	190	3000	500
125	195	3000	
150	230	3000	
200	310	3000	
250	385	3000	
300	465	3000	
350	540	3000	
400	615	3000	
450	692	1000	
500	770	1000	
550	838	5500	
600	912	5500	
650	990	5500	
700	1000	12000	

Note: The above tabulation shows sizes which can be fabricated and rubber lined satisfactorily.

DIMENSIONS OF REDUCING PIPES (STEEL) FOR RUBBER LINING FEASIBILITY of CONCENTRIC AND ECCENTRIC REDUCING PIPES.



REDUCING PIPES

4-3 REDUCING PIPES:

The dimensions of concentric and eccentric reducing pipes which can be satisfactorily lined are given below. Pipes should be reduced by mechanical process or by high-frequency reducers.

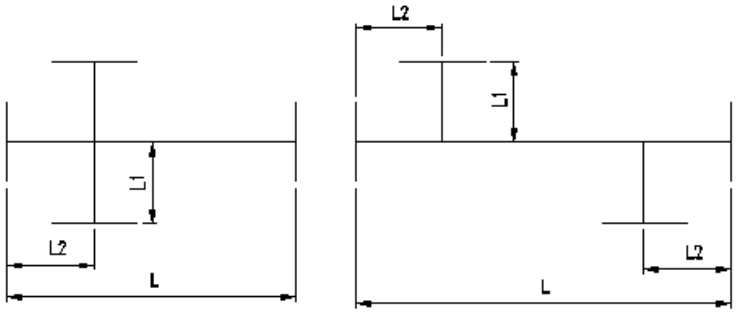
ALL DIMENSIONS IN MILLIMETERS

NOM.DIA	L1 MAX.	L2 MAX.	NOM.DIA	L1 MAX.	L2 MAX.
25	100	2750	200	230	5500
32	120	2750	250	250	5500
40	120	2750	300	300	5500
50	130	5500	350	480	5500
65	150	5500	400	500	5500
80	150	5500	450	530	5500
90	160	5500	500	650	5500
100	160	5500	550	650	5500
125	200	5500	600	650	11000
150	220	5500	700 & above	2000	10000

Note:

- The above tabulation shows sizes which can be fabricated and rubber lined satisfactorily.

DIMENSIONS OF TEES, CROSSES AND BRANCHED PIPES (STEEL) FOR RUBBERLNING FEASIBILITY.



THE DIAMETER OF THE BRANCH(S) SHOULD BE THE SAME OR LESS THAN THAT OF THE STRAIGHT PIPE.

ALL DIMENSIONS IN MILLIMETERS

NOM.DIA	L	L1 MIN.	L2 MAX.
25	2750	80	100
32		85	100
40		90	100
50	5500	100	100
65		115	100
80		125	150
90		135	150
100	5500	145	150
125		165	150
150		190	200
200		225	250
250		270	300
300	5500	310	500
350		340	500
400		370	500
450		410	500
500		450	500
550		490	500
600 & above	12000	see notes below	see notes below

Note: The above tabulation shows sizes which can be fabricated and rubber lined satisfactorily.

5. FLANGES AND GASKETS:

5-1 All branches and outlets of tank should be equipped with flange to allow the rubber lining to over flange face. Typical flanged joints are illustrated in Fig.11.

5-2 Mating flange of sectional tank should be square and plumb, and sections should be made to avoid distortion and when bolted together.

5-3 Normally, soft rubber gaskets should be interposed between lined flanges. If the flange faces have to withstand very high loads, the flanges joint shown in Fig. 11(d) should be used.

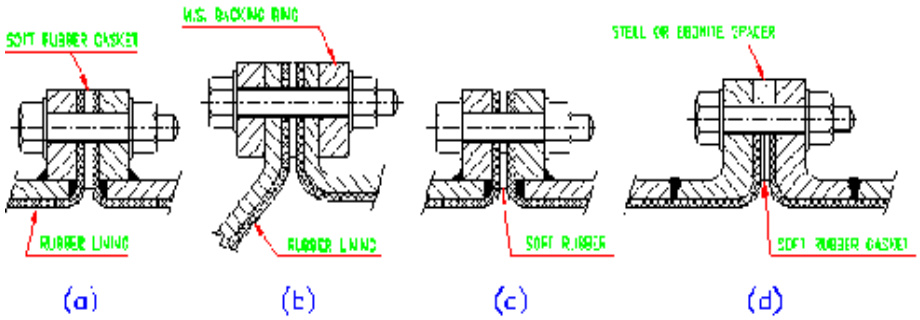


FIG. 11

6. NOTES:

6-1 : Any surface of the base metal to be lined should not be coated with paint or oil.

6-2 : Any surface of the base metal to be lined should not be galvanized.

6-3 : Although it is possible to line on various construction materials, carbon steel is most preferable as substrate. For cast materials special care should be taken to prevent blowholes or cavities.

7. INSPECTION PROCEDURE AND STANDARD FOR LINING PIPES:

Each pipe should be confirmed whether it is ready for rubber lining through checking dimensions, appearances and quality of weld etc. according to the drawings standard for lining.

If any obstacle is detected, repairing should be requested to the fabricator of pipes.

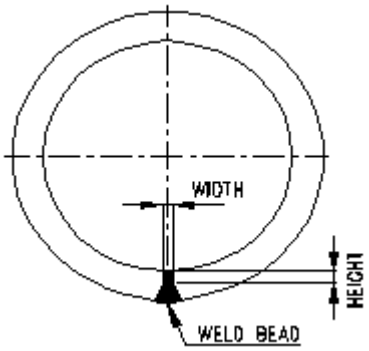
7.1 INSPECTION OF WELD ZONE:

a) Visual inspection:
Weld lines shall be free from weld cavity and spatters shall be completely removed. Under-cut shall be 0.3 mm or less.
Appearance shall be not unsightly.

