


TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b>		<b>Product</b> <b>STD NO.</b>	<b>BA89257</b>
			<b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT</b> <b>TANK AGITATOR FOR NTPC KORBA</b>		Rev. No. 00	
					Page 1 of 39	


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***TECHNICAL SPECIFICATION FOR  
MILL CIRCUIT TANK AGITATORS.***

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Refer Doc			PREPARED	CHECKED	APPROVED	Date of 1st Issue:
			UDAY REDDY	PVS	AMAN	09.04.2022

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			<b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT TANK AGITATOR FOR NTPC KORBA</b>		Rev. No. 00	
					Page 2 of 39	

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**CONTENTS**

1. PROJECT INFORMATION.....	3
2. GENERAL DESCRIPTION OF MILL CIRCUIT TANK AGITATOR .....	4
3. APPLICABLE CODES & REGULATIONS .....	5
4. INTENT OF SPECIFICATION .....	5
5. PROVENNESS CRITERIA: .....	8
6. TANK DETAILS AND MEDIA ANALYSIS .....	8
7. SCOPE OF SUPPLY.....	8
8. GENERAL TECHNICAL REQUIREMENTS .....	10
9. DESIGN AND CONSTRUCTION OF AGITATOR .....	13
10. PACKING AND FORWARDING .....	20
11. SUPERVISION OF ERECTION AND COMMISSIONING .....	23
12. EXCLUSION .....	23
13. QUALITY ASSURANCE .....	24
14. PAINTING .....	30
15. SPARES.....	30
16. SPECIAL TOOLS AND TACKLES .....	34
17. PERFORMANCE GUARANTEES AND SCHEDULE OF GUARANTEES .....	34
18. WARRANTY .....	35
19. FIRST FILL OF CONSUMABLES:.....	36
20. TRAINING .....	36
21. CONFLICT .....	36
22. DOCUMENTATION .....	37
A. TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER: .....	37
B. DOCUMENTS TO BE SUBMITTED AFTER CONTRACT: .....	37
ANNEXURES LIST: .....	38



## 1. PROJECT INFORMATION

Korba Super Thermal Power Project (KSTPP) was originally conceived as a pit head coal-based power plant. The present capacity of the plant is 2600 MW which has been implemented in 3 stages. Stage-I comprises of three 200 MW units, Stage-II comprises of three 500 MW units and the Stage-III of the plant comprises of one 500 MW unit. The present proposal is for implementation of FGD system in the stage-III (1x500MW) of Korba STPP for reduction of SO<sub>x</sub> emissions. The site is located on the western bank of river Hasdeo near Korba town in Korba District of Chhattisgarh State. The site is very close to all weather road between Katghora & Korba and is approximately 110 kms from Bilaspur and 10 kms from Korba town.

a)	Owner	National Thermal Corporation Limited
b)	Buyer	BHEL, Hyderabad
c)	Process/Application	Flue Gas Desulphurization

### A) SITE CONDITIONS

#### Barometric Pressure

		Barometric Pressure		
		Minimum	Reference	Maximum
Observational Record	hPa	<b>977.5</b>	-	<b>981.5</b>
Design Value	Outdoor hPa		<b>977.5</b>	

#### Ambient Temperature

		Ambient Temperature		
		Minimum	Reference	Maximum
Observational Record	Deg C	<b>24.1</b>		<b>31.1</b>
Design Value	Outdoor Deg C	<b>27</b>		<b>45</b>
Design Value	Indoor Deg C			

#### Relative Humidity

		Humidity		
		Minimum	Reference	Maximum
Observational Record	%	<b>46</b>		<b>67</b>
Design Value	Outdoor %		<b>60</b>	
Design Value	Indoor %			

Note:

- 1) Guarantee point site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test.
- 2) Equipment and Material must be suitable for the range of ambient site conditions

### B) PROJECT LOCATION

- a. Country: India
- b. State/Division: Chhattisgarh.
- c. District: Korba



## 2. GENERAL DESCRIPTION OF MILL CIRCUIT TANK AGITATOR

Agitator is part of Mill circuit tank, The Mill Circuit tank is provided to hold and dilute the circulating slurry of the mill circuit for desired operation of the Ball mill for limestone grinding. The main purpose of agitator is to avoid settling of limestone slurry and to maintain the slurry concentration at pump feed.

To prevent mechanical blocking load start up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.

Mill circuit tank agitator shall be of top entry (vertical) type and will be designed for continuous operation. The design of the agitators will be of proven type. The blades of the agitators shall be of stainless steel Alloy 926 or better. The shaft will be of CS material rubber lined.

S. No.	Description	Requirement
1	<b>Quantity</b>	
	Quantity of Agitators per tank	1 set
	Number of Circuit tanks	02
2	<b>Parameters</b>	
	Tank Details	PLEASE REFER ANNEXURE - 3 FOR TANK DRAWING
	Media to be Handled	Limestone Slurry
	Limestone and process water Analysis	Refer Clause No. 6
	Type of Agitator	Vertical mounted type.
	Duty	Continuous
3.	<b>Application</b>	Inside Mill circuit tank. Tank placed outdoor.
	<b>Power Supply</b>	
	The following voltage levels shall apply:	
	415 V $\pm$ 10%, 50Hz	Standard voltage for power supplies to small electric power consumers and motors below 200 KW lighting and domestic
Design Ambient Temperature-- 50 Deg C.		
<b>Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.</b>		



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4.

**CONTROL & INSTRUMENTATION SYSTEM**

**BASIC DESIGN CRITERIA:**

When more than one device uses the same measurement or control signal, the transmitter and other components/ module shall be fully equipped to provide all signal requirements. All the 4-20 mA output signals from transmitters/other control system shall be able to drive minimum 500 Ohms load resistance. The system shall be arranged so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.

