TECHNICAL SPECIFICATION
OF
AGITATORS

REVISIONS	NO	DATE	DESCRIPTION	REF.NO.	CHECKED	APPROVED

PREPARED BY	SASHI KUMAR
CHECKED BY	SHAKTIKANTA DASH
APPROVED BY	SHAKTIKANTA DASH
REV	00
DATE	19 05 2015

CUSTOMER :M/s. NTPC

PROJECT :Bongaigaon- 3x250 MW

Technical Specification Reference:

NTPC: BONG: FGD: AGIT:01:REV-00

CONTENTS

ATTACHMENTS

General Arrangement Drawings Of Slurry Tanks And Drain Pits			
Sl.no.	**Drawing Title**	**Drawing number**	**Rev.**
a.	GA for Agitators for Limestone slurry Tank	FGD/ Limestone slurry Tank	00
b.	GA for Agitators for Auxiliary Absorber Tank	FGD/ Auxiliary Absorber Tank	00
c.	GA for Agitators for Filtrate Water Tank	FGD/ Filtrate Water Tank	00
d.	GA for Agitators for Secondary H 'cyclone Tank	FGD/ Secondary Hydro cyclone	00
e.	GA for Agitators for Waste water Tank	FGD/ Waste Water Tank	00
f.	GA for Agitators for Lime feed tank	FGD/ Lime Feed Tank	00
g.	GA of absorber Drain Pit	FGD/GA of Absorber Drain Pit	00
h.	GA of Gypsum dewatering area drain pit	FGD/Gypsum Dewatering area drain pit	00
i.	GA of Ball Mill area drain pit	FGD/Ball Mill Area drain Pit	00

Sec		Description			Vendor confirmation (Yes /No)
1.0.0	**PROJECT INFORMATION**				
	a.	Owner		M/s. NTPC	
	b.	Buyer		BHEL	
	c.	Process / Application		Wet Limestone FGD	
1.1.0	**Site Conditions**		**Units**		
	a.	Ambient Temperature (At Guarantee)	° C	27	
	d.	Ambient Temperature (At Design)	° C	50	
	b.	Relative Humidity	%	60	
	c.	Plan Level from MSL	m	47	
1.2.0	**Project Location & Approach**				
	a.	District		Kokrajhar	
	b.	State		Assam	
1.3.0	**Pre-Qualification Requirement**				
	Both indigenous and import sourced are eligible to participates in this tender. The bidders are required to meet the qualification requirement for the Agitator as per criteria stipulated below: a. To meet the qualification requirement the bidders should be an Original Equipment Manufacturer (OEM) and have designed, manufactured / got manufactured & supplied Agitators for the tanks and pits sizes (given in the tender document) or larger sizes for limestone slurry application for Flue Gas Desulphurization plants only. The Agitators should have been in operation for a period not less than one (1) year as on the date of bid opening. **OR** b. A Bidder should have collaboration agreement / technology licensing agreement either an ongoing basis or one time basis as minimum to this project as on the date of Techno Commercial bid opening with OEM who is meeting the above qualifying requirement(point a). The Bidder should furnish along with the bid an undertaking jointly executed by the Bidder and the OEM, where in the OEM and the Bidder jointly stand guarantee for meeting the 'performance guarantee'. This undertaking should contain the following conditions: i. All drawings submitted by the bidder shall be based on OEM design and shall be endorsed & stamped by the OEM. ii. All Engineering calculations and datasheets submitted by bidder shall be based on OEM design and shall be endorsed & stamped by the OEM.				

Sec		Description	Vendor confirmation (Yes /No)
	iii.	All manufacturing drawings submitted by bidder shall be certified by OEM.	
	iv.	Specifications and selections of bought out components shall be vetted and certified by OEM.	
	v.	The quality plan provided by the bidder shall be certified by OEM.	
	vi.	Key components manufactured by bidders shall be inspected and cleared by OEM.	
	vii.	Equipment guarantee for performance and material workmanship shall be jointly given by bidder and OEM to BHEL and to end customer NTPC.	
	viii.	Any meeting called for by end customer NTPC to discuss technical and quality issues shall be attended jointly by OEM and bidders along with BHEL.	
	ix.	Erection, Operation and Maintenance manuals submitted by bidder shall be authenticated by OEM.	
	x.	Supervision of erection through deputation of expert services, and commissioning and post commissioning support if required shall be provided by OEM in addition to that given by bidders.	
		The above list is not exhaustive but only indicative. The above requirements are enumerated to ensure that the bidder's design, manufacture and product supply is qualified by the technology holder.	
		The following information should be submitted by the vendor who meets the above Qualification requirements.	
		• Bidder to submit reference list. The reference list should contain, in addition to the name of customer, the customer location and details like phone, fax, email etc. BHEL may independently approach any such customer/s to get feedback on the performance of the equipment supplied by the bidder. • Bidder can also submit performance certificate from the customers regarding satisfactory performance of the supplied items for a period not less than one (1) year as on date of bid opening for limestone slurry application for Flue Gas Desulphurization plants. • In case the bidder is not OEM and having collaboration/ technology licensing agreement with OEM should submit the copy of collaboration agreement / technology licensing agreement.	
		BHEL reserves the right to verify the information provided by vendor. In case the information/ documents provided by vendor are found to be false/ incorrect the technical offer shall be rejected.	
		Note: In case the bidder is not OEM but is having collaboration / technology licensing agreement with OEM either the bidder or the OEM is allowed to submit the offer. The bidder in his own interest shall submit only one bid. If a bidder is a participant in more than one bid, all such bids are liable for rejection.	

Sec		Description	Vendor confirmation (Yes /No)
		In case, bidder has collaboration with OEM then bidder has to submit the authorization letter duly filled and signed by OEM as per **annexure-A**	
2.0.0		**INTENT OF SPECIFICATION**	
		Scope of Supply	
	a.	This specification covers the general design, materials, construction features manufacture, shop inspection and testing at the manufactures works and delivery of Agitators.	
	b.	Design, Manufacturing, Testing, supervision of Erection and Commissioning of Vertically mounted Agitators for Limestone Slurry tanks of Different dimensions and capacity and for Drain pits.	
	c.	Bidder to submit the General Arrangement incorporating the detail Dimensions of agitator along with number of Baffles plates required for each tanks if applicable.	
	d.	Bidder to provide the mounting arrangement drawings, considering the applicable dynamic and static loads & operating conditions for all the agitators.	
	e.	Bidder to provide the mounting arrangement drawings for intermediate shaft if applicable.	
	f.	3 working man days per Tank and 6 working man days for all the 5 Pits are required. There are 7 tanks & 5 pits in which the agitators are to be installed. Hence 27 working man-days required for supervision of erection & commissioning of agitators. After supervision of E&C, Bidder also shall furnish inspection report for E&C and testing.	
3.0.0		**BASIC DESIGN**	
3.1.0		**AGITATORS TYPE AND OPERATION**	
	a.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box / belt & pulley of rigid type, solid shaft coupling between gear box and agitator and flexible coupling of spacer type coupling between Motor and Gear Box. Both Gear Box and Motor should be vertically/horizontally flange mounted type with a common frame of the whole equipment. The entire thrust load of agitator should be transmitted to the thrust bearing of Gear box.	
	b.	Cable entry to the Motor terminal box should preferably be from top when motor is vertically mounted at its position and it should be easily accessible.	
	c.	It shall be noted that all Agitators are meant for keeping the solid particles in suspended mode in liquid to ensure Uniform Solid Concentration.	
	d.	During shut off condition, slurry particle will be sediment on the bottom of tank. Bidder to provide sufficient clearance on the bottom of tank based on the	