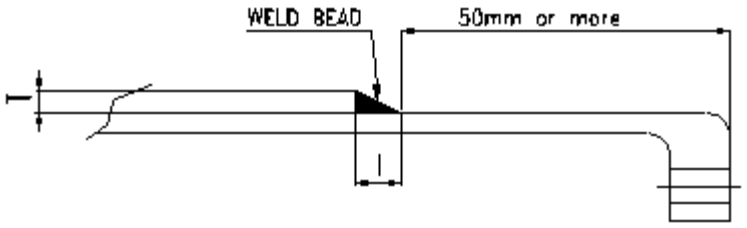
b) Check Curved faces at corner :
Convex shall be 3 mm Radius at least, concave shall be 10 mm Radius at least.

c) Check height and width of weld bead :

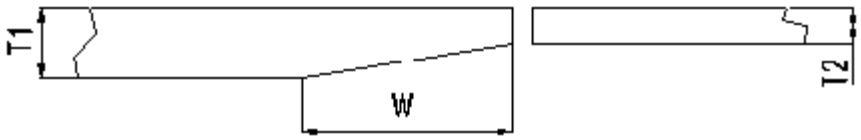
Diameter 550 mm or less :	Diameter 600 mm or larger :
Height - 0.1 ~ 0.2 mm	Height - 1.0 ~ 1.5 mm
Width - 1.5 ~ 2.0 mm	Width - not specified



d) Check finish of bead end:



e) Check butt joint when plates of different thickness is used:



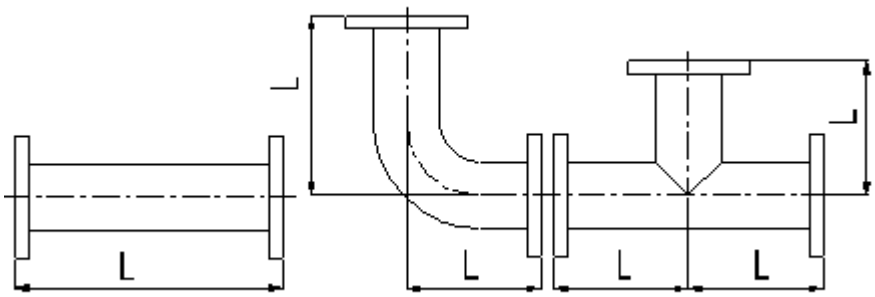
$W = (T_1 - T_2) \times 10$ mm or longer

7-2 Visual inspection:

The flange faces to be lined shall be free from disadvantages irregularity.

7-3 Dimensional inspection:

a) Tolerance of length of pipes, bends and tees :



1 = + 0, - 3 (for length of 1000 mm and less)

1 = + 0, - 3 (for length over 1000 mm)

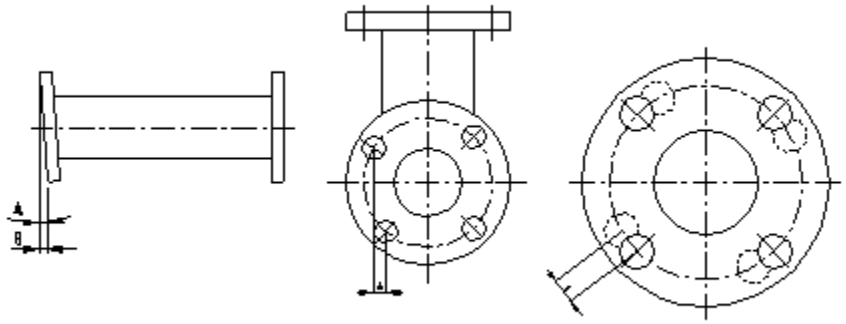
b) Inclination of flange:

A = ± 1/2º

B = max. 5 mm

c) misalignment of bolt holes :

A = ± 1.5 mm



It should be noted that some tanks designed for operation, in vertical position, are to be handled in horizontal position during the various stages of lining. Hence, such vessels should be designed accordingly.

During operation of some rubber lined tanks, such as hydrochloric acid, the fumes / mist emanating out of the tank, tend to corrode the external surface especially at the roof. It may be advisable to provide rubber lining externally especially around the vent nozzles. In such of the tanks, sometimes due to overflow etc. corrosion occurs at the bottom kerbs, also the corrosive medium goes below the surface of the bottom plate. Care must be taken by suitable design to prevent such situations.

In large size tanks, piping, process equipments, suitable lifting lugs should be provided.

If the vessels, pipes require external hot / cold insulation, the steel cleat for holding the insulation should be welded before handing over the fabricated item for rubber lining.

SUB-SECTION-B

FORMAT FOR OPERATION AND MANITENANCE

Format for Operation & Maintenance Manual

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

SUB-SECTION-C

SITE STORAGE AND PRESERVATION GUIDELINES

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. ‘No smoking’ signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	**Description of the equipment**	**Type of Storage**	**Check for**	**Remarks**
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