**ENVIRONMENTAL CONDITIONS:**

Instruments, devices and equipment's for location in outdoors/indoor/air-conditioned areas shall be designed to suit the environmental conditions indicated below and shall be suitable for continuous operation in the operating environment of a coal fired utility station and also during periods of air conditioning failure without any loss of function, or departure from the specification requirements covered under this specification.


Ambient Temperature (outside cabinets)	Pressure	Relative humidity	Atmosphere	Required protection Class of panels/ cabinets/ desks to be provided by contractor.
<b>Outdoor Location</b>				
55 degree C max.	Atmosp here	100 % Max.	Air (dirty)	IP 55
4 degree C min.	Atmosp here	5 % min.	Air (dirty)	IP 55

**3. APPLICABLE CODES & REGULATIONS**

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition (as applicable as on date of bid opening). The design, manufacturing, installation and testing of the agitator shall follow the latest applicable Indian/International (ISO/ASTM/AISI/ASME/EN/Japanese) Standards. If any other country standard used shall also be accepted subjected to approval by NTPC, in such case bidder shall furnish adequate information to justify that these standards are equivalent or superior to the international standard mentioned above. A copy of such standard duly translated (complete word to word translation) in English shall be furnished by vendor.

**4. INTENT OF SPECIFICATION**

4.1. The specification covers Supply part, Services part and Mandatory spares comprising of design (i.e. Preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at

TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b> <b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT</b> <b>TANK AGITATOR FOR NTPC KORBA</b>	Product STD NO.	BA89257
				Rev. No. 00	
				Page 6 of 39	

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vendor's & sub-vendor's works, painting, maintenance tools & tackles, fill of lubricants & consumables till handing over, mandatory spares along with spares for erection, start-up and commissioning, forwarding, proper packing, shipment and delivery at site, assembly and services part covers supervision services for erection & commissioning, trial run at site and carrying out Performance guarantee tests at site, training of customer/ client O&M staff covering all aspects of the Agitator including Operation & Maintenance, Troubleshooting etc., training of customer at manufacturer's works (3 persons for 2 days including lodging and boarding) & handover in flawless condition of the package to the customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.


The following points may be noted.

- a) Agitator is part of mill circuit tank, details of which are given in Technical Information of Agitator.
- b) Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- c) The Bidder shall offer only proven design which meets the Provenness /Pre-qualification requirement of NTPC. Necessary document evidences as per Attachment-3K for qualification shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, their offer will be rejected.

4.2. The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of Agitators for FGD Slurry Tanks.


4.3. It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

4.4. The extent of supply under the contract includes all items mentioned in the specification and /or schedules. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation.

TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b> <b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT</b> <b>TANK AGITATOR FOR NTPC KORBA</b>	Product STD NO.	BA89257
				Rev. No. 00	
				Page 7 of 39	

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- 4.5. Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 4.6. The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.
- 4.7. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of prebid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 4.8. Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Section -II); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/it's customer.
- 4.9. In the event of any conflict between the requirements of two clauses of this specification & requirements of different codes/standards and between respective clauses of sub-section C & sub-section D, more stringent clause as per the interpretation of the owner shall apply.
- 4.10. In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 4.11. Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b>		<b>Product</b> <b>STD NO.</b>	<b>BA89257</b>
			<b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT</b> <b>TANK AGITATOR FOR NTPC KORBA</b>		Rev. No. 00	
					Page 8 of 39	

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- 4.12. The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 4.13. BHEL's Customer's representative shall be given full access to the shop in which the equipment's are being manufactured or tested and all test records shall be made available to him.
- 4.14. Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.
- 4.15. All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.
- 4.16. The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

#### **5. PROVENNESS CRITERIA:**

The Bidders are required to meet the Qualification Requirement (QR) for agitators as per enclosed **Annexure-1 & submit the Annexure to qualification requirement (Attachment-3K). Bidder's offers will be rejected if they fail to meet the QR.**


#### **6. TANK DETAILS AND MEDIA ANALISYS**

Tank details and analysis of limestone & water is as per enclosed Annexure-3.

#### **7. SCOPE OF SUPPLY**

The bidder shall assume sole responsibility for the design, fabrication, testing, surface preparation & painting, packing, transportation and performance of the specified equipment with accessories, and shall ensure that the equipment with accessories are in conformance with this specification, as well as other documents which form part of the Purchase Order/Contract.

Various inspections by the BHEL/NTPC shall not relieve the Bidder in any way of his obligation to maintain an adequate test, inspection, and documentation program of his own, and shall not relieve the Bidder of any other obligation under this specification.

TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b> <b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT</b> <b>TANK AGITATOR FOR NTPC KORBA</b>	Product STD NO.	BA89257
				Rev. No. 00	
				Page 9 of 39	

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Furthermore, any inadvertent overlook of deviations from some requirements of this specification by the buyer shall not constitute a waiver of these requirements, or of the Bidder's obligation to correct the condition when it is discovered, or of any other obligation under this specification.

This specification only states the lowest technical requirement, neither specifying all technical details, nor referring the pertaining code and standard fully. It is the Bidder's responsibility to ensure that the complete delivery complies with all relevant codes, standards and specifications.

The Bidder is obliged to supply relevant drawings and documentation to the buyer. All to be in English language and metric system, if not otherwise agreed in writing.

Scope for the bidders shall include Design, Manufacturing, Supply, and Supervision of Erection & Commissioning


**Design:** Broadly includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, Erection & assembly Drawings, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from customer.

