SPECIFICATION OF COMPLETE AGITATOR ASSEMBLY-WBM 3260

1. INTENT OF SPECIFICATION:

This specification is intended to cover the design, engineering, manufacturing, inspection and testing at manufacturer's works, packing and delivery to site, supervision of erection and commissioning of complete agitator assembly along with its accessories complete in all respects. Mill Circuit Tank is a fabricated rubber lined cylindrical tank with flange mounted top entry (vertical) type agitator. The agitators shall be designed for continuous operation capable of maintaining uniform concentration in the circuit tank and the discharge slurry properties shall be as per clause no: 04.

In case of additional requirement of instrumentation, controls and other accessories/auxiliaries for safe, reliable and trouble-free operation of the agitator with mill circuit tank necessary reasons for recommendation shall be furnished and the same shall be included in scope of supply with the purchaser's approval.

2. APPLICATION:

In Wet Ball Milling System, the dilution of limestone slurry is done with water in the Mill Circuit Tank. Agitator shall be used in mill circuit tank to prevent caking and settlement of limestone particles out of the slurry and maintain uniform slurry concentration.

3. SCOPE OF SUPPLY:

3.1 Agitator Shaft
3.2 Agitator Blades (Impeller)
3.3 Coupling arrangement (Flexible)
3.4 Gland Packing, Seals, O Rings, Glands
3.5 Shaft Sleeve
3.6 Bearing Housing
3.7 Bearings
3.8 Agitator Mounting Flanges with gaskets and fasteners
3.9 Drive Motor with gearbox arrangement
3.10 Mating flange for supporting on slurry tank roof
3.11 Painting and Rust Prevention during shipment and construction
3.12 Supervision of Erection & commissioning at site
3.13 Special tools & tackles as applicable
3.14 Start-up spares as applicable

3.15 Installation, operation and maintenance manuals

3.16 Any other items required for completeness of the equipment except the items covered in the exclusions.

4. DISCHARGE SLURRY PROPERTIES :

4.1 Solids (limestone) Concentration (w/w) %: 55

4.2 Flow rate (m^3/Hr) : 132

4.3 Specific gravity of slurry : 1.53

5. INLET SLURRY PROPERTIES:

5.1 Solids (limestone) Concentration (w/w) %: 70

5.2 Flow Rate (m^3/Hr) : 88.65

5.3 Specific gravity of slurry : 1.78

6. FLOW RATE OF DILUTION WATER:

Flow Rate (m^3/Hr): 43.55

7. WEAR PROTECTION:

The shaft of the agitator, impeller blades and impeller should be rubber lined.

8. COMPONENTS OF AGITATOR:

8.1 BLADE AND HUB OF IMPELLER

8.1.1 The Blade design of the Agitator to be of most efficient design in order to offer least power consumption.

8.1.2 Although Agitator will have substantial low speed because of reduction Gear Box, hydraulic unbalance at impeller can cause severe vibration, hence it is mandatory that rotating assembly shall be dynamically balanced to its rated speed.

8.1.3 Impeller should be dynamically balanced to ISO-1940 Gr: G16: after rubber lining of shaft.

8.1.4 The shape of the impeller blades shall be designed to avoid wear on the impellers so that the agitator performance is not affected for a minimum period of 2 years of continuous operation under design conditions for the limestone slurry specified in this specification.

8.1.5 In order to avoid excessive wear impeller tip speed must not exceed 12 m/s.

8.1.6 MOC of blade and hub of impeller: Alloy 926 or equivalent material.

8.2 SEALING SYSTEM:

8.2.1 Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type.

8.2.2 Mechanical and hydraulic conditions in the seal chamber required to maintain a stable film at seal face, including temperature, pressure and flow, shall be jointly be established by Agitator manufacturer and seal manufacturer, and shall be noted in data sheet submitted in tender.