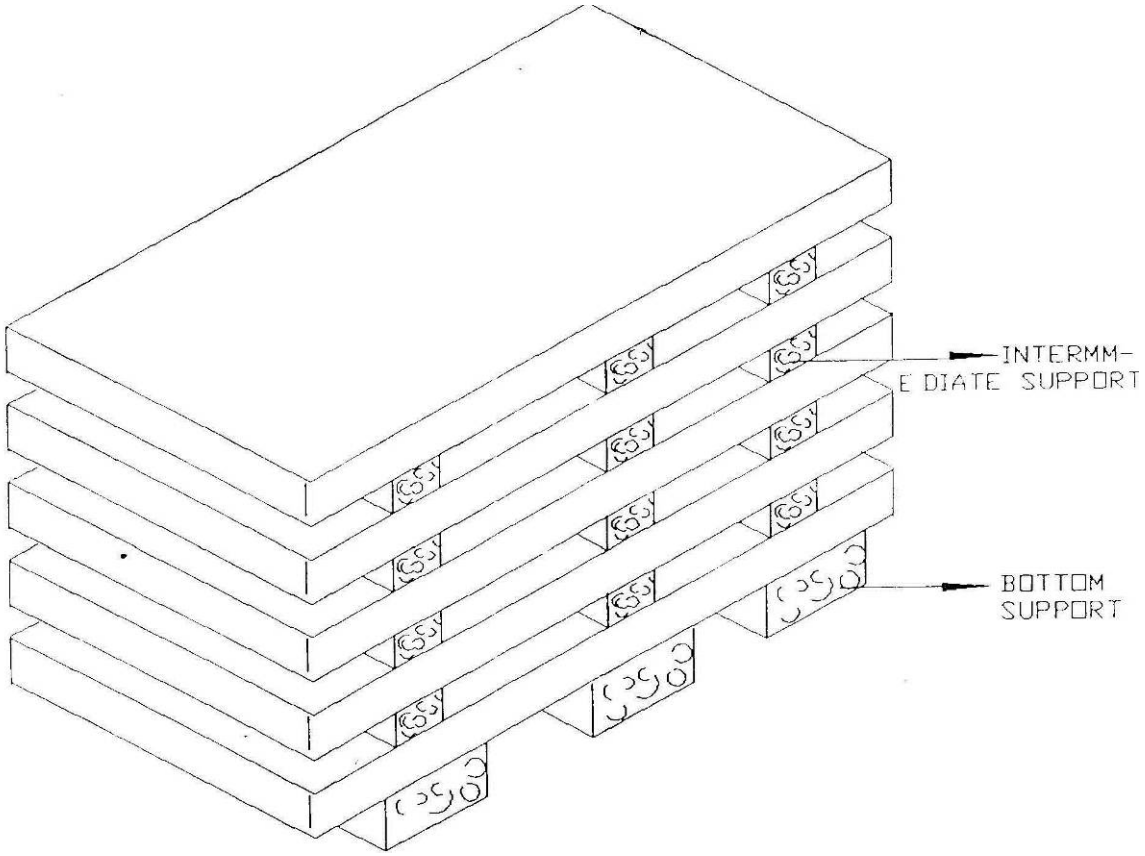


Figure – 1 – PLATE STACKING ARRANGEMENT

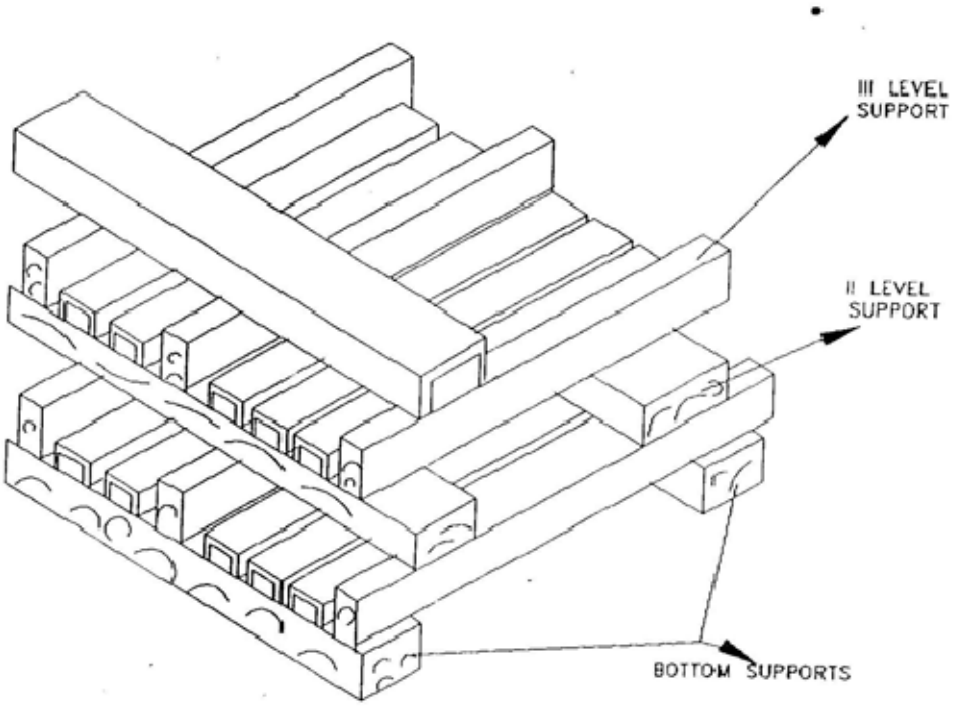


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION-III

ANNEXURE-1

LIST OF DOCUMENTS TO BE SUBMITTED WITH BID

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

1. Compliance cum confirmation certificate (refer annexure-2 of section-III)
2. Pre-bid clarification schedule as per format given under Section-III (Annexure-3), in case of any clarifications.
3. Deviation schedule as per format given under Section-III (Annexure-4), in case of any deviations by bidder.
4. Un priced format for main package (mentioning quoted against each item)
5. Un priced format for Tools and Tackles (mentioning quoted against each item)
6. Un priced format for Commissioning spare (mentioning quoted against each item)
7. List of makes of sub vendor items (refer annexure-6 of section-III)
8. FGD Tanks Schedule & GA Drawing (Typical) with Agitator Platform (refer annexure-8 of section-III)

ANNEXURE-2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

ANNEXURE-3
PRE-BID CLARIFICATION SCHEDULE

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

ANNEXURE-4

SCHEDULE OF TECHNICAL DEVIATION

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:-3x660 MW NABINAGAR STPP

PACKAGE:- MISC. FGD TANKS

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

LIST OF MAKES OF ITEMS

S.N.	ITEM NAME	MANUFACTURER	LOCATION

ANNEXURE-6

LIST OF TOOLS & TACKLES

Bidder shall supply a set of special tools and tackles required either for erection or operation or maintenance of the Tanks units. A list of such tools and tackles shall be submitted along with the offer.

ANNEXURE-7

LIST OF COMMISSIONING SPARES

3x660 MW NABINAGAR STPP- MISC. FGD TANKS PACKAGE

LIST OF COMMISSIONING SPARES (Required for Commissioning of Misc. FGD Tanks

Break up price for COMMISSIONING SPARES

Sl. no	Description	Qty.	Unit	Unit price	Total Ex-Works Prices duly packed	ED	CST	FREIGHT Inclusive Service Tax	Total price FOR SITE
1	CAF Gasket of each size	2 nos.							
2	Nuts, bolts & washers of each size (nos. of bolts, nuts & washers as required for each nozzle) as per approved Drg.	1 lot							
3	Any other item required for successful commissioning of the tanks including rubber lining (to be specified clearly by bidder)	1 lot							

NOTE -

1. The items indicated in the above list are minimum. Any other spares if required shall be included by bidder in the above list.

2. Bidder shall furnish unit price of commissioning spares in above format alongwith the Bid. Any part even though not mentioned in list furnished but required at later date shall be supplied free of cost.

3.Bidder to note that the items indicated in the above list shall be provided prior to commissioning of the Misc FGD Tanks. Further, items indicated in the list shall be supplied over and above the consummables that is supplied along with the Misc FGD Tanks prior to start up.