**Supply:** The scope includes the following:

- Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.
- Mandatory spares as defined in section 15.2
- Recommended spare parts list to be furnished (is not part of scope of supply)
- Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units.
- Start-up & Commissioning Spares
- First fill of consumables

**Services:** Services to be provided by the bidder:

- Detailed Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by BHEL.
- Supervision for Erection & Commissioning, trial run at site
- Performance guarantee tests at site & handover in flawless condition of the package to the customer
- Training of customer/ client O&M staff covering all aspects of the GDS- Operation & Maintenance, Trouble-shooting etc. at site

TD 106-1 Rev No. 6	Form No.		<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PULVERISERS, HPEP HYDERABAD</b>	Product STD NO.	BA89257
				Rev. No. 00	
				Page 10 of 39	
			<b>TECHNICAL SPECIFICATION FOR MILL CIRCUIT TANK AGITATOR FOR NTPC KORBA</b>		

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- Training of customer at manufacturers works (3 persons for 2 days including lodging and boarding)
- Visits shall be planned by BHEL site team and prior intimation shall be sent to supplier for visit to site for supervision services. Bidder shall be informed at least 10 days in advance for the requirement of visit at site. Visiting team shall consist of one or two expert of bidder as deemed necessary by them.
- Bidder shall prepare the model of all Agitators under scope in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, BOQ, schematics and logic diagrams etc. in the aforesaid 3D model.
- After the completion of engineering the corresponding complete 3D review model shall be handed over to BHEL.

The scope of supply for AGITATORS shall include but not limited to the following:  
 AGITATOR complete with

- a. AGITATOR Blades
- b. AGITATOR Shafts
- c. Coupling arrangement (Flexible)
- d. Gland Packing, Seals, O Rings, Glands
- e. Shaft Sleeve
- f. Lanterns/ Stools ( Bearing Housing), Safety Guard
- g. Bearings
- h. Agitator Mounting Flanges with gaskets and fasteners
- i. Drive Motor(IE3) with gearbox arrangement
- j. Mating Flange for Supporting on Slurry Tank Roof
- k. Shims
- l. Painting and Rust Prevention during shipment and construction
- m. Packing and transportation
- n. Supervision of Erection & commissioning at site
- o. Special tools & tackles as applicable
- p. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per
- q. Project Specific Requirement
- r. Installation, operation and maintenance manuals
- s. Any other items required for completeness of the equipment except the items covered in the exclusions

## 8. GENERAL TECHNICAL REQUIREMENTS



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Sl. No	Description	Vendor to confirm
1.	Agitator shall be designed for continuous operation.	
2.	The Material of Construction (MOC) of Agitator: Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be CS with rubber lined.	
3.	It should be roof mounted.	
4.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box 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.	
5.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.	
6.	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.	
7.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.	
8.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material	
9.	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.	
10.	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.	
11.	Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.	
12.	All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion.	
13.	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.	
14.	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.	
15.	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.	
16.	All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power.	



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Sl. No	Description	Vendor to confirm
17.	All exposed moving parts shall be covered by guards.	
18.	The shape of the impeller blades of top entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.	
19.	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.	
20.	Maintaining a uniform concentration over the 95% of liquid column. Absolute sweeping of solid particle from tank bottom is a must for all Agitators. If speed is required to be increased to guarantee the above requirements; the same can be increased by vendor. Bidder's machines that consume less power will be in an advantageous position.	
21.	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 FGD Process & determines the "In efficiency of the Agitator".	
22.	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.	
23.	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 vibrations 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.	
24.	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 liquid in every tank for every Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. Any minor change in liquid level required by Agitator supplier will be accommodated only if it is acceptable to the pump supplier.	
25.	Agitator must have low-pitch propeller with low solidity ratio and Power Number. The Maximum Input Power at motor terminal shall be considered as a guaranteed parameter and the same shall be calculated for maximum liquid level in tank. A calculation of power specifying the hydraulic power of 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. Motor should be selected based on the highest power demand with a 10% margin at maximum liquid level, taking into account frequency variation.	



Sl. No	Description	Vendor to confirm
26.	The agitator shall be suitably designed for mounting and operation in purchaser's tank whose drawings is annexed with the enquiry specification. The bidder shall review and comment on the BHEL's tank drawings for number and size of the baffles, sparger locations, mounting nozzle details etc	
27.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material. Impeller hub material has to be Alloy 926 or better material.	
28.	Unless otherwise specified, for small diameter impeller, it shall be possible to remove complete agitator assembly without dismantling through the opening provided on the tank/sump, and for large diameter impeller, the blade shall be of removable construction for ease of removal. Bidder shall also provide the headroom required for taking out the agitator as above.	
29.	Any instruments provided shall be Profibus Compatible.	
30.	Bidder shall provide the design and arrangement of baffle plates in circular tanks/rectangular sumps. Baffle plates are in BHEL scope.	
31.	Bidder shall provide proper dowelling between motor and base plate, gear box and mounting tool/base plate, for ease of assembly of agitator unit. Tapered dowell shall be provided.	
32.	Vendor shall provide suitable arrangement for supporting the agitator shaft with impellers during removal of gear-box for maintenance and details of such arrangements shall be furnished.	

## 9. DESIGN AND CONSTRUCTION OF AGITATOR

(Bidder to fill and submit the enclosed technical data sheet along with offer)

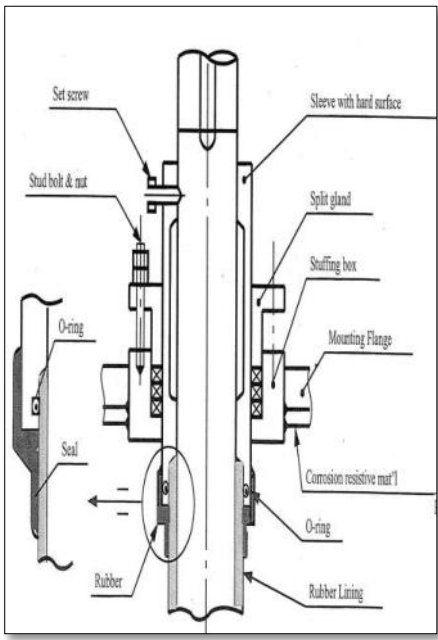
### 9.1 BLADE AND HUB OF PROPELLER

Sl. No.	Description	Vendor to confirm
1.	The blades of the agitators shall be of Alloy 926 or better material.	
2.	The Blade design of the Agitator to be of most efficient design in order to offer least power consumption. The Agitator power consumption is part of the guarantee parameters.	
3.	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. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.	
4.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.	