8.2.3 If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.

8.3 SHAFT :

8.3.1 Spacing of the shaft joint should not be more than 3.0 m for easy assembly if it is more than 40kg.

8.3.2 Use of dissimilar material at flange joint shall be avoided to eliminate any crevice corrosion.

8.3.3 MOC of shaft: Alloy 926 or superior material.

8.4 BEARING AND BEARING HOUSING IN GEAR BOX:

8.4.1 Bearing shall be of rolling type radial (anti friction bearing) and thrust bearing as required.

8.4.2 Thrust bearing shall be sized for continuous operation of agitator considering both up-thrust and down thrust load developed by agitator during operation.

8.4.3 Life of antifriction bearing used in housing should be min. of L10 of 25000 hr.

8.4.4 The method of lubrication of bearing should be specified.

8.5 DRIVER (MOTOR):

8.5.1 Driver shall be sized to meet all specified operating conditions including bearing housing, seal, external gear box and coupling loss (if any).

8.5.2 Degree of protection: IP 55.

8.5.3 The motor rating shall be selected by considering a margin of 20% more than Maximum power consumption.

8.5.4 The motor shall be as per IEC: 60034-1 with efficiency class IE3.Degree of protection: IP 55. Insulation class: F (temperature rise limited to class B).

8.6 GEAR BOX:

8.6.1 Gear box should be vertical flange mounted solid shaft type reducing speed type, specially designed for the requirement of Slurry mixing.

8.6.2 An auxiliary slow drive provision shall be provided in the Gear Box so that slurry is always kept in dynamic condition to avoid settling of slurry at bottom, in the event of Agitator is not operating at its rated speed.

8.6.3 Gear box rating shall be at least 1.5 times the rated torque of agitator.

8.7 COUPLING AND COUPLING GUARD :

8.7.1 Coupling and coupling guard should be supplied between driver and driven equipment.

8.7.2 Coupling should be designed taking into consideration of adequate service factor.

8.7.3 Design rating of the coupling (excluding service factor) should be indicated in data sheet.

8.7.4 Coupling must be having locking screw so that it does not slide over shaft in due course of operation.

8.7.5 Coupling shall be of spacer-type flexible coupling made of cast Iron. Spacer shall be of sufficient length so that Motor and gear box shall be able to run independently at no-load condition by detaching the respective coupling.

8.7.6 Coupling should be dynamically balanced to Gr: G6.3, ISO-1940.

8.8 All fasteners used in wetted condition must be of AISI-316L.

9. CONSTRUCTION OF MILL CIRCUIT TANK:

9.1 The lining inside diameter of the tank is 3200 mm and height of the tank (distance between top and bottom plates) is 3000 mm. Refer Annexure-II. The thickness of the plates to be considered shall be as per Annexure-II.

9.2 The tank shall be provided with nozzles for drain line, over flow line, water line, hydrocyclone return line, inlet and discharge ports, standby holes for future requirements etc. with positions and elevations followed as per Annexure –II. All flanges shall be in accordance with ANSI B16.5 class 150.

9.3 For tank connections refer Annexure-IV. For foundation and mounting details of mill circuit tank refer Annexure-III.

10. TECHNICAL REQUIREMENTS :

10.1 It shall be noted that all Agitators are meant for keeping the solid particles in suspended mode in liquid with "Full off-Bottom Suspension" of solid particles to 98% of liquid column to virtually "Uniform Solid Concentration". No chemical reaction will takes place.

10.2 Maintaining a uniform concentration over the 95% of liquid column. Absolute sweeping of solid particle from tank bottom is a must for Agitator.

10.3 It is to be noted that in continuous process any deposit at tank bottom is the loss of material which are not getting converted as per process. Hence, total loss of material by sedimentation is a loss to milling system & determines the "In efficiency of the Agitator".

10.4 Vendor should ensure nil settlement; utilization of solid material shall be a guaranteed parameter and will be assessed in percentage (%) term to net wet of solid mass of inflow or out flow. This is one of the guarantee parameter.

10.5 Every Tank will have a pump whose suction line shall be connected to tank. These pumps are to operate continuously at the lowest operating level which is decided by Process requirement. Hence, the minimum operating level of slurry in the tank for Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. The slurry level in the tank is indicated in annexure-II.