ANNEXURE-8

FGD TANKS SCHEDULE

&

GA DRAWING (TYPICAL) WITH AGITATOR PLATFORM AND FIELD QUALITY PLAN

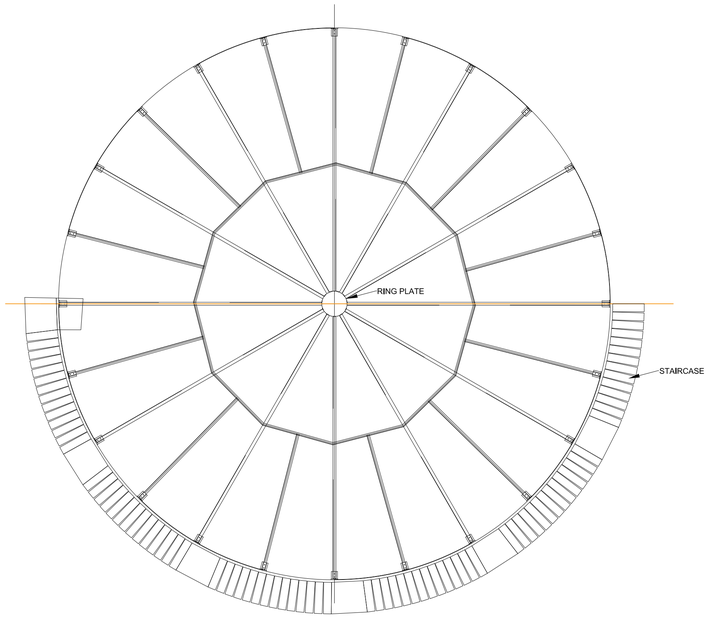
TANK SCHEDULE (Signed and Stamped copy to be sumbmitted with the offer by Bidder)

Sl.no.	Description	Primary Hydrocyclone feed tank	Filtrate water tank	Secondary Hydrocyclone feed tank	Waste water Tank	Limestone Slurry Storage tank	Auxiliary Absorbent Tank	Process Water tanks	Belt wash tank	Cake wash tank	Absorber Area Drain Pit	Gypsum Dewatering Area Drain Pits	Ball Mill Area Drain Pit
1	Tank Sl No.	1	2	3	4	5	6	7	8	9	10	11	12
2	Type of agitator	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Marine Propeller – Horizontal Type (Side Entry),	Not applicable	Not applicable	Not applicable	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)
3	Medium to be handled	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry	Gypsum slurry	Process Water	Process/Clarified Water	Process/Clarified Water	Gypsum slurry	Gypsum slurry	Gypsum slurry
4	Duty	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Not applicable	Not applicable	Not applicable	Continuous	Continuous	Continuous
5	Agitator Location	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Not applicable	Not applicable	Not applicable	Outdoor	Outdoor	Outdoor
6	Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Whenever FGD is under maintenance	Not applicable	Not applicable	Not applicable	Continuous	Continuous	Continuous
7	**Pipe Material Specification**												
a)	150 Nb & below	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)	SA106 Gr.B (IIR)
b)	Above 150 Nb	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)	IS: 3589 (IIR)
8	**Tank details**												
a)	Tank Shape	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Vertical cylindrical	Rectangular	Rectangular	Rectangular
b)	Tank name	Primary Hydrocyclone feed tank	Filtrate water tank	Secondary Hydrocyclone feed tank	Waste water Tank	Limestone Slurry Storage tank	Auxiliary Absorbent Tank	Process water tanks	Belt wash tank	Cake wash tank	Absorber Area Drain Pit	Gypsum Dewatering Area Drain Pits	Ball Mill Area Drain Pit
c)	Tank Material	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**IS:2062 E250 GR.BR (Refer Note-1)**	**RCC (refer note-2)**	**RCC (refer note-2)**	**RCC (refer note-2)**
d)	Tank Quantity (in No.)	1	1	1	1	2	1	2	2	2	3	1	1
	Capacity of Tank (in m3)												
e)	Capacity (Hold Volume)	269.4	135.4	161.2	288.6	2089.8	1595.0	175.0	21.2	35.6	56.0	56.0	56.0
f)	Capacity (Effective)	215.51	97.40	121.58	234.75	1889.40	1570.00	127.23	11.31	22.13	27.20	27.20	27.20
	Dimension (in m)												
g)	Diameter	7.0	5.5	6.0	7.0	13.5	12.5	6.0	3.5	3.5	-	-	-
h)	Length	-	-	-	-	-	-	-	-	-	4	4	4
i)	Breadth	-	-	-	-	-	-	-	-	-	4	4	4
j)	Height	7.5	6.2	6.2	8.0	15.4	13.8	6.7	4.2	4.2	4	4	4
9	Quantity of Agitator per tank	1	1	1	1	1	3 (Refer note-2)	Not applicable	Not applicable	Not applicable	1	1	1
10	Total quantity of agitators (for three units)	1	1	1	1	2	3 (Refer note-2)	Not applicable	Not applicable	Not applicable	3	1	1
11 (i)	**Slurry Analysis**												
a)	Slurry to be handled	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry	Gypsum slurry	Water	Water	Water	Gypsum slurry	Gypsum slurry	Limestone slurry
b)	Maximum solid particle size	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	-	-	-	6-7 mm	6-7 mm	6-7 mm
c)	Normal solid particle size, d50	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	-	-	-	6-7 mm	6-7 mm	6-7 mm
d)	Solid to be handled	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	Limestone + impurities	gypsum along with Limestone & other impurities	-	-	-	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	Limestone + impurities
e)	Chloride concentration	max 30000 ppm	max 30000 ppm	max 30000 ppm	max 30000 ppm	max 1000 ppm	max 30000 ppm	-	-	-	max 30000 ppm	max 30000 ppm	max 1000 ppm
f)	Hardness of particle	5-7 mho scale	5-7 mho scale	5-7 mho scale	5-7 mho scale	5-7 mho scale	5-7 mho scale	-	-	-	5-7 mho scale	5-7 mho scale	5-7 mho scale
g)	Slurry concentration, wt%	30 wt%	11%	16.60%	3%	30 wt%	30%	-	-	-	25%	25%	30 wt%
h)	Sp. Gravity of slurry	1.216	1.069	1.112	1.023	1.215	1.216	-	-	-	1.216	1.216	1.216
i)	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	-	-	-	2.32(avg)	2.32(avg)	2.32(avg)
j)	Viscosity of Slurry	10 cP	4 cP	4 cP	3 cP	30 cP	10 cP	-	-	-	10 cP	10 cP	30 cP
k)	pH	4 to 8	4 to 8	4 to 8	4 to 8	5 to 8	4 to 8	-	-	-	4 to 8	4 to 8	5 to 8
l)	SiO_2 Content	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	-	-	-	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l
m)	Temperature	Normal -63 deg C; Design-70 deg C.	Normal -59 deg C; Design-70 deg C.	Normal -63 deg C; Design-70 deg C.	Normal -45 deg C; Design-55 deg C.	Normal -63 deg C; Design-70 deg C.	Normal -63 deg C; Design-70 deg C.	Normal -27 deg C; Design- 35 deg C.	Normal -58 deg C; Design- 70 deg C.	Normal -58 deg C; Design- 70 deg C.	Normal -63 deg C; Design-70 deg C.	Normal -63 deg C; Design-70 deg C.	Normal -45 deg C; Design-55 deg C.
11(ii)	**Process water Analysis**												
a)	Calcium as CaCO3	-	-	-	-	-	-	131	131	131	-	-	-
b)	Magnesium as CaCO3	-	-	-	-	-	-	52	52	52	-	-	-