Sec		Description		Vendor confirmation (Yes /No)
		concentration of slurry so that the impeller shall not immersed in the slurry particle.		
	e.	The maximum power consumption of agitators should not exceed the values given below		
		Tanks / Pits	**Power Consumption per Agitators in KW**	
		Limestone Slurry Tank	45	
		Auxiliary Absorbent Tank	45	
		Secondary Hydro clone Feed Tank	40	
		Filtrate Water Tank	15	
		Waste Water Tank	15	
		Lime Feed Tank	5	
		Drain Pits	5	
3.2.0	**SERVICE CONDITIONS**			
3.2.1	**Agitator shall be designed with the following service condition within the limit**			
	a.	Maximum operating temperature	60° C	
	b.	Minimum operating temperature	10° C	
	c	Absolute sweeping of solid particle from tank bottom is a must for all Agitators		
3.2.2	**Sl. no**	**Location of Tank / Pits**	**Mode of operation**	
	a.	Limestone Slurry Tank	Continuous	
	b.	Auxiliary Absorbent Tank	Emergency tank-stand by	
	c.	Secondary Hydro clone Feed Tank	Continuous	
	d.	Filtrate Water Tank	Continuous	
	e.	Waste Water Tank	Continuous	
	f.	Lime Feed Tank	Continuous	
	g.	Drain Pits	Continuous	
	h.	Auxiliary Absorbent Tank is a storage tank. Vendor to ensure 100% solids are in suspended state at any point of time.		
	i.	Others Tanks except Auxiliary Absorbent Tank will have continuous inflow and outlet, hence vendor to ensure nil settlement.		

Sec		Description							Vendor confirmation (Yes /No)
3.2.3	**Details of Limestone Slurry Tanks and Drain Pits for Agitators requirement**								
	Tanks details:								
	Sl. no	**Description of Tank**	**Number of Tanks**	**Capacity m^3**	**Dimensions in meter**		**No of Agitators**		
							Per Tank (including ware house spares)	**Total**	
	a.	Limestone Slurry Tanks	2	1227	Diameter	11.5	1 + 1	4	
					Height	12.29			
	b.	Auxiliary Absorbent Tank	1	2083	Diameter	16.5	1+1	2	
					Height	10.173			
	c.	Filtrate Water Tank	1	614	Diameter	10.0	1+1	2	
					Height	9.06			
	d.	Secondary Hydro cyclone Feed Tank	1	2652	Diameter	16.0	1+1	2	
					Height	13.6			
	e.	Waste Water Tank	1	746	Diameter	10.0	1+1	2	
					Height	9.775			
	f.	Lime feed tank	1	2.5	Diameter	1.4	1+1	2	
					Height	1.69			
							Total	14	
	Drain Pits Details:								
	Sl. no	**Description of Pits**	**Number of Pits**	**Capacity m3**	**Dimensions in meter**		**No of Agitators (including ware house spares)**		
							Per Pit	**Total**	
	g.	Absorber Area Drain Pit	3	15	Length	3.0	1+1	6	
					Width	3.0			
					Height	1.6			
	h.	Gypsum Dewatering Area Drain Pits	1	23	Length	3.0	1+1	2	
					Width	4.0			
					Height	1.9			
	i.	Ball Mill Area Drain Pit	1	15	Length	3.0	1+1	2	
					Width	2.0			
					Height	2.4			
							Total	10	

Sec		Description						Vendor confirmation (Yes /No)
3.2.4	PROCESS PARAMETERS FOR SLURRY TANKS							
	Sl. no	Description	Auxiliary Absorber Tank	Lime Stone Slurry Tank	Filtrate &Sec. Hydro cyclone Tank	Waste water Tank	Lime feed Tank	
	a.	Maximum solid particle size	200 mesh (75 micron)	150 mesh (104 micron)	325 mesh (43micron)	200 mesh (75micron)	325 mesh (43micron)	
	b.	Normal solid particle size,d50	325mesh (43micron)	325 Mesh (43micron)	500 mesh (25 micron) to 1250 (10 micron)	325 mesh (43 micron) and fine particles	325 mesh (43micron)	
	c.	Solid to be handled	Gypsum along Lime Stone and other impurities	Lime Stone and other impurities	Gypsum	Lime stone or Gypsum or mixture of two	Hydrated Lime	
	d.	Sp. Gravity of Slurry	1.1	1.224	1.025	1.025	1.087	
	e.	Hardness of particle	5-7 (Mho scale)	5-7 (Mho scale)	5-7 (Mho scale)	5-7 (Mho scale)	5-7 (Mho scale)	
	f.	Concentration of slurry	15% by weight	30% by weight	4% by weight	4 % by weight	12% By weight	
	g.	Sp. Gravity of Lime Stone	2.51 (Avg.)	2.80	2.80	2.51 (Avg.)	2.51 (Avg.)	
	h.	Concentration of Chlorine	20000ppm	20000ppm	20000ppm	20000ppm (max)	<100 ppm	
	i.	Viscosity of Slurry	10-15cp	20-30cp	2-5cp	10cp	8-15cp	
	j.	Operating temp of Slurry	60 deg C	60 deg C	45 deg C	50 deg C	45 deg C	

	PROCESS PARAMETERS FOR DRAIN PITS			
	Sl. No	Description	Drain pits	
	a.	Maximum solid particle size	6-7 mm	
	b.	Normal solid particle size, d 50	325 mesh (43 micron) and fine particles	
	c.	Solid to be handled	Limestone and Gypsum Slurry	
	d.	Concentration of slurry	30 % by weight	
	e.	Sp. Gravity of Lime Stone	1.12	

Sec		Description			Vendor confirmation (Yes /No)
	f.	Concentration of Chlorine		20,000 ppm (max)	
	g.	Viscosity of Slurry		10cp	
	h.	Maximum operating temperature of Slurry		45-60 C	
3.2.5	**LIQUID LEVEL IN TANKS**				
	Sl. no	**Utility**	**Tank Diameter (m)**	**Water Level in m**	
				Minimum / **Maximum**	
	a.	Lime Stone Slurry Tank	11.5	(+)2.750 / (+)11.825	
	b.	Auxiliary Absorbent Tank	16.5	(+)4.250 / (+)9.750	
	c.	Filtrate Water Tank	10.0	(+)3.550 / (+)8.75	
	d.	Secondary Hydro clone Feed Tank	16.0	(+)4.120 / (+)13.2	
	e.	Waste Water Tank	10.0	(+)0.775 / (+)9.5	
	f.	Lime Feed Tank	(+)1.4	Vendor to specify / (+)1.5	
4.0.0	**DESIGN REQUIREMENTS**				
	a.	Agitator shall be capable of operating up to at least 115% of the rated speed because of frequency variation.			
	b.	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.			
	c.	Power consumption at motor terminal and vibration of equipment will be conducted at site. Vendor to indicate other material tests that are to be conducted as per their practice in their Quality plan.			
	d.	All fasteners used in wetted condition must be of AISI-316L or superior material so that even if it comes in contact with liquid by swelling of rubber, thread remains unaffected. Raw material of fastener must undergo Inter-granular Corrosion test as per ISO-3651, Part-1 for Nitric Acid test.			
	e.	No liquid should enter the tube through any flange joint. "O"-ring used in the flange joint will deteriorate at a highly chlorinated and acidic environment of medium at a maximum operating temperature unless right quality of rubber is used.			