10.6 All agitator parts and accessories in contact with the stirred fluid (limestone slurry) shall be constructed of materials specifically designed for the conditions and nature of the slurry and be resistant to erosion and corrosion.

10.7 Agitator, Seal loss, Gear box and Motor internal loss must be submitted along with the offer. A characteristics curve showing power versus liquid level should be submitted from the lowest liquid level, required for Agitator to maximum liquid level in the tank.

10.8 Motor should be selected based on the highest power demand with a 10%margin at maximum liquid level, taking into account frequency variation.

10.9 Agitator and its driver shall perform on the test stand at shop and on the Agitator's permanent location at site within vibration limit. The vibration of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the "Acceptance Criteria" of the equipment. Please note vibration at test stand can only be taken as for information.

10.10 The overall vibration level at site shall be as per ISO 10816. Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.

10.11 The vendor shall finalise the baffle plate design, location and number to be kept internal to the circuit tank.

10.12 For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.

10.13 For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.

10.14 The vendor shall comply to the schedule of guarantees as per annexure-V.

11. GENERAL :

11.1 Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation.

11.2 Lifting lugs and special tackles shall be provided as necessary to permit easy handling of the agitators and their components.

11.3 All exposed moving parts shall be covered by guards.

11.4 Noise level at a distance of 1.0 meter horizontally from the equipment and 1.5 m above the operating floor at site shall be less than or equal to 85 dB(A).

11.5 The mounting details of motor, gearbox, sealing system, lubrication system of bearing should be furnished in the drawings.

11.6 Vendor should furnish technical data as per Annexure-I and general arrangement drawings with the offer.

11.7 Quality plan should be furnished to BHEL for customer approval on placement of purchase order. BHEL hold points of inspection will be indicated.

12. TESTING REQUIREMENTS:

12.1 Dimensional checks, during in-process and final inspection, shall be carried out for alignments, circularity, verticality, orientation of connections, etc.

12.2 Rubber lining in agitator shall be tested for hardness and spark test, as applicable.

12.3 Impellers shall be tested for dimensional and balancing check.

12.4 Gear Box shall be tested for run test as per standard practice.

12.5 Since there is no standard for "Acceptance Test Procedure" for Agitator, Agitator manufacturer is to submit a test procedure and Quality Plan, clearly indicating that equipment will meet the desired parameter.

13. TEST CERTIFICATES:

The following test certificates should be furnished in triplicate along with the consignment:

13.1 Non-Destructive test over and above the material test along with results of the following components:
- Mechanical Seal- Manufacturer's recommendation.
- Replaceable Rubber liner- Shore Hardness, Class and Type certificate

13.2 Test certificates shall be issued for each lot of raw material used in the coating, Corresponding to specific weight and traction resistance.

14. PACKING:

The Agitator shall be wrapped in polythene bags & packed in a strong rigid wooden crate to prevent damages during transit and storage. Rain water should not enter into the internals during storage in the outer yard of power plant.

15. PAINTING:

15.1 SURFACE PREPARATION: Commercial blast Swedish STD SA2.5

15.2 PRIMER COAT: One coat of two component moisture curing zinc (ethyl) silicate primer coat. Dry film thickness (DFT) 50 microns.

15.3 INTERMEDIATE COAT: One coat of epoxy (high build) paint. Dry film thickness (DFT) 100 microns.

15.4 FINISHED COAT: Two coats of two pack aliphatic polyurethane paint shade: Grey white RAL 9002.Dry film thickness (DFT) =70 microns (35 microns * 2 coats).