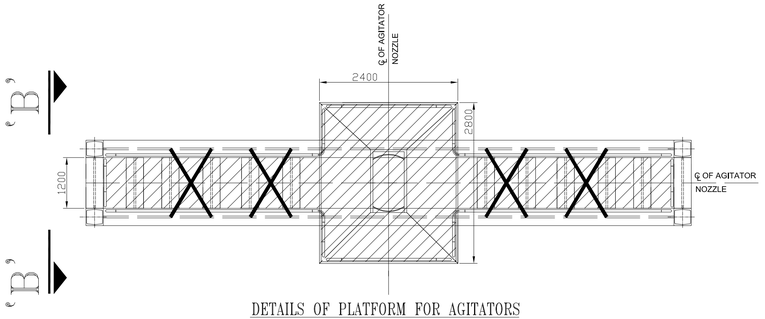
Sl.no.	Description	Primary Hydrocyclone feed tank	Filtrate water tank	Secondary Hydrocyclone feed tank	Waste water Tank	Limestone Slurry Storage tank	Auxiliary Absorbent Tank	Process Water tanks	Belt wash tank	Cake wash tank	Absorber Area Drain Pit	Gypsum Dewatering Area Drain Pits	Ball Mill Area Drain Pit
c)	Sodium as CaCO3	-	-	-	-	-	-	65	65	65	-	-	-
d)	Potassium as CaCO3	-	-	-	-	-	-				-	-	-
e)	Iron as Fe	-	-	-	-	-	-	0.3	0.3	0.3	-	-	-
f)	Total alkalinity as CaCo3	-	-	-	-	-	-	125	125	125	-	-	-
g)	Chlorides as CaCO3	-	-	-	-	-	-	20	20	20	-	-	-
h)	Sulphate as CaCO3	-	-	-	-	-	-	93	93	93	-	-	-
i)	pH	-	-	-	-	-	-	7.0 - 8.2	7.0 - 8.2	7.0 - 8.2	-	-	-
j)	Turbidity	-	-	-	-	-	-	10	10	10	-	-	-
12	**Inside Lining of tank (Refer Note-3)**												
a)	Lining specification	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	4MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)	5MM thick of best quality bromine butyl rubber lining with hardness 55+/-5 (Shore A hardness)
13	**Reference GA Drawing No.**	sketch-01	sketch-02	sketch-03	sketch-04	sketch-05	sketch-06	sketch-07	sketch-08	sketch-09	sketch-10	sketch-10	sketch-10

Notes	
1	**For detailed material specification refer respective tank GA drawings attached in Section-I, Sub-Section-D, Annexure-III of the technical specification.**
2	**The absorber area Drain Pit, Gypsum dewateriag area Drain Pit, Ball mill area Drain Pit is exluded from bidder scope of work. However, the supply, erection and commissioning of the rubber lining within the pit shall be in bidder's scope. Further the erection of the agitators within the mentioned pits shall be in bidder's scope of work. The agitator shall be free issued by BHEL. BHEL shall also arrange the supervision of Erection and commisssioning activity.**
3	**The supply, erection and commissioning of the rubber lining within the pit shall be in bidder's scope.**
4	**The number of agitators is indicative and for estimation purpose. The same shall be finalized during detail engineering.**
5	**For detailed scope of work refer the technical specification.**

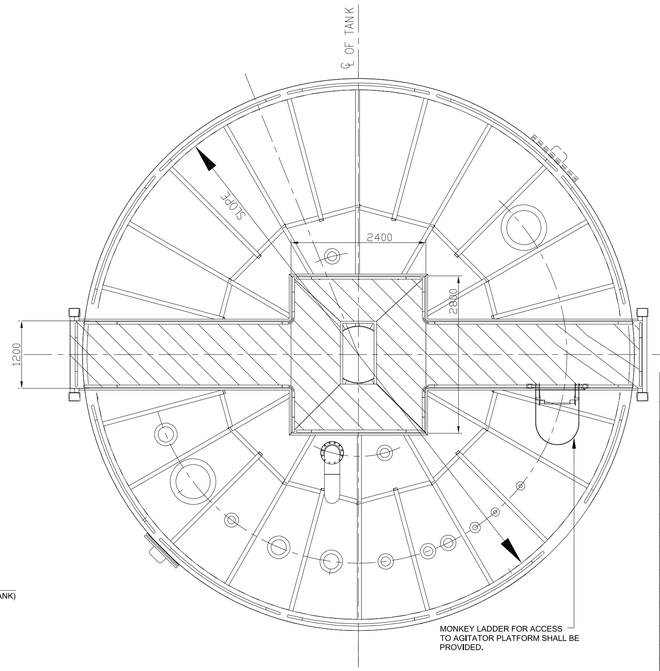
DRAWING NO. 3-FW-000-00-505



PLAN



DETAILS OF PLATFORM FOR AGITATORS



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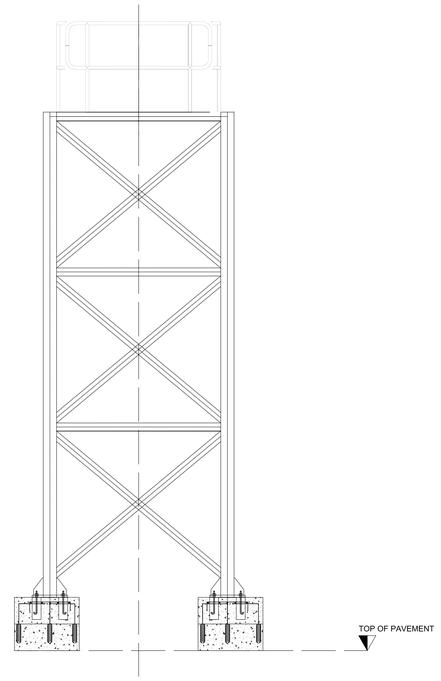