### 9.2 SEAL



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 It must not be used directly or indirectly in any way detrimental to the interest of the company.

Sl. No.	Description	Vendor to confirm
1.	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Construction of Gland Packing shaft seal system shall be as per the below fig: 	
2.	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. 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 established by Agitator manufacturer and seal manufacturer, and shall be noted in data sheet submitted in tender. If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.	

**9.3 SHAFT**

Sl. No.	Description	Vendor to confirm
1.	MOC of Shaft shall be CS with rubber lining (min 6 mm thk Chloro/bromo butyl rubber). Use of dissimilar material at flange joint shall be avoided to eliminate any crevice corrosion. Spacing of the shaft joint should not be more than 3.0 m for easy assembly if it is more than 40kg. If welding is used for joining two tubes, welding joint must be 100% radio graphed. If split shaft is proposed for larger tanks, shaft flange at the joining interface has to be rubber lined at manufacturer's works and necessary fasteners have to be provided.	

**9.4 BEARING & BEARING HOUSING IN GEAR BOX**

Sl. No.	Description	Vendor to confirm
1.	Bearing shall be of rolling type radial and thrust bearing (FAG/SKF/Timken make only) as required. Thrust bearing shall be sized for continuous operation under all specified condition.	
2.	Thrust bearing shall provide full load capability if the Agitator's normal direction of rotation is reversed. Up-thrust and Down-thrust load must be taken into account in sizing bearing. Life of the every anti-friction	



	bearing, used in the bearing housing as per manufacturer's design, should have L10 of 25000 hr (minimum).	
3.	Bearing housing should be grease/oil lubricated. If bearing is oil lubricated, constant-level sight-feed oiler of 100cc size or bigger capacity is to be provided. Bearing housing should have oil drain, constant oil level indicator. A provision of one(1) number G1/2" thread (ISO-228, Part-1) port is required for remote control of temperature of bearing housing oil bath RTD.	
4.	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.	
5.	Lubricating oil will be the responsibility of Gear Box manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.	

### 9.5 MATERIALS

Sl. No.	Description	Vendor to confirm
1.	Agitator components designated as "Full Compliance Material" shall meet the requirements of the industry specification as listed for the material in the table as well as in the specification in the respective section.	
2.	A detail quality plan is to be submitted along with offer for all items marked "Full Compliance Material".	
3.	Final acceptance of the quality plan will be by ultimate user during detailed engineering without any commercial implication. QAP should be as per the best practice followed internationally to avoid any conflict of interest.	

### 9.6 GEAR BOX

Sl. No.	Description	Vendor to confirm
1.	Gear box should be vertical flange mounted solid shaft type (Vertical Agitators), reducing speed type, specially designed for the requirement of Slurry mixing and to be manufactured by the Agitator supplier. Complete up-thrust and down-thrust, developed by Agitator shall be taken by thrust bearing housing of Gear Box. 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. Rating of Gear box shall be at least 1.5 times the rated torque of Agitator. Gear box details are subject to customer approval during detailed engineering without any commercial implications.	



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2.	The reduction unit shall be procured from a reputed manufacturer and shall confirm to BS:721 (latest edition)/AGMA/Equivalent specification. The sub-vendor of the gear-box shall be approved by CUSTOMER during contract execution.	
3.	Gear drives shall have splash type oil lubrication. If oil pumps are used, they shall be removable for maintenance without disturbing the motor or drive housing.	
4.	The gear reduction unit shall always be provided with an oil drain, a breather and oil level gauge. The lubrication to be designed keeping in view that the temperature within the bearing should not exceed 85 Deg C.	
5.	The bidder shall provide an easily accessible oil level gauge and a dipstick that will indicate oil level under standstill and operating conditions.	

#### 9.7 COUPLING & COUPLING GUARD

Sl. No.	Description	Vendor to confirm
1.	Coupling and coupling guard should be supplied between driver and driven equipment.	
2.	Coupling should be designed taking into consideration adequate service factor.	
3.	Design rating of the coupling (excluding service factor) should be indicated in data sheet	
4.	Coupling must be having locking screw so that it does not slide over shaft in due course operation.	
5.	It is desirable that for servicing of seal, coupling half should not be removed. Coupling should be dynamically balanced to Gr: G6.3, ISO-1940. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.	
6.	Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations.	

#### 9.8 PLATE AND FASTENING BOLTS

Sl. No.	Description	Vendor to confirm
1.	Base plate shall be interpreted as the component of Agitator assembly through which the whole load will be transmitted to the Sole Plate/Nozzle over which the equipment will be mounted. The Base plate shall be fabricated with mild steel of structural quality (UTS=42N/sq mm minimum) with anti-corrosive paint of sufficient dry-film thickness.	
2.	Base plate must have provision of leveling on its intended mounting place. Nozzle is not in the scope of supply of Agitator manufacturer. It	



	should be noted that Nozzle will be rubber lined to prevent any leakage of corrosive gases.	
3.	Alignment between Gear Head Shaft and Agitator shaft shall be within the permissible limit of Gear Box. Similarly, misalignment between Motor shaft and Gear Box Shaft shall be within 0.050 micron (radial) and 2 degree (angular) or better as per requirement of Motor and Gear Box	
4.	Base plate with desired number of hole shall be provided by the bidder, will be machined on one side. Base Plate shall be welded to the structure after leveling, as recommended by Agitator manufacturer and rubber lining is completed before placing the equipment in its desired location.	