Sec		Description	Vendor confirmation (Yes /No)
	f.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to lower rotating assembly from top. Manhole is shown in the General Assembly drawing attached along with this technical specification. Vendor to review and confirm that the opening will be enough to lower the rotating assembly inside the tank from top, where manhole is not possible because of smaller tank size, the same also is to be indicated.	
	g.	Motor, Electrical components and electrical installations shall be suitable for area classification (Class, Group, Division/Zone) as per the specification and shall meet the requirements of NFPA as well as local codes and furnished by end user.	
	h.	It shall be specifically noted that "Guarantee Life" shall be interpreted as a data from manufacturer that gives a confidence that, with reliability factor of 95%, the component is expected not to be replaced within specified time. However, in case of warranty, the defective component is liable to be replaced free of cost.	
	i.	The Agitators should be so designed that the same can be removed from the top nozzle as & when required for maintenance.	
	j.	The Agitators, motors and bedplate shall be designed for the maximum vibration load.	
	k.	The Agitators shall be able to start up even when the solids contained in the tank are all at the bottom in the form of sediment.	
	l.	The Velocity of the impeller shall not exceed seventy five percent (75 %) of the agitator's first critical velocity.	
5.0.0	**MECHANICAL REQUIREMENTS**		
	a.	**Impeller**	
		The impeller blades shall be made of carbon steel with rubber lining with minimum life of 2 years. Rubber linings to be used, should be of chlorobutylic or brombutylic type, generally 6 mm thick. The bidder can opt for higher thickness of rubber as per their design practice for high abrasion zones.	
		Rubber lining to blade should be minimum 6mm thick with a shore hardness of 55 (±) 5 shores A.	
		The type of impeller shall be selected on the basis of the suspended solids where the work is being performed. The Selected profile shall be consistent with the specified operating conditions.	
		It must be possible to remove the blades from their joining point	
		Each blades shall be made of one single piece.	
		The Profile of the impeller shall be as suitable as possible for the tank size, to ensure that the agitation process is efficient.	
		The Position of the impeller shall be as low as possible, but above the level of the solid sediment that is generated after the agitator has been stopped and restarted	
		Impeller shall be dynamically balanced to Gr: G16: ISO-1940	

Sec		Description	Vendor confirmation (Yes /No)
	b.	**Shaft**	
		The Shaft shall be made of carbon steel with rubber lining with minimum life of 2 years.	
		When the shaft is coupled to the motor, its first critical lateral speed shall be at least thirty percent (30 %) greater than the maximum operating speed.	
		The Shaft design shall be of the cantilever type. None of the shaft bearings shall be allowed to be inside the tank or drain.	
	c.	**Bearing**	
		The bearing shall be of the anti-friction type, with an "L-10 rating" and a useful working life of at least 25,000 hrs. at maximum load.	
		They shall be located on the outside of the processing tank. No intermediate supports will be permitted and neither will guide bearings be allowed on vertical agitators.	
		The lower bearing for agitators on ceiling shall be designed to absorb on radial stresses.	
	d.	**Motors**	
		The Motor speed shall be 1500 rpm or less.	
		The Motor shall have a capacity of at least 1.2 times the maximum capacity required at the shaft.	
		Paint shade shall be as per RAL5012.	
		Degree of protection for various enclosures shall be IP55	
		Noise level of all motor shall be limited to 85 dB(A) at 1m distance.	
		Vibration shall be limited within the limit prescribed by IS12075, Part-14. Motor shall withstand the vibration produced by driven equipment.	
		Motors, the maximum temperature rise shall be 70^{0} C by resistance method for both class B & F insulation.	
	e.	**Seals**	
		The seals shall be of the "Cartridge "type and it must be possible to dismantle them without uncoupling the motor from the agitator.	
		It must be possible to dismantle the seals without emptying the tank.	
		The rotating components forming part of the seal assembly shall be safely attached to the shaft.	
		The corrosion margin for the parts that are subjected to pressure shall be 3 mm.	
	f.	**Coupling& Coupling guard**	
		Coupling and coupling guard should be supplied between driver and driven equipment	

Sec		Description	Vendor confirmation (Yes /No)
		Coupling should be designed taking into consideration adequate service factor.	
		Coupling must be having locking screw so that it does not slide over shaft in due course operation.	
		All the couplings, exposed shafts and moving parts that are located outside the tank shall be supplied with a rigidity – supported protective device that can be dismantled.	
		The coupling must not be connected when being transported.	
	g.	**Gear Box / Reducers**	
		The Speed reducers shall comply with standard API-677	
		They shall be designed to operate without cooling.	
		The Service factor shall be 2.0.	
		The reducers shall be lubricated with an independent system. Measures shall be provided for taking samples of the lubricating oil.	
	h.	**Lubrication**	
		The Lubrication system shall be designed to keep the lubricating temperature of the bearings within he recommended operating range under normal condition.	
		A system shall be supplied to prevent leaks coming from the agitator shaft.	
		Bidder to supply First Fill of Consumables, Oil & Lubricants.	
6.0.0	**INSPECTION & TESTING**		
	a.	All material inspection and testing will be carried out as per approved QAP by BHEL/ BHEL authorized agency/ Customer/ Customer authorized agency.	
	b.	Vendor shall furnish the testing / inspection procedure in in line with approved QAP for inspection by customer / ultimate customer.	
	c.	Inspection of agitator components and dynamic balancing (free run test) will be carried out at vendor works at one place only.	
	d.	Vendor shall make necessary arrangement for the test bed for the dynamic balancing at their works.	
	e.	The Supplier's standard test shall be conducted in the workshop on reducers, motors and items of transmission equipment.	
	f.	**For Surfaces with rubber lining:**	
		Welding will be visually inspected to verify the absence of rough areas and unacceptable transitions between surfaces which prevent the adequate adherence of the rubber.	
		The degree of cleaning of the metallic surface will be visually checked before the application of coating. There must be no areas with oxidation, dirt or partial or generalized corrosion defects.	

Sec		Description	Vendor confirmation (Yes /No)
		Adherence test shall be conducted on production samples.	
		Adherence tests shall be conducted on the actual covered surfaces through hammering, in order to verify the absence of air pockets or surfaces without adherence.	
		The coating thickness shall be checked 100%	
		High voltage porosity shall be conducted on 100% of the coated surface.	
7.0.0	**PAINTING PROCEDURE**		
	Painting shall as per the **Annexure-X**		
8.0.0	**FOR SHIPMENT**		
	a.	Flanged openings shall be provided with metal closure of 4.8 mm minimum.	
	b.	The working agitators shall be protected for storage of 12 months at site, if any extra precaution is to be taken by the Purchaser for storage beyond 12 months the same shall be explicitly indicated in the operation and maintenance manuals.	
	c.	The ware house agitator shall be protected for storage at site for a long duration. If any special type of packing is require to protect the ware house agitators, vendor shall provide the packing and same shall be explicitly indicated in the operation and maintenance manuals.	
	d.	To meet mandatory spares requirement – the ordered agitator components shall be crafted in a metal container for transportation and suitable for at least 4 years storage.	
9.0.0	**MANDATORY SPARES**		
	a.	Impeller Assembly	1 no. of each type
	b.	Bearing Assembly	1 no. of each type
	c.	Motor	1 no. of each type
	d.	Belt & Pulley (If applicable)	1 no. of each type
	e.	Gear Box Assembly (If applicable)	1 no. of each type
10.0.0	**DOCUMENTATION**		