15.5 TOTAL DFT –EXTERNAL SURFACE : 220 microns

15.6 Colour shade for external surface: Grey white RAL 9002.

16. SUPERVISION OF ERECTION,TESTING AND COMMISSIONING :

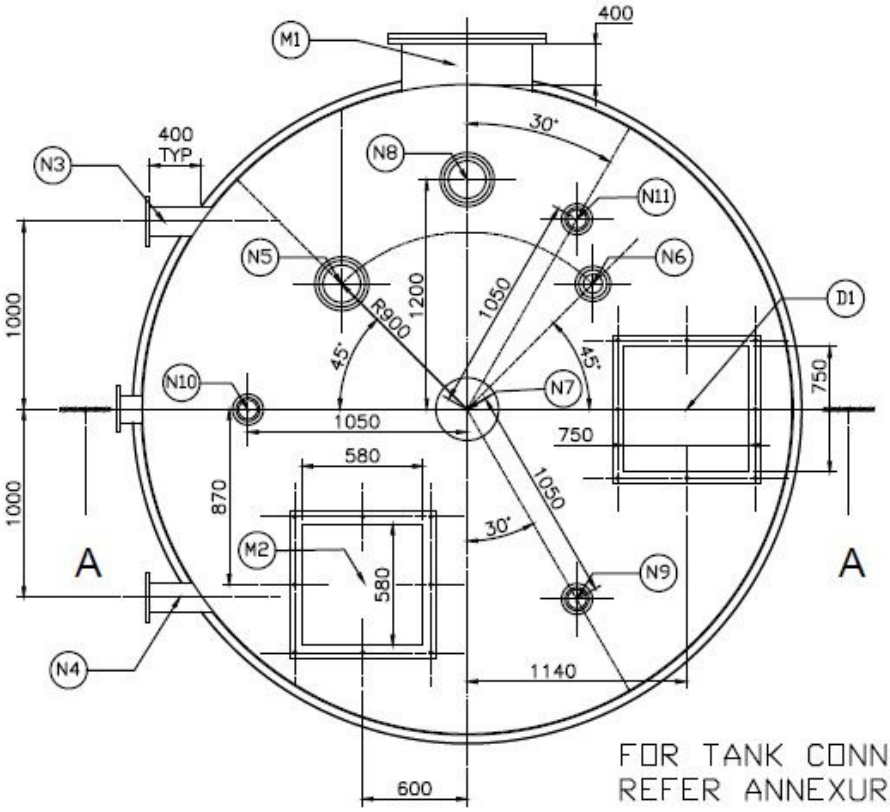
The erection of Agitators will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit (7 Days) for the supervision of erection, precommissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply. The bidder will be informed well in advance for the visit.