### 9.9 OTHER COMPONENTS

Sl. No.	Description	Vendor to confirm
1.	All fasteners used in wetted condition must be of Alloy 926 or better 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.	
2.	Mounting flange dimensions shall be as per ASME B16.5 up to 600 NB, ASME B 16.47 for more than 600 NB.	
3.	Rubber Lining (As Applicable) a) Rubber lined surfaces shall utilize 6 mm nominal thickness chlorobutyl rubber. b) Areas of high wear (e.g. leading edges on impeller blades) shall have an additional 6 mm of rubber for abrasion protection. c) No field-applied linings are permitted except for file patch kits.	

### 9.10 MOTOR

Sl. No.	Description	Vendor to confirm
a)	<ul style="list-style-type: none"> <li>▪ Above 0.2 kW and upto 200 kW: 3 phase 415 V AC-VENDOR SCOPE</li> </ul> Bidder to submit the motor datasheets as per format given in the specification. Motor shall be sourced only from NTPC approved sources and <b>data sheet approval shall be obtained from BHEL before placing order.</b> If motor is procured from any new source, acceptance shall be subject to approval by NTPC/ BHEL before placing order and bidder shall submit relevant documents as per sub-supplier questionnaire attached in enclosed Annexure-5 (sub-supplier questionnaire).	



	Double compression cable gland with lugs to be provided by the vendor, however, exact size will be informed to vendor after award of contract.  Motors shall be as per the <b>specification given in Annexure-4.</b>	
b)	Driver shall be sized to meet all specified operating conditions including bearing housing, seal, external gear box and coupling loss( if any).	
c)	Motor shall be able to accelerate to speed at reduced voltage and frequency as specified in "Site Power Supply Condition" as per Clause: 3.3.	
d)	All AC motor shall be Squirrel cage induction motor and, shall be suitable for direct –online starting. Rating of the motor should of Type S1 (Continuously rated) as per ISO- 60034, Part-1. Rating of motor must be selected with minimum margin( as per the below table) above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation:  Agitator Rated BKW Motor Margin <22KW 125% of Agitator Rated BKW 22KW-55KW 115% of Agitator Rated BKW >55KW 110% of Agitator Rated BKW	

### 9.11 FIELD MOUNTED LOCAL JUNCTION BOXES/LOCAL CABINETS & CONDUITS

Sl. No.	Description	Vendor to confirm
a)	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a local cabinet or Junction box. Provisions shall be made for the interface between the local cabinet or junction box and the DCS such that the operation of the equipment's can be controlled from the BHEL supplied DCS in the FGD Control room.	
b)	<b>JUNCTION BOX</b> shall be Powder coated Junction box with CRCA sheet for IP class IP65 and the following requirements to be met:  <b>No. of ways</b> ----- 12/24/36/48/64/72/96/128 with 40% spares terminals.  <b>Material and Thickness</b> ----- 4mm thick Fiberglass Reinforced Polyester (FRP).  <b>Type</b> --- Screwed at all four corners for door. Door gasket shall be of synthetic rubber.	

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	<p><b>Mounting clamps and accessories-----</b> Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply</p> <p><b>Type of terminal blocks-----</b> Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm<sup>2</sup>. A M6 earthing stud shall be provided.</p> <p><b>Grounding-----</b> To be provided.</p> <p><b>Color -----</b> RAL 7035.</p>	
c)	<p><b><u>CONDUITS</u></b></p> <p>Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate.</p> <p>Flexible conduits shall be water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.</p> <p>All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.</p> <p>Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.</p> <p>Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.</p> <p>Conduits shall be securely fastened to all boxes and cabinets.</p>	

### 9.12 INSTRUMENTS

Sl. No.	Description	Vendor to confirm
a)	<p>Any instruments required for function of the system shall be provided by the vendor.</p> <p>Bidder has to follow the below mentioned philosophy for designing individual equipment P&amp;ID's:</p>	



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	<ul style="list-style-type: none"> <li>• Primary instruments like microprocessor based transmitters employing PROFIBUS protocol, thermocouples &amp; RTD's along with temperature transmitters, pressure/diff pressure/temperature/flow*ultrasonic/electromagnetic) transmitter &amp; gauges, flow sensing elements (orifice plates, flow nozzles etc.), ultrasonic, radar type level transmitters and density meter(coriolis type).</li> <li>• Integral to equipment which are not indicated in the tender drawings, but are required for control, monitoring and operation of the equipment for which no P&amp;ID is attached shall be provided to meet the actual system requirements and meeting redundancy and other technical specifications.</li> <li>• For binary and analog inputs required in major equipment's of FGD system, protection triple-sensing devices shall be provided. Binary and analog inputs, which are required for protection of more than one equipment as well as protection signals for HT drives etc., triple sensing devices shall be provided.</li> <li>• For other critical binary and analog inputs required for protection and interlock purpose of other equipment (Eg. Those interlocks which may lead to loss if production, non-availability of major equipment etc.,) <b>triple sensors</b> shall be provided</li> <li>• Temperature elements, electronic transmitters etc., are to be provided for all the cases. Use of process actuated switches is acceptable only in case indicated in tender drawings.</li> </ul> <p>All instruments shall be as per specification enclosed in <b>Annexure-4</b>.</p>	
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**9.13 NETWORKING PROTOCOLS AND CONTROL LOGICS:**

Sl. No.	Description	Vendor to confirm
a)	All the measuring instruments, process instruments and electrical actuators shall be through field bus i.e. PROFIBUS protocol complying to IEC-61158.	
b)	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected to local junction boxes. Bidder shall provide the control logic for the entire system.	