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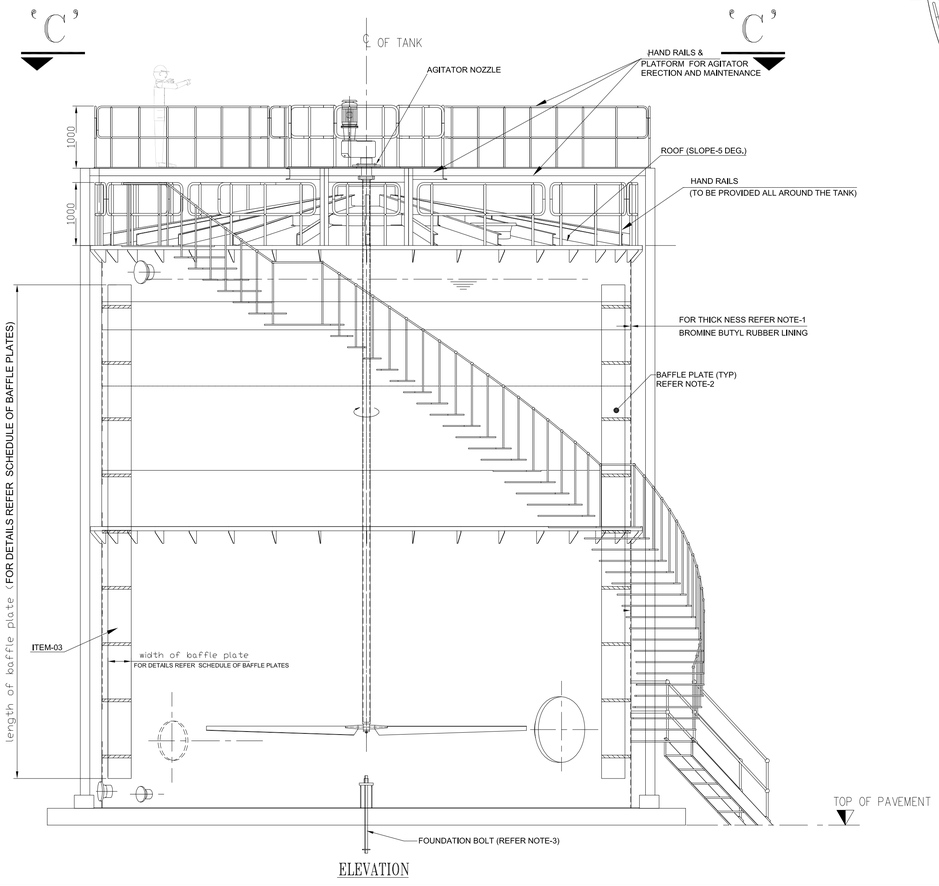


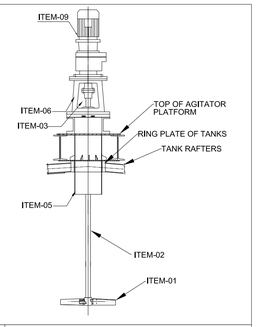
ELEVATION

SCHEDULE OF BAFFLE PLATES

TANK NAME	TANK DIA.(in M)	TANK HT.(in M)	BAFFLE PLATE DETAILS (All Dimensions in MM) (*) NOS./TANK	APPROX. LENGTH	APPROX. WIDTH	APPROX. THK.	REMARKS
AUXILIARY ABSORBER TANK	12.5	13.8	01	-	-	-	BAFFLE PLATES NOT APPLICABLE
FILTERATE WATER TANK	5.5	6.2	01	7700	650	12	
PROCESS WATER TANK	6.0	6.7	02	-	-	-	AGITATOR NOT APPLICABLE
WASTE WATER TANK	7.0	8.0	01	11800	1000	18	
PRIMARY HYDROCYCLONE TANK	7.0	7.5	01	9700	800	16	
SECONDARY HYDROCYCLONE TANK	6.0	6.2	01	8950	750	14	
LIMESTONE SLURRY STORAGE TANK	13.5	15.4	02	6350	1450	40	
BELT WASH TANK	3.5	4.2	02	-	-	-	AGITATOR NOT APPLICABLE
CAKE WASH TANK	3.5	4.2	02	-	-	-	AGITATOR NOT APPLICABLE
GYPSUM DEWATERING AREA DRAIN PIT	4 (L) X 4 (W) X 4 (H)		-	-	-	-	BAFFLE PLATES NOT APPLICABLE
ABSORBER AREA DRAIN PIT	4 (L) X 4 (W) X 4 (H)		-	-	-	-	BAFFLE PLATES NOT APPLICABLE
BALL MILL AREA DRAIN PIT	4 (L) X 4 (W) X 4 (H)		-	-	-	-	BAFFLE PLATES NOT APPLICABLE

(*) THERE MAY BE A (+/-)10% VARIATION IN THE DIMENSIONS . EXACT DIMENSIONS SHALL BE DECIDED DURING DETAIL ENGINEERING.

REMARKS	
1	This is typical drawing for vertical agitator mounting in circular tanks.
2	For tank dia (D) and Height (H) , bidder shall be refer to the technical specification.