	Sl. no	Description	With Proposal	After Award Of Contract	
	a.	Compliance of specification	yes	--	
	b.	Deviation List	Yes	--	
	c.	Performance Curve	yes	Yes	
	d.	General Assembly Drawing	Yes	Yes	
	e.	Motor Sizing Calculation	--	Yes	
	f.	Cross-sectional Drawing	-	Yes	
	g.	Data Sheet	Yes	Yes	

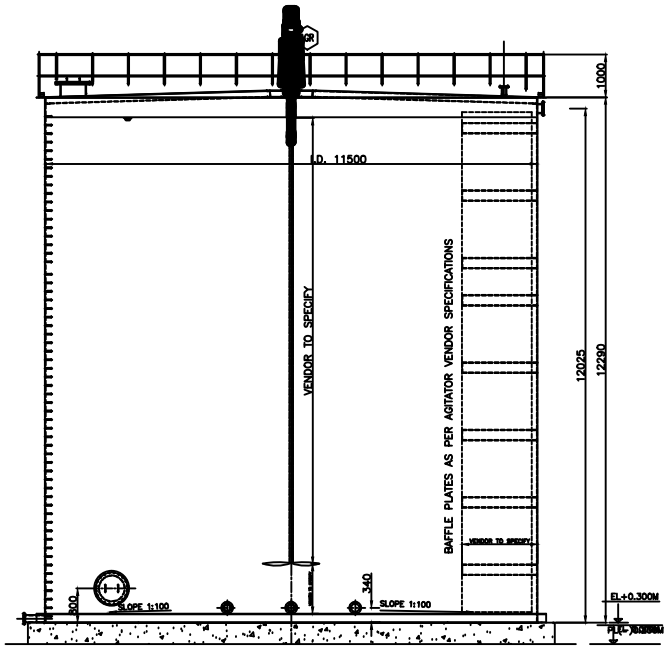
Sec		Description			Vendor confirmation (Yes /No)
	h.	Sub-Vendor List	yes	Yes	
	i.	Material Test Certificates	--	yes	
	j.	Erection check list	--	yes	
	k.	Pre Commissioning Check List	--	yes	
	l.	Scope of Supply	Yes	--	
	m.	Quality Plan	yes	Yes	
	n.	Operation & Maintenance Manual	--	10 copies + CD	
	o.	Spare List (Mandatory., Recommended)	Yes	Yes	
	p.	Start-up & Commissioning Spare	yes	Yes	
	q.	List of Special Tools	Yes	Yes	
	r.	Delivery Schedule	yes	yes	
	s.	Test Arrangement	--	Yes	
	t.	T-N curve	--	Yes	
	u.	Motor Drawing	--	Yes	
	v.	Curve of Motor (T-N, Efficiency, time etc.)	--	Yes	
	w.	Catalogue	Yes	--	

ANNEXURE-X

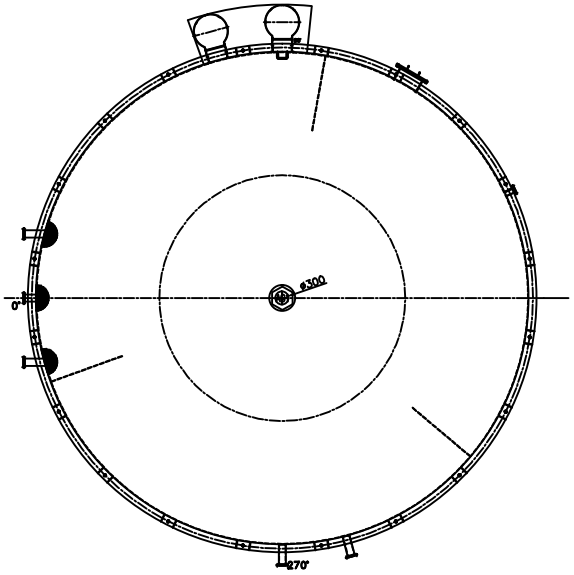
PAINT PROCEEDURE

Primer Coat		Intermediate Coat		Finish Coat			Total DFT µm (min)
Paint	No of Coats /DFT	Paint	No of Coats	Paint	No of Coats	Shade	
HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 µm per coat (Solid by Volume min 60%)	2	--	--	Chlorinated Rubber Based Finish paint DFT= 30 µm per coat (Solid by Volume min 60%)	2	Gray shade to R9002	160

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION



PLAN

SI No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	500	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

NOTE:-

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF AGITATOR ROD SPECIFY TO VENDOR.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 3X250MW–NTPC–BONGAIGOAN FLUE GAS DESULPHURIZATION SYSTEM

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: BOILER AUXILIARIES PLANT.
RANIPET – 632 406.

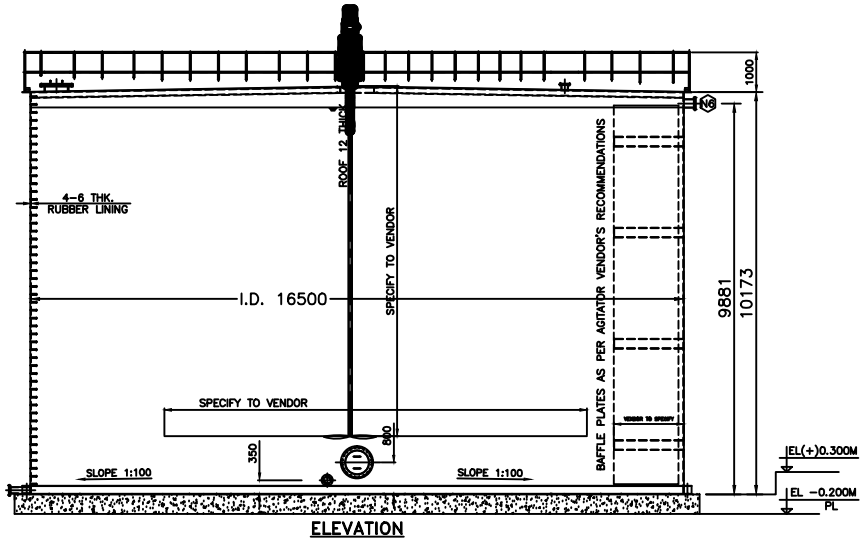
	NAME	SIGN	DATE	NO.OF VAR.
DRN	SRIDHAR			
CHD	SASHI			
APPD	SK DASH			

DEPT / CODE	GRADE OF UNTOL.DIM	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
	PR: QA: 500					