**10. PACKING AND FORWARDING**

S. No	Description	Vendor to confirm
a)	Proper packing to be ensured.	



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	<p><b>Indigenous Supply:</b> WBM &amp; sub system assembly shall be wrapped in polythene bags &amp; packed in a strong rigid wooden crate. Rain water should not enter into the WBM internals during storage in the outer yard of power plant.</p> <p><b>Imported Supply:</b> All imported supply should be packed as per Sea worthy packing standards Annexure – 6 (Specification: <b>HY0490569</b>). All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.</p>	
b)	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site. All the major equipments shall be supplied in steel crates. The package shall be supplied in containers and it should be suitable for storage in the outside yard of the plant for a minimum period of 12 months.	
c)	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.	
d)	Crates and packing material used for shipping will become the property of owner (NTPC)	
e)	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.	
f)	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.	
g)	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: <ul style="list-style-type: none"> <li>a. Destination</li> <li>b. Package Number</li> <li>c. Gross and Net Weight</li> <li>d. Dimensions</li> <li>e. Lifting places</li> <li>f. Handling marks and the following delivery marking</li> </ul>	
h)	<b>Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows.</b>	



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	<p><b>NTPC Korba Super Thermal Power Project (KSTPP)</b>  <b>Korba district, Chhattisgarh -India PINCODE:495450</b>  <b>EPC CONTRACTOR: "BHARAT HEAVY ELECTRICALS LIMITED, INDIA</b></p> <p>In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.</p>	
i)	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.	
j)	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.	
k)	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.	
l)	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks).	
m)	<p>Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following:</p> <ol style="list-style-type: none"> <li>Upright position</li> <li>Sling position and center of Gravity position</li> <li>Storage category</li> <li>Fragile components ( to be marked properly with a clear warning for handling)</li> </ol>	
n)	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating the to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.	
o)	<p><b>The packing slip shall contain the following information: -</b></p> <p>Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of WBM &amp; accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.</p>	
p)	Prior to transport from manufacturer's work to destination, components unit shall be completely cleaned to remove any foreign particles. Flange and other machined surfaces shall be protected by an easily removable preventive coating followed by suitable wrapping.	
q)	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the	



	environment zone which is defined as "very severe" during finishing/shipping.	
r)	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.	
s)	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).	
t)	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.	

## 11. SUPERVISION OF ERECTION AND COMMISSIONING

Sl. No	Description	Vendor to confirm
a)	The erection of Agitator to be done by owner (BHEL) as per Erection Manual and check List provided by bidder. The bidder has to supervise for erection, pre-commissioning & post- commissioning check-up, start-up, trial runs of all the items covered under the scope of supply.	
b)	There will be two visits per agitator totally there will be 4 visits. The bidder will be informed well in advance for the visit. Bidder shall consider 5 working days per agitator.	
c)	In case erection and commissioning activities get delayed due to any account, resulting into overstay of vendor supervisory engineer beyond schedule time, then BHEL shall pay for additional man-day stay of vendor supervisory engineers. Vendor to quote Per day cost for deputation along with this offer.	
d)	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supervision charges portion.	
e)	Charges for supervision of Erection & commissioning shall be quoted by the bidder.	
f)	Supervision charges for conductance of Performance guarantee test shall be borne by bidder. It is excluded from supervision of E&C charges.	
g)	Price comparison for evaluating the lowest bid will be considered all main supply, supervision of E&C charges and mandatory spares price all together.	

## 12. EXCLUSION

S. No	Description	Vendor to confirm
	The following work associated with the agitator will be by BHEL: <b>a.</b> Supply of mill circuit tank. <b>b.</b> Cable for motor (cable gland in bidder scope).	



### 13. QUALITY ASSURANCE

(As per approved quality plan. However, minimum requirements are as below)

S. No	Description	Vendor to confirm
	<b>Quality Plan Requirement:</b>	
	(i) MQP (Manufacturing Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw material Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during pre- award / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standards to BHEL/Customer/Consultant.	
<b>1.</b>	<p><b>Important Notes shall be included in MQP:</b></p> <p>(a) Latest revision of Standard s &amp; Specification shall apply. Only International Standards are applicable. Indian &amp; Chinese Standards are not applicable</p> <p>(b) Materials shall be procured in compliance to Functional Technical Specification.</p> <p>(c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product.</p> <p>(d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.</p> <p>(e) Gauges and measuring Instruments, with valid calibration only shall be used.</p> <p>(f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule.</p> <p>(g) Finished Products shall be packed to comply with Approved Packing Schedule.</p> <p>(h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.</p>	
<b>2.</b>	<p><b>Domestic / Inland Inspection</b> will be carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc. (As applicable).</p>	



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	<p>“The inspection charges at actuals incurred by BHEL will be loaded to compare with foreign suppliers”.</p>	
3.	<p><b>Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Foreign Sources:</b></p> <p>(1) Any one of the following Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself.</p> <p>(2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own, then these charges non claimable by the bidder.</p> <p><b>List of TPIA</b></p> <ol style="list-style-type: none"> <li>1) M/s Bureau Veritas</li> <li>2) M/s TUV-Nord</li> <li>3) M/s TUV-SUD</li> <li>4) M/s TUV Rheinland</li> <li>5) M/s Lloyds Register</li> <li>6) M/s DNV</li> </ol>	
4.	<p><b>Stage Inspection during manufacturing Process:</b> Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review, verification and clearance for further processing. This inspection call shall be given well in advance (at least 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.</p>	
5.	<p><b>Inspection before dispatch for domestic supplier:</b> Inspection before dispatch at supplier's works shall be carried out by BHEL/BHEL appointed Inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet.</p>	
6.	<p><b>Inspection at Foreign Source/Supplier:</b></p> <p>(a) As in Sl. No.: 3. shall be ensured without fail.</p> <p>(b) No material / items shall be dispatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc. (As applicable).</p> <p>Inspection before dispatch for Foreign supplier: Inspection before dispatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in Sl. no: 03 at supplier's cost.</p>	

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7.	<b>Painting</b> shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in advance before proceeding including the BOI being procured for assy / skid like motors etc	
8.	Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechanical + HT + NDT etc. (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drawings with actual make / rating used with BHEL/customer approved drawings.	
9.	<b>Packing / Seaworthy Packing</b> shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care transit / handling / transshipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before dispatching the material as per contract conditions.	
10.	<b>Outsourcing of test facilities:</b> Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accredited third party lab / Govt. / Govt. Lab for major testing such as NDT, Electrical & Mechanical testing.	
11.	<b>Important Note:</b> No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidences in the offer itself.	
12.	<b>##</b> Necessarily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	
<b>A)</b>	<b>Minimum Testing requirements to be considered are as below:</b>	
1.	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.	
2.	List of Non-Destructive test over and above the material test are as follows: a. Mechanical Seal- Manufacturer's recommendation. b. Base Plate- Stress relieving of weld.	