S.NO	ITEM	SUPPLY	E&C	REMARKS
1	Impeller Blades	BHEL	BIDDER	SUPERVISION OF ERECTION BY AGITATOR SUPPLIER (SHALL BE ARRANGED BY BHEL). COMMISSIONING BY AGITATOR SUPPLIER
2	Shafts	BHEL	BIDDER	
3	Coupling arrangement (Flexible)	BHEL	BIDDER	SUPERVISION OF ERECTION BY AGITATOR SUPPLIER (SHALL BE ARRANGED BY BHEL). COMMISSIONING BY AGITATOR SUPPLIER
4	Gland Packing, Seals, O Rings, Glands	BHEL	BIDDER	
5	Shaft Sleeve	BIDDER	BIDDER	
6	Lantern Stools (Bearing Housing), Safety Guard	BHEL	BIDDER	SUPERVISION OF ERECTION BY AGITATOR SUPPLIER (SHALL BE ARRANGED BY BHEL). COMMISSIONING BY AGITATOR SUPPLIER
7	Bearings	BHEL	BIDDER	
8	AGITATOR Mounting Flanges with gaskets and fasteners	BIDDER	BIDDER	
9	Drive Motor(IE3) with gearbox arrangement	BHEL	BIDDER	SUPERVISION OF ERECTION BY AGITATOR SUPPLIER (SHALL BE ARRANGED BY BHEL). COMMISSIONING BY AGITATOR SUPPLIER
10	Mating Flange for Supporting on Slurry Tank Roof	BIDDER	BIDDER	
11	Baffle plate (min 4 nos. per tank)			

NOTES:

1. FOR THICKNESS AND SPECIFICATION OF RUBBER LINING (BIDDERS SCOPE) REFER TANKS SCHEDULE AND GA OF MISCELLANEOUS FGD TANKS PROVIDED WITH THE TECHNICAL SPECIFICATION.
2. FOUNDATION BOLTS FOR ALL TANKS SHALL BE IN BIDDER'S SCOPE. THE MINIMUM NO. OF FOUNDATION BOLTS HAVE BEEN SPECIFIED IN THE GA OF MISCELLANEOUS FGD TANKS. THE FINAL QUANTITY SHALL BE DECIDED DURING DETAIL ENGINEERING.
3. FOR ROOF SLOPE OF TANKS REFER GA OF MISCELLANEOUS FGD TANKS.
4. ALL DIMENSIONS, UNLESS OTHERWISE MENTIONED, SHALL BE IN MM.
5. FOR GA OF MISCELLANEOUS FGD TANKS , REFER SECTION-I, SUB-SECTION-D, ANNEXURE-III OF TECHNICAL SPECIFICATION.
6. 8MM THICK CHEQUERED PLATES SHALL BE CONSIDERED ON ALL AGITATOR PLATFORMS.
7. THE LOCATION AND ORIENTATION OF PLATFORM/STAIRCASE ARE REPRESENTATIVE ONLY. FINAL LOCATION AND ORIENTATION SHALL BE DECIDED DURING DETAIL ENGINEERING BASED ON THE ACTUAL LAYOUT.
8. THE NOZZLES SHOWN IN THE DRAWING IS INDICATIVE ONLY. FOR NOZZLE DETAILS REFER GA OF MISCELLANEOUS FGD TANKS.
9. FOR SIDE MOUNTED AGITATORS MOUNTING ON AUXILARY ABSORBER TANK, REFER SKETCH-2

NTPC DRG. No.

PROJECT: 3X660MW NABINAGAR STPP (SYSTEM : FLUE GAS DESULPHURIZATION)

CUSTOMER: NTPC LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE)

BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN			
	CHD			
	APPD			

TITLE: TYPICAL ARRANGEMENT OF VERTICAL MOUNTED AGITATOR & AGITATOR PLATFORM, BAFFLE PLATES

SCALE : NTS

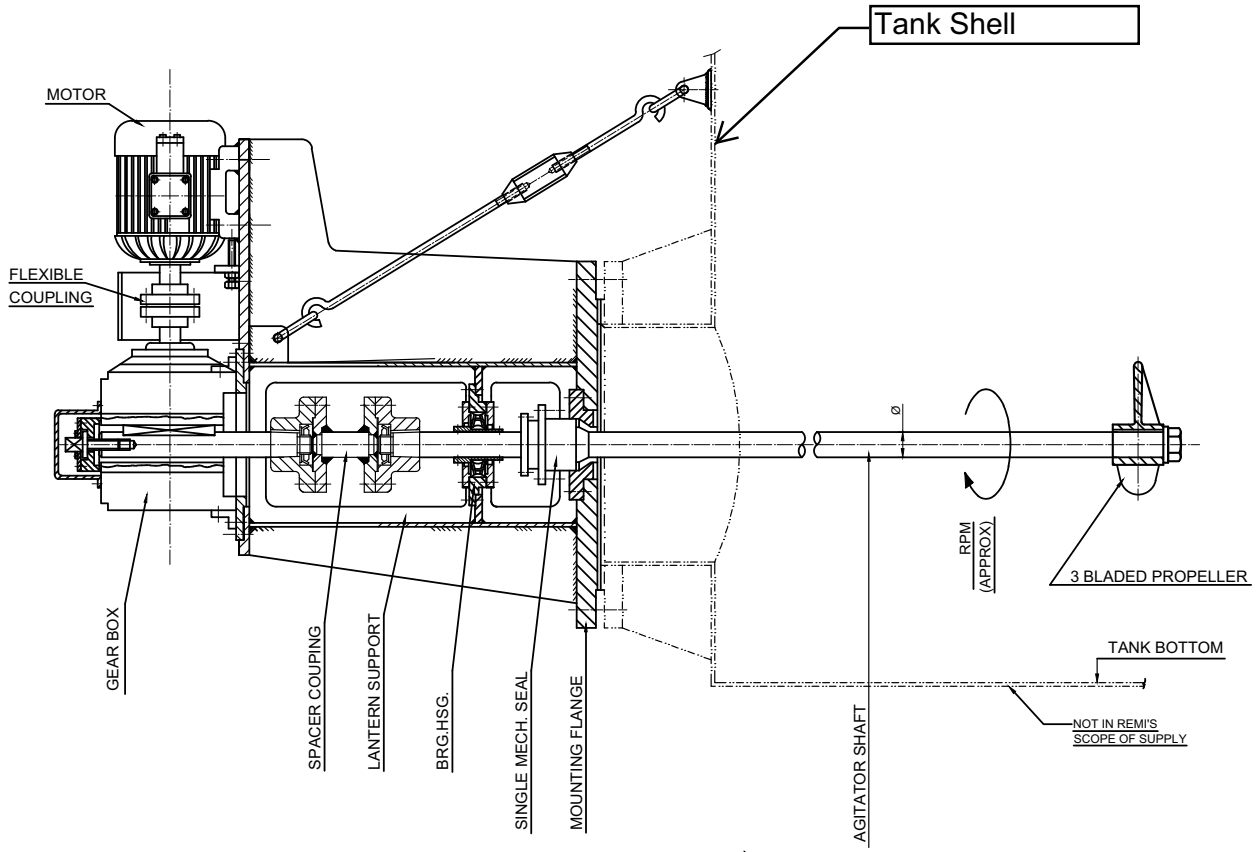
DRAWING NO. SKETCH-11

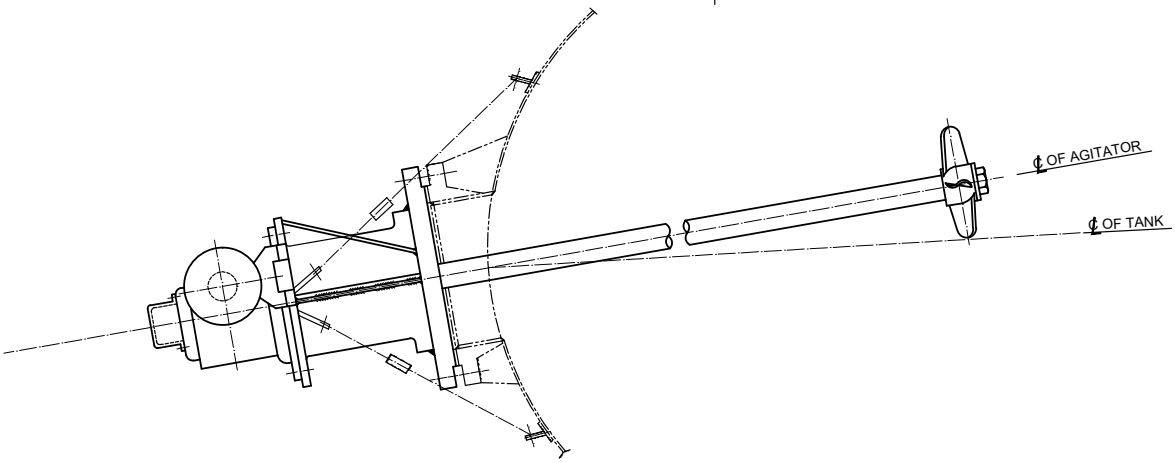
SH 01 OF 02

REV. 00

Size A1

1) ABSORBER TANK AGITATOR





NOTES:

1) All supporting arrangement along with the mounting flange shall be in bidders scope.
2) The erection of the agitator shall be in bidder's scope. The agitators shall be provided as free issue item by BHEL. Further the supervision of the erection shall be arranged by BHEL.
3)Commissioning of agitator is excluded from the scope of bidder.
4) There shall be minimum 3nos. of agitator for the absorber tank.

INDICATIVE SKETCH

FOR REFERENCE ONLY

TYPICAL MOUNTING ARRANGEMENT OF SIDE MOUNTED AGITATOR-SKETCH-11

एनटीपीसी NTPC	**SYSTEM EQUIPMENT** **Misc. Tanks**	**STANDARD FIELD QUALITY PLAN** **CONFORMING TO CODE: IS:803-1976**	QP NO.: 0000-999-QOM – I -001 Rev. No 0 Date 15-02-2005 Page 1 Of 1 VALID UPTO : 14-02-2008	REVIEWED BY:	APPROVED BY अनुमोदित APPROVED अनिल गुप्ता ANIL GUPTA अपर महाप्रबंधक (गुणवत्ता आश्वासन) Addl. General Manager (QA) एन टी पी सी लि./NTPC LTD.

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D *	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.		10.
1	**RAW MATERIAL INSPECTION**									
1.1	MS Plates	Mechanical & Chemical	B	Mechanical & Chemical	1 sample per Heat	Appd Drg./ Data Sheet	Relevant Material Specs	TC		In absence of Correlated TCs, Check Testing shall be witnessed by NTPC.
		Surface Defects	B	Visual	100%	No Pitting/ Corrosion	Damaged Plates not to be used	IR		
		Thickness	B	Measure	100%	Appd Drg.	Appd Drg.	IR		
2	**IN PROCESS INSPECTION**									
2.1	Welding	WPS/PQR/WQR	A	Qualification / Verification	100%	ASME Sec-IX	ASME Sec-IX	WPS/ PQR		See Note # 1.
		Marking, Cutting, Rolling, Joint Set-up	C	Visual & Measure	100%	Appd Drg.	Appd Drg.	IR		
		NDT on Back Gauging	B	DPT	100%	ASTM E-165	No Indications	IR		Except for Bottom Plates.
		NDT on Root Run	B	DPT	100%	ASTM E-165	No Indications	IR		For Bottom Plates only.
		NDT on Finished Welds	A	Vacuum Testing	100%	IS:803	No Leakage	IR		For Bottom Plates only.
3	**FINAL INSPECTION**									
3.1	Finished Tank	Finish, Orientation	B	Visual	100%	IS:803 & Appd. Drg.	IS:803 & Appd. Drg.	IR		
		Dimensions including Verticality, Ovality	B	Visual & Measure	100%	IS:803 & Appd. Drg.	IS:803 & Appd. Drg.	IR		
		NDT on Final Welding	A	DPT	100%	ASTM E-165	No Indications	IR		Except for Bottom Plates. See Note # 2.
		Leak Proof ness	A	Water Fill Test	100%	IS:803 & Appd. Drg.	No Leakage	IR		For 24 Hours
3.2	Painting	Surface Preparation	B	Visual	100%	IS:803, Appd. Drg., NTPC Specs	IS:803, Appd. Drg., NTPC Specs	IR		
		Coating Thickness, Colour	B	Visual & DFT	100%	IS:803, Appd. Drg., NTPC Specs	IS:803, Appd. Drg., NTPC Specs	IR		

Note : - 1. Only Qualified Welders are to be used. If Welders qualified by NTPC/ BHEL/ LRQA/ BVQI are available & continuously doing the job, then re-qualification is not necessary.
2. NDT on Finished weld shall also include Spot RT (10%), if Joint efficiency is taken as 0.85, in line with requirements of Code.

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS #: A = CRITICAL, B = MAJOR, C = MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION/ CONSTRUCTION DEPTT AND **'C'** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

ENGG. DIV./QA&I

FORMAT NO.: QS-01-QAI-P-10/F4-R1