ANNEXURE-I

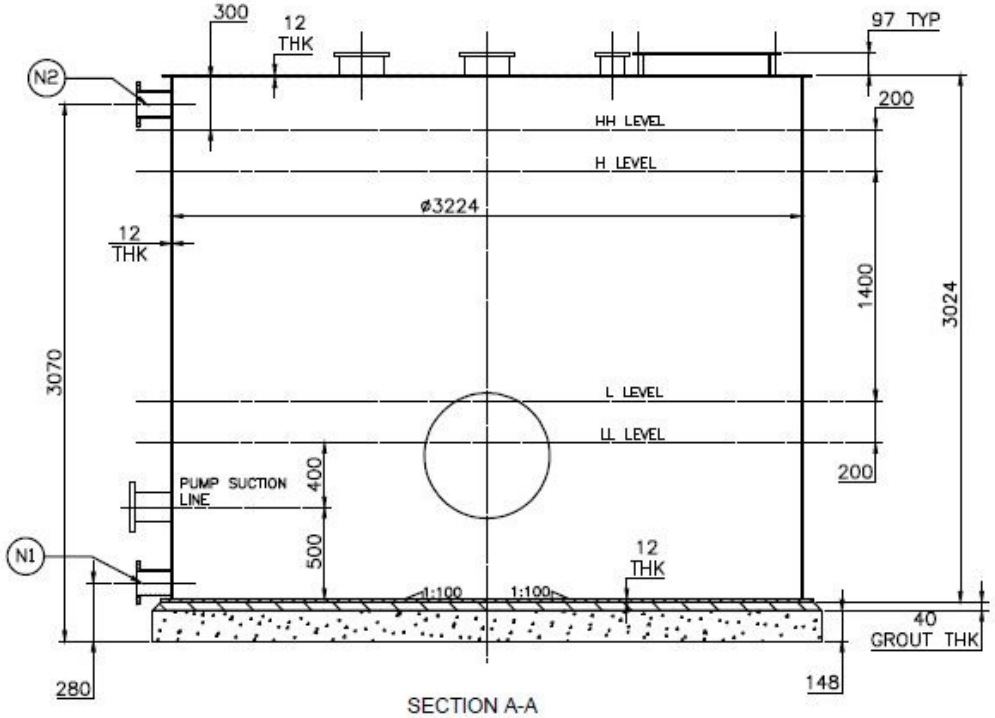
COMPLETE AGITATOR ASSEMBLY-WBM 3260: BA9789133006

Sl.No	DESCRIPTION	VENDOR'S COMPLANCE /DATA
1	Make	
2	Application	Top entry agitator to mill circuit tank
3	Shaft diameter (mm)	
4	Impeller diameter (mm)	
5	Impeller Tip speed (m/sec)	
6	No: of impellers	
7	Coupling Type	
8	Agitator speed (RPM)	
9	Motor Rating (KW)	
10	Motor speed (RPM)	
11	Gear Box make and model	
12	MOC of impeller	
13	MOC of shaft	
14	GD^2 at motor end	
15	Noise level dB(A)	
16	Total weight of all components	

ANNEXURE-II



FOR TANK CONNECTIONS
REFER ANNEXURE-IV



SECTION A-A

REVISION	PREPARED BY	APPROVED BY	DATE OF 1ST ISSUE
	K PAVAN	AMAN	02.07.2022

PRODUCT STANDARD
PULVERISERS
HYDERABAD

Product STD no.	BA89133
Rev No	00
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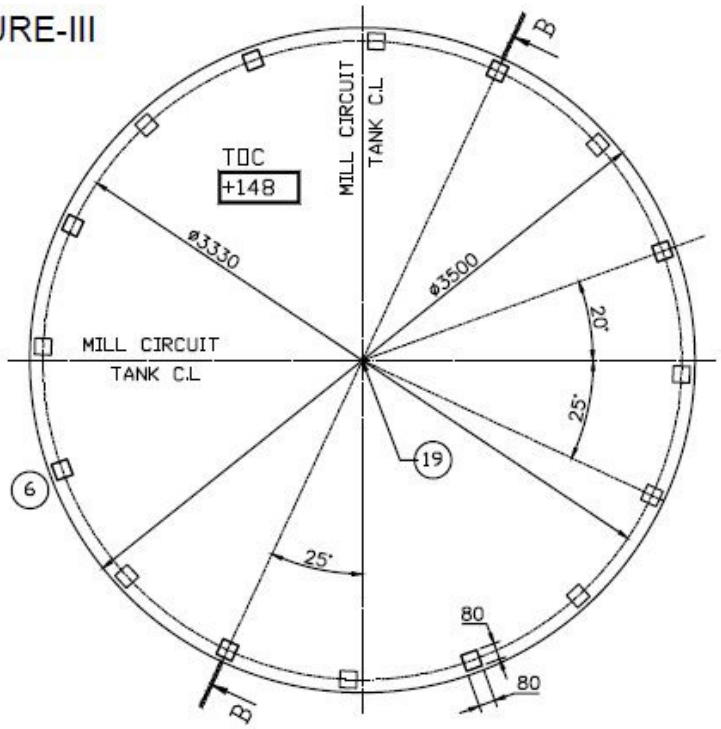
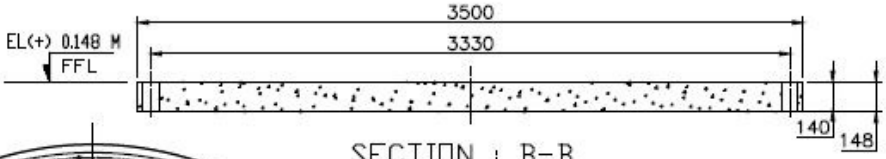
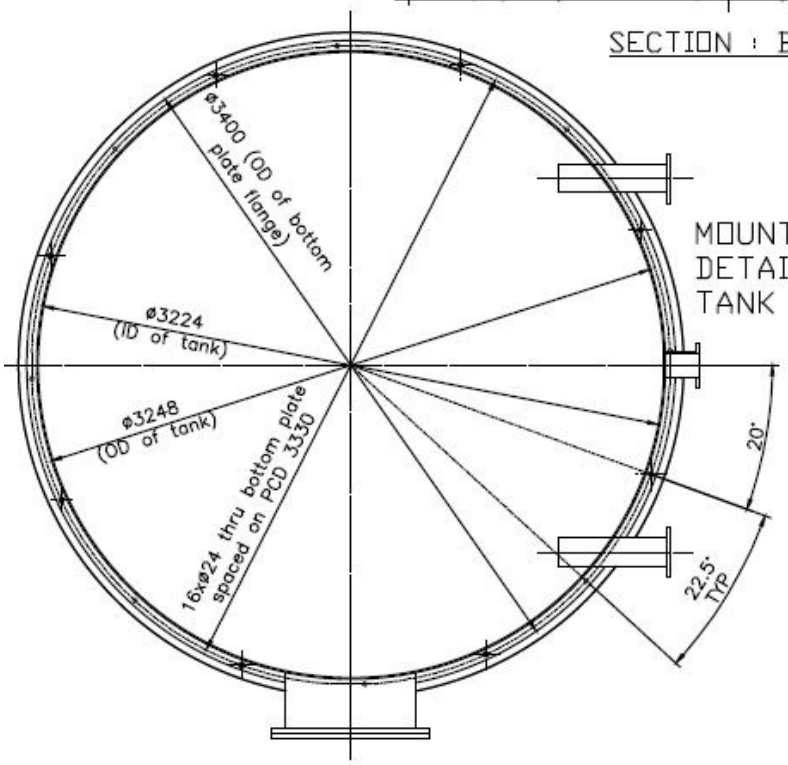
ANNEXURE-III