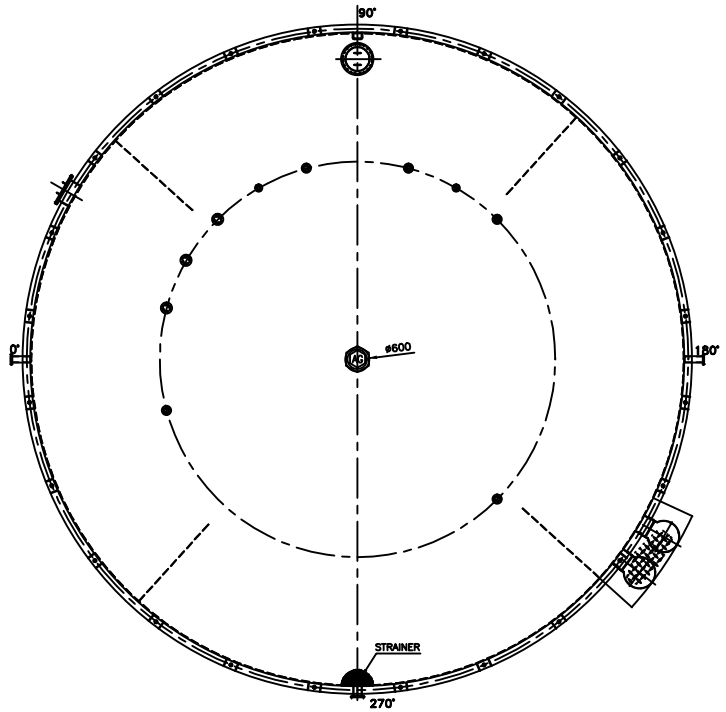
TITLE	CARD CODE	DRAWING NO.	REV
GA OF LIMESTONE SLURRY TANK FOR AGITATOR		4–FW–000–00227	00

Size A3

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION



PLAN

SI No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	600	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

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DRN	SRIDHAR			
CHD	SASHI KUMAR			
APPD	S K DASH			

DEPT	GRADE OF UNTOL.DIM		SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
CODE	PR:QA:500						

TITLE: G.A. FOR AUXILIARY ABSORBENT TANK FOR AGITATOR

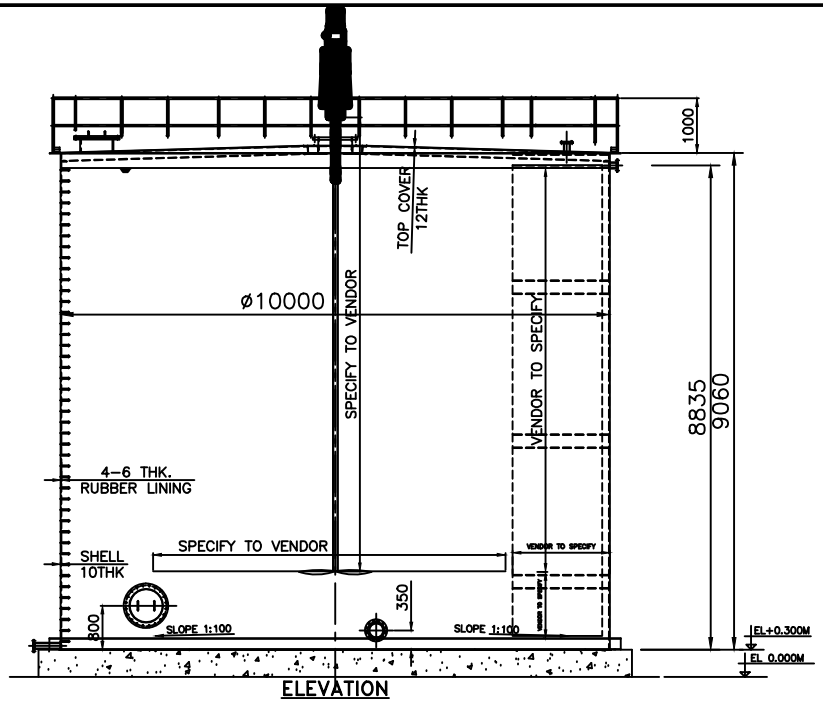
CARD CODE

DRAWING NO.: 4-FW-000-00225

REV: 00

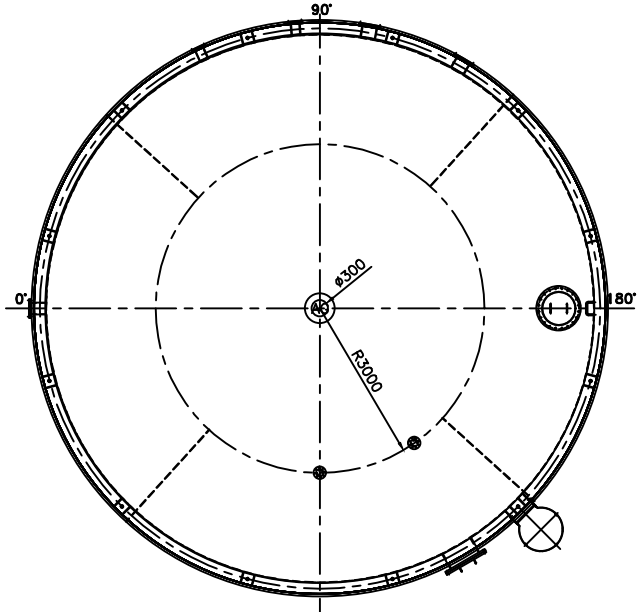
Size A3

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION

SI No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	500	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE



PLAN

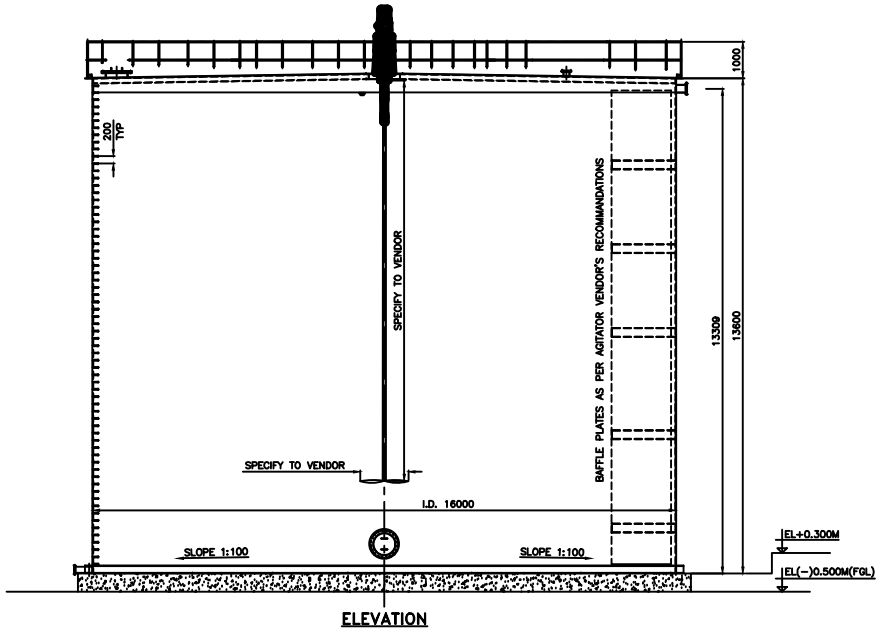
NOTE:-

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF THE AGITATOR ROD SPECIFIED TO THE VENDOR.