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	c. Replaceable Rubber liner- Shore Hardness, Class and Type certificate.	
3.	Once mounting is finished and operation test will be conducted on each WBM to determine the characteristic curves to determine the parameters at the design point, mechanical running & performance testing shall be performed & witnessed.	
4.	Vibration test and Noise level test shall be witnessed at site.	
5.	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.	
6.	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.	
7.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.	
8.	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.	
9.	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.	
10.	Wear resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out.	
<b>B)</b>	<b>General Inspection requirements to be considered are as below:</b>	
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / NTPC prior to manufacture. Inspection of above mentioned tests by BHEL/ NTPC representative at bidder's works is envisaged.	
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/customer.	
3.	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.	
4.	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.	
5.	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. Hydrostatic testing of tube assembly is required at a pressure of twice that of maximum liquid column in any tank or 30m whichever is higher. The hydro test duration will be for a minimum of 1 hr to check sweating at any flange. Hydrostatic test is meant in part for a check of equipment joint at new condition only. It is cannot be considered as a guarantee of functional objective of rubber used.	



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6.	<p>Mechanical Run Test (in air): Each Agitator unit shall be given a 4-hour mechanical run test in air at vendor's shop. Agitator unit shall be mounted in the same manner as it will operate in the field. During this test the record shall be made of:</p> <p>a) Shaft run out at free end.                  b) Dynamic shaft deflection adjacent to the mechanical seal/packing/vapour seal.                  c) Gearbox oil temperature and temperature of bearing housing in stool. The temperature of the gear box oil shall not exceed ambient plus 40 Deg.C and that of bearing housing shall not exceed from room temperature plus 20 Deg.C after temperatures have stabilized.                  d) Bearing Housing vibration checks shall be carried out. Maximum acceptable vibration velocity shall be 6 mm/sec.                  e) Noise level shall be checked and shall be within the specified limits mentioned in the specification.                  f) Agitator shaft RPM and motor RPM.                  g) Check of satisfactory operation of shut off and retracting arrangement.                  Please also refer Sl. No. 8 below.</p>	
7.	<p>Mechanical Run Test (in slurry of similar concentration as applicable for the project)                  Each agitator unit shall be given a load test in slurry at the vendor's shop. The duration of this test shall be 4 hours unless agreed otherwise between the Purchaser and the vendor.                  The following parameters shall be recorded during the test:</p> <p>a) Dynamic shaft deflection adjacent to the mechanical seal/packing/vapor seal.                  b) Gear box bearing oil temperature and temperature of bearing housing in stool. The temperature of gear box oil shall not exceed ambient plus 40°C and that of bearing housing shall not exceed room temperature plus 20°C after the temperatures have stabilized.                  c) Bearing housing vibrations. Maximum acceptable vibration velocity is 6 mm/sec.                  d) Noise levels shall be checked and shall be within the specified limits mentioned in the specification.                  e) Electrical power input to the motor.                  f) Agitator shaft RPM and motor RPM.                  g) Check of satisfactory operation of shut off and retracting arrangement.                  As a part of the Quality Assurance Plan, where possible as per facility available at bidder's work, bidder may demonstrate the power consumption also of each agitator at shop with the available fluid along with relevant calculation to establish the correlation with the slurry used for the project, apart from necessarily demonstrating power requirement at site.                  Please also refer Sl. No. 8 below.</p>	
8.	<p>In case of any constraints in carrying out shop tests indicated at Sl. No. 6 &amp; 7 above, the Mechanical run tests for agitators shall be carried out with air/water at shop along with other test requirement in line with the QAP to be approved by customer (NTPC) during detail engineering.</p>	



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<b>9.</b>	Acceptance Test (at Site) After the agitator has been installed at site and is ready for test, vendor shall depute his representative to supervise the site acceptance test	
<b>10.</b>	<u>DYNAMICS</u>	
<b>10.1</b>	<u>CRITICAL SPEED</u> <ul style="list-style-type: none"> <li>• Operation speed of the Agitator motor shall be at least 25% below the first critical speed.</li> <li>• Additional to the requirement of the critical speed of Agitator, as specified above. Agitator manufacturer is to analyze the torsional critical speed of combined system of Agitator, Gear Box and Motor to establish there is a separation margin of minimum 20% between the torsional critical speed (dry/wet) and any operating speed.</li> </ul>	
<b>10.2</b>	<u>VIBRATION SEVERITY</u> <ul style="list-style-type: none"> <li>• During performance test, unfiltered vibration measurements shall be made with running of Agitator in Air. Measurement shall be taken on the Gear Box thrust bearing housings as well in motor top.</li> <li>• Guaranteed Site vibration of the equipment on its own pedestal, at commissioning with normal level of liquid and with maximum liquid at respective tank, Vibration limit at site will be as per ISO-10816, and 1.5-2.3mm/sec even if Motor rating falls below 15kw. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.</li> <li>• Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity.</li> <li>• 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.</li> </ul>	
<b>11.</b>	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.	
<b>12.</b>	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.	
<b>13.</b>	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.	
<b>14.</b>	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.	
<b>15.</b>	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.	
<b>16.</b>	Out of all Agitators One Number of each type will be inspected at the Bidder's works before dispatch or where the test facilities are available.	
<b>17.</b>	The Bidder shall conduct performance test for the remaining Agitators and submit the reports.	
<b>18.</b>	Contract shaft mechanical seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition, if applicable.	
<b>19.</b>	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.	