SECTION : B-B



MOUNTING AND FASTENING DETAILS OF MILL CIRCUIT TANK

REVISION	PREPARED BY	APPROVED BY	DATE OF 1ST ISSUE
	K PAVAN	AMAN	02.07.2022

ANNEXURE-IV

DETAILS OF MILL CIRCUIT TANK CONNECTIONS				
Application	Description	Legend	Nozzle Size	Flange
Shell application	Drain	N1	DN100	ANSI B16.5 class 150
	Overflow	N2	DN100	ANSI B16.5 class 150
	Pump Suction-1	N3	DN150	ANSI B16.5 class 150
	Pump Suction-2	N4	DN150	ANSI B16.5 class 150
	Man Hole	M1	Ø 600	
Roof application	Hydrocyclone return	N5	DN250	ANSI B16.5 class 150
	Process water feed	N6	DN100	ANSI B16.5 class 150
	Agitator and accessories	N7	Ø 400	
	Spare Nozzle	N8	DN250	ANSI B16.5 class 150
	Level Transmitter	N9	DN100	ANSI B16.5 class 150
	Level Transmitter	N10	DN100	ANSI B16.5 class 150
	Level Transmitter	N11	DN100	ANSI B16.5 class 150
	Man Hole	M2	580 X 580	
	Mill discharge port	D1	750 X 750	

ANNEXURE-V

SCHEDULE OF GAURANTEES

SL.NO	DESCRIPTION	UNIT	DATA
1	Possible rate of deposit of solid particles at tank bottom of total sold particle inflow/outflow	%	
2	Noise level at a distance of 1.0 meter from the equipment at site	dB(A)	85
3.	Life of Agitator components parts, from the date of commissioning ▪ Blade of the agitators shall be of stainless steel or Nickel alloy suitable to the service condition. In case, the ,vendor offers the Blade with Rubber lining' the guarantee life of Rubber lining of the Blade shall be minimum life ▪ Shaft should be of "Stainless steel" or "nickel alloy"		24 months
	Anti-friction bearing		25000 Hrs

RECORD OF REVISIONS

REV .NO	DATE	REVISION DETAILS	REVISED	APPROVED