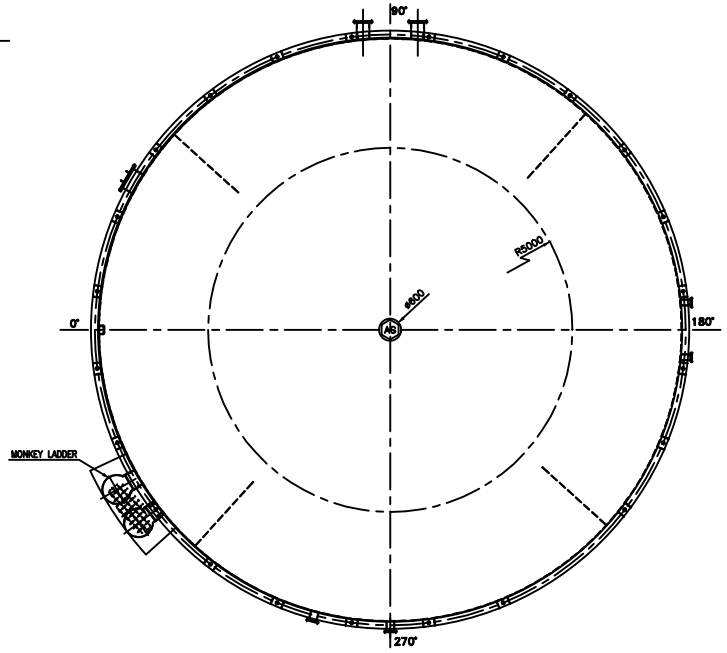
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	3X250MW-NTPC-BONGAIGOAN FLUE GAS DESULPHURIZATION SYSTEM					
BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT. RANIPET – 632 406.		NAME	SIGN	DATE	NO.OF VAR.	
	DRN	SRI				
	CHD	MANOJ				
	APPD	C.GANESH				
DEPT / CODE	GRADE OF UNTOL.DIM PR:QA:500	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
TITLE: G.A FOR FILTRATE WATER TANK FOR AGITATOR	CARD CODE	DRAWING NO. 4-FW-000-00226			REV 00	

Size A3

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION



PLAN

Sl No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	600	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

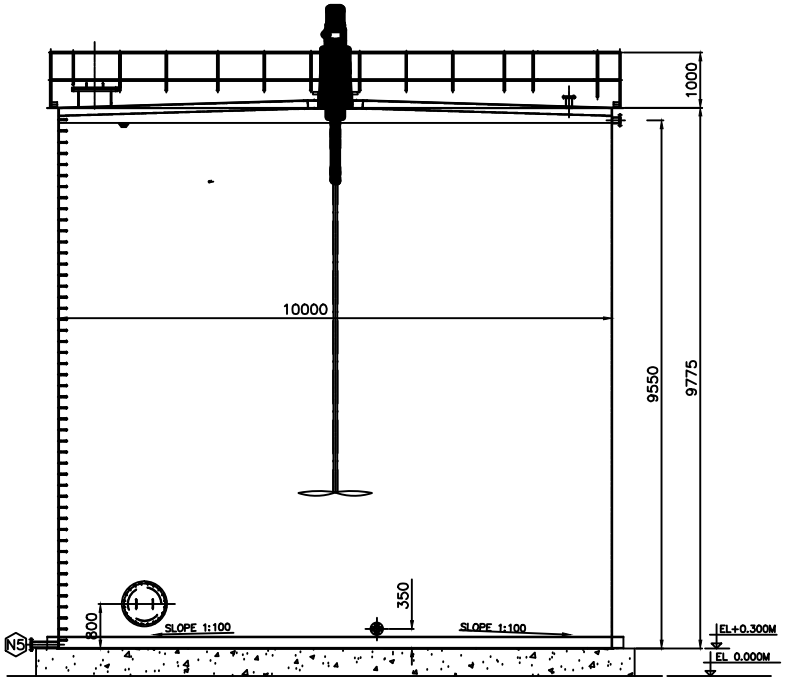
NOTE:-

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF THE DIAMETER ROD SPECIFY TO VENDOR.

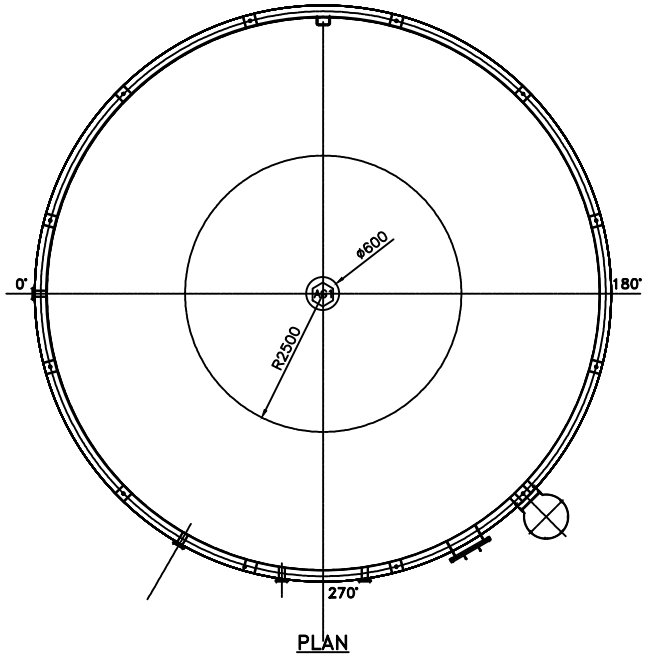
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	3X250MW–NTPC–BONGAIGOAN FLUE GAS DESULPHURIZATION SYSTEM					
BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT. RANIPET – 632 406.		NAME	SIGN	DATE	NO.OF VAR.	
	DRN	SRIDHAR				
	CHD	SASHI				
	APPD	SK DASH				
DEPT / CODE	GRADE OF UNTOL.DIM PR: QA: 500	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
TITLE: G.A.FOR SECONDERY H'CLONE FEED TANK FOR AGITATOR	CARD CODE	DRAWING NO. 4–FW–000–00223	REV 00			

Size A3

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION



PLAN

Sl No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	600	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

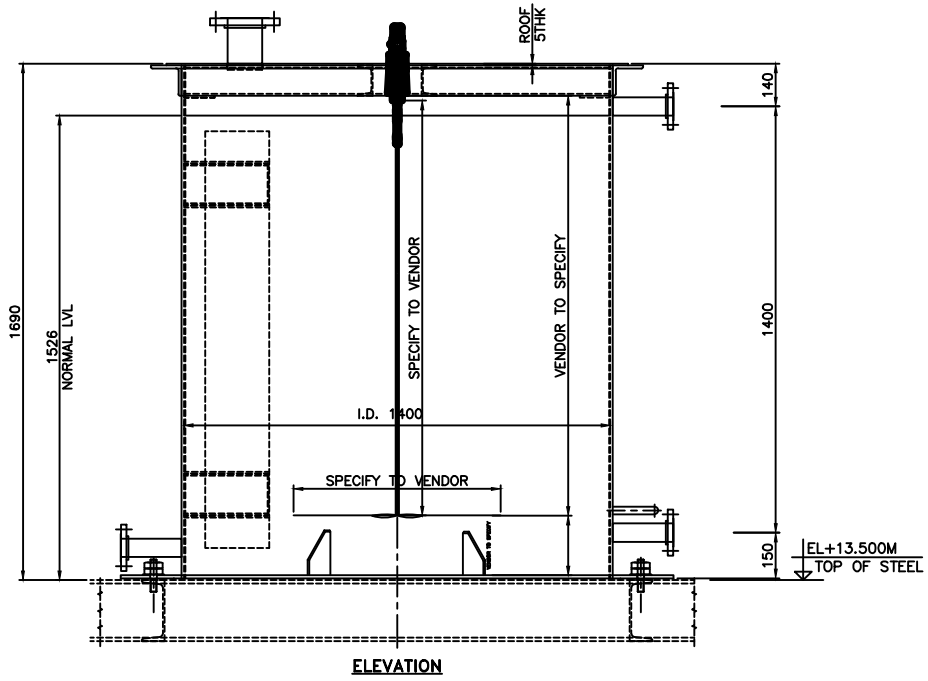
NOTE:-

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF THE AGITATOR ROD SPECIFY TO VENDOR

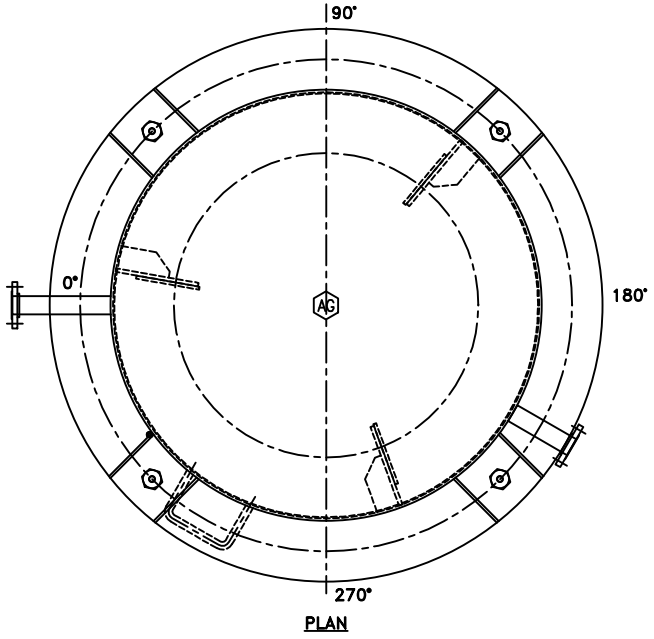
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	3X250MW–NTPC–BONGAIGOAN FLUE GAS DESULPHURIZATION SYSTEM						
BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT. RANIPET – 632 406.		DRN	SRIDHAR			NO.OF VAR.	
		CHD	SASHI				
		APPD	SK DASH				
DEPT / CODE	GRADE OF UNTOL.DIM PR:QA:500	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.		ITEM NO.	NO. OF ITEMS
TITLE: G.A. FOR WASTE WATER FOR AGITATOR		CARD CODE		DRAWING NO. 4-FW-000-00224			REV 00

Size A3

ALL DIMENSIONS ARE IN MILLIMETRES



ELEVATION



PLAN

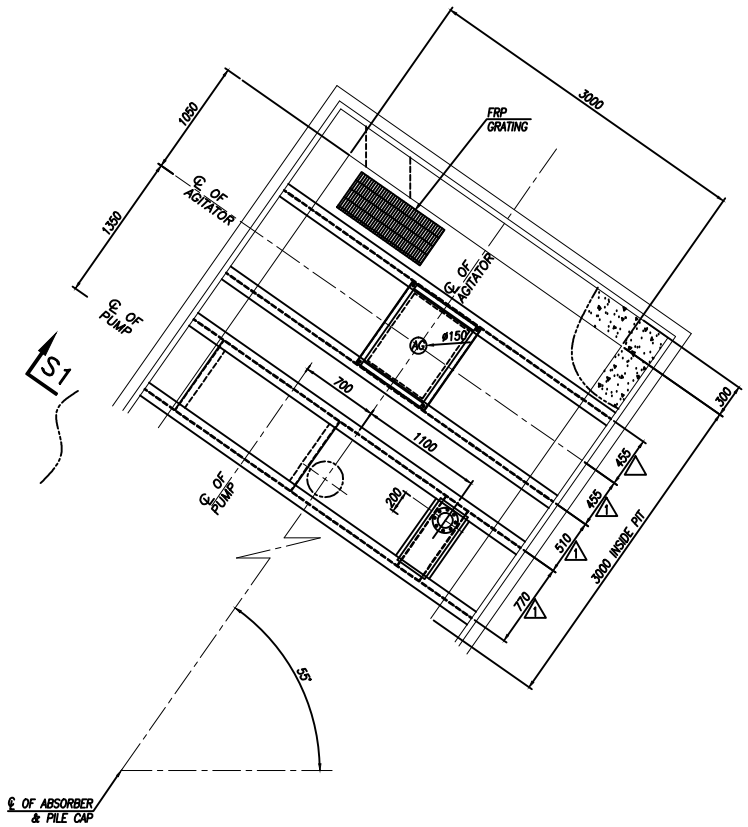
SI No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	300	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

NOTE:-

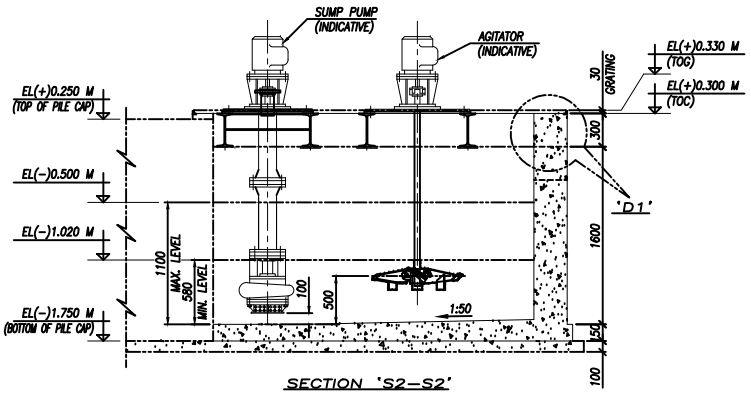
1. DIAMETER OF THE BLADE HEIGHT OF THE AGITATOR ROD SPECIFY TO VENDOR.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	3X250MW–NTPC–BONGAIGOAN FLUE GAS DESULPHURIZATION SYSTEM					
BHARAT HEAVY ELECTRICALS LTD., UNIT: BOILER AUXILIARIES PLANT. RANIPET – 632 406.		DRN	NAME: SRIDHAR	SIGN	DATE	NO.OF VAR.
		CHD	SASHI			
		APPD	S K DASH			
DEPT / CODE	GRADE OF UNTOL.DIM: PR:QA:500	SCALE	WEIGHT (KG).	REF. TO ASSY/OLD DRG.	ITEM NO.	NO. OF ITEMS
TITLE: G.A. LIME FEED TANK FOR AGITATOR		CARD CODE	DRAWING NO. 4–FW–000–00228			REV 00

Size A3



PLAN
@ EL(+)0.300 M
DRAIN PIT FOR ABSORBER DRAIN & PUMP HOUSE



SECTION 'S2–S2'

Sl No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	300	AGITATORS	03 WORKING & 03 WAREHOUSE SPARE

NOTE:

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF THE AGITATOR ROD SPECIFY TO VENDOR.
2. 01 AGITATOR PER PIT 01 WAREHOUSE SPARE PER PIT THEREFORE 06 NO OF AGITATORS FOR 3 UNITS

PROJECT : BONGAIGOAN-3X250MW-FLUE GAS DESULPHURIZATION SYSTEM

NTPC Limited

NTPC DRG NO. 4610-101-03RP-PVM-B-039 REV. 00

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT.
MANIPUT - 000 000.

	NAME	SIGN	DATE
DSWN	SRIDHAR		–
CHD	SASHI		–
APPD	SK DASH		–

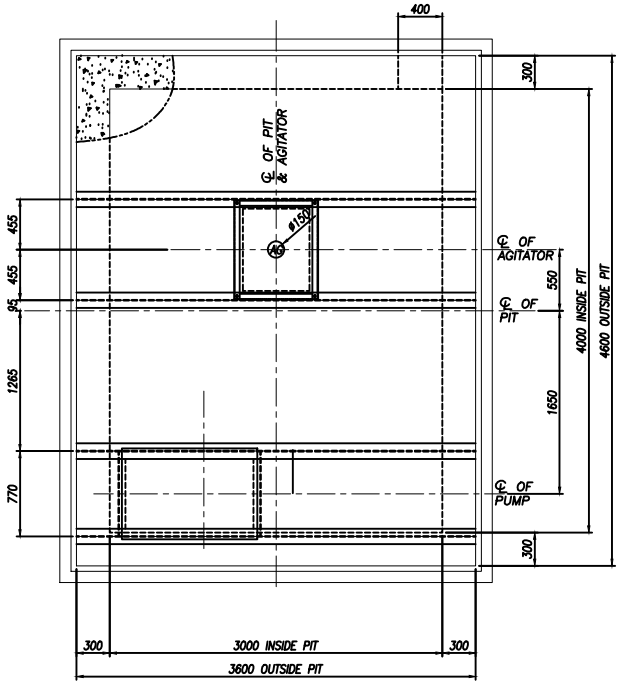
BHEL DRG NO. : 4-FW-000-00047 REV. 00

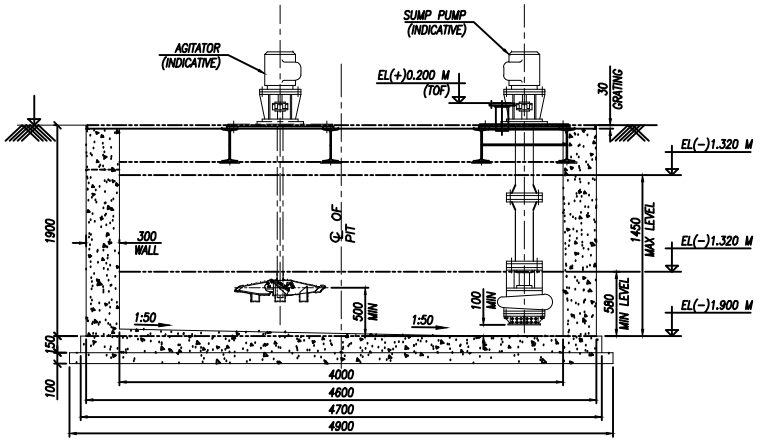
TITLE : GA OF ABSORBER DRAIN PIT

DUCON DRG NO. DC109-5038-ME-05-010

SCALE : 1:30

SHEET 00 OF 00 REV. 01





NOTE:

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF AGITATOR ROD SPECIFY TO VENDOR.

Sl No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	300	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	CLEARED BY C	M	E	Cnl	APPD	DATE
										11.06.10
										19.06.10

CUSTOMER NO. : ---

PROJECT : BONGAIGOAN-3X250MW-FLUE GAS DESULPHURIZATION SYSTEM

NTPC Limited

NTPC DRG NO. 4610-101-03RP-PVM-B-049 REV. 00

BHARAT HEAVY ELECTRICALS LTD. UNIT: BOILER AUXILIARIES PLANT. HARIDWAR - 249 403.

	NAME	SIGN	DATE
DRWN	---		--
CHD	---		--
APPD	---		--

BHEL DRG NO. : 4-FW-000-00066 REV. 00

DUCON TECHNOLOGIES, INC. "DEFINING THE INDUSTRY SINCE 1939" FARMINGDALE, NEW YORK 11735, U.S.A. (631) 694-1700 FAX.(631) 420-4855

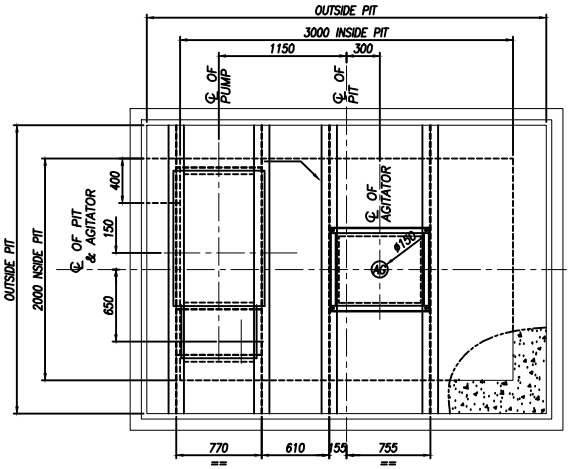
	NAME	SIGN	DATE
DRWN	S NASIR		19.06.2010
CHD	S PATIL		19.06.2010
APPD	B KANAN		19.06.2010

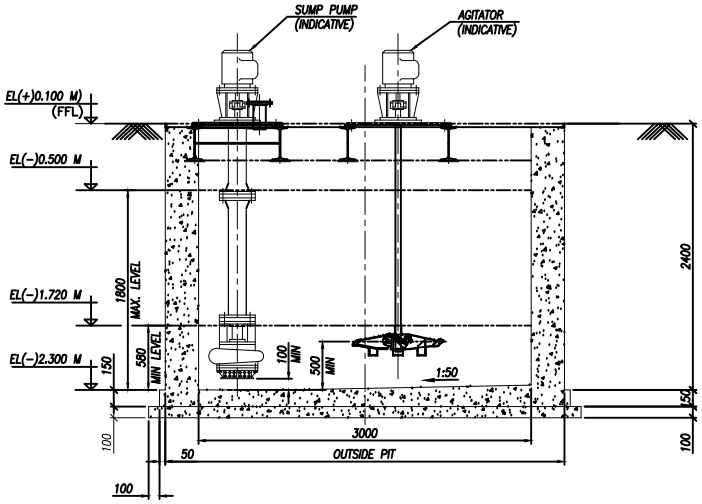
TITLE : GA OF GYPSUM DEWATERING BUILDING DRAIN PIT

DUCON DRG NO. DCI09-5038-ME-05-029

SCALE : 1:30

SHEET 01 OF 01 REV. 01





Sl No.	AGITATOR NOZZLE SIZE	INSTRUMENT	QUANTITY
01	300	AGITATORS	01 WORKING & 01 WAREHOUSE SPARE

NOTE:

1. DIAMETER OF THE AGITATOR BLADE AND HEIGHT OF THE AGITATOR ROD SPECIFY TO VENDOR.

PROJECT : BONGAIGOAN-3X250MW-FLUE GAS DESULPHURIZATION SYSTEM

NTPC Limited

NTPC DRG NO. ---- REV.

BHARAT HEAVY ELECTRICALS LTD.
UNIT: BOILER AUXILIARIES PLANT.
HARDWAR - 000 000.

	NAME	SIGN	DATE
DRWN	SRIDHAR		
CHD	SASHI		
APPD	SK DASH		

TITLE : GA OF BALL MILL AREA DRAIN PIT

DUCON DRG NO. DCI09-5038-ME-05-038

SCALE : 1:30

SHEET 01 OF 01 REV. 01