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20.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.	
21.	Bidder to arrange all calibrated gauges, Instruments during inspection.	
22.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.	
23.	All testing requirement/certificates shall be in line with QAP to be approved by customer during detailed engineering	
<b>C)</b>	<b>PURCHASE AND SERVICE</b>	
1.	The major items/ equipment's/ components to be manufactured in the shop of the contractor i.e. in-house items and those procured from sub-vendors / sub-manufacturer / sub-contractors i.e. bought out items (BOIs) shall be listed out by the contractor in their bid proposal.	
2.	The list of manufacturers/ sub-vendors for all the BOIs envisaged in contract shall be included in the bid proposal by the contractor which shall be reviewed by the NTPC during post bid discussions and the list of proposed manufacturers / sub-vendors for each of the BOIs shall be agreed/ approved. If any item is left out or gets included during detailed engineering, the contractor shall propose the manufacturer's / sub vendor's details for review / approval of NTPC, prior to initiating the procurement of such materials.	
3.	This specification also contains the Indicative vendor list (with disclaimer) mentioned against particular item/ equipment/ component/ system etc. The vendor list are only indicative and not exhaustive. Refer Annexure-16	

#### **14. PAINTING**

**The painting details shall be finalized during contract stage.**

#### **15. SPARES**

##### **15.1. START UP & COMMISSIONING SPARES**

S. No	Description	Vendor to confirm
	Start-up & Commissioning Spares shall be part of the main supply of the WBM. Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares required for successful operation till commissioning of WBM shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipment's are energized.	

**15.2. MANDATORY SPARES (FOR EACH PROJECT)**

*Vendor to quote 1 Set per project. List of items with quantities per Set is as per below tables. Project Consists Of Two Sets of Agitator Assembly.*

S. No	Description	Vendor to confirm
a)	The list of mandatory spares considered essential by the Employer is indicated in the list below. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in their Bid. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.	
b)	Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the <b>station (project)</b> , unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified as a 'set' (marked by **) it will include the total requirement of the item for a unit, module or the station as specified. Where it is specified as 'set' (marked by*) it would mean the requirement for the single equipment / system as the case may be. Also one set for the particular equipment. e.g. 'set' of bearings for a pump would include the total number of Bearings in a pump. Also the 'set' would include all components required to replace the item; for example, a set of bearings shall include all hardware normally required while replacing the bearings.	
c)	The assembly / sub assembly which have different orientation (like left hand, right hand, top or bottom), different direction of rotation or mirror image positioning or any other regions which result in maintaining two different sets of spares to be used for subject assembly / sub-assembly shall be considered as different type of assembly/sub-assembly.	



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<b>d)</b>	The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.	
<b>e)</b>	All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.	
<b>f)</b>	The Employer reserves right to buy any or all the mandatory spare parts.	
<b>g)</b>	Bidder to provide the split up price for mandatory spares during placement of order.	
<b>h)</b>	Bidder shall indicate the service expectancy period for the spare parts under normal operating conditions before replacement is necessary.	
<b>i)</b>	All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccators packs as necessary.	
<b>j)</b>	All the spares shall be manufactured as per same specification quality plan.	
<b>k)</b>	The bidder shall provide employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the employer to identify and finalize order for recommended spares.	
<b>l)</b>	Each spare part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.	
<b>m)</b>	The bidder will provide the employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipment's covered under the contract and will further ensure with his vendors that the employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.	



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<b>n)</b>	The bidder shall guarantee long term availability of spares to the employer for the full life of the equipment covered under this contract. The bidder shall guarantee that before going out of production of spare parts of the equipment covered under the contract, he shall give the employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the bidder and/or his subcontractors, bidder will provide the employer, two years in advance, with full manufacturing drawings, material specification and technical information on alternate equivalent makes required by the employer for the purpose of manufacture/procurement of such items.	
<b>o)</b>	Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.	
<b>p)</b>	Any fraction of an item shall mean the next higher integer.	
<b>q)</b>	Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by bidder shall be the specified percentage (%) of the total population of the plant. In case quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.	
<b>r)</b>	Where ever quantity has been indicated for each type, size, thickness, material, radius, range etc., the same shall be furnished in the bid.	
<b>s)</b>	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed:	

### 15.2.1. AGITATORS

Sl. No	Description	Nos. /Sets for each project	Vendor to confirm whether quoted or not
1.	<b>Impeller Assembly</b>	<b>1 EACH</b>	
2.	<b>Bearing Assembly</b>	<b>1 EACH</b>	
3.	<b>Motor</b>	<b>1 EACH</b>	



4.	<b>Gear Box Assembly</b>	<b>1 EACH</b>	
5.	<b>Agitators shaft assembly</b>	<b>1 EACH</b>	
6.	<b>Complete Agitator Assembly</b>	<b>1 EACH</b>	

### **15.3. RECOMMENDED SPARES**

S. No	Description	Vendor to confirm
1.	In Addition to the spare parts mentioned above, the contractor shall provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices. The list shall take into consideration the mandatory spares into consideration. The employer reserves right to buy any or all the recommended mandatory spares, the recommended spares shall be delivered at project site at least two months before the schedule date of initial operation.	
2.	Prices of recommended spares will not be used for evaluation of the bids. The prices of these spares will remain valid up to 6 months after placement of Purchase order. However, bidder shall be liable to provide justification for the quoted prices for these spares as desired by employer.	

### **16.SPECIAL TOOLS AND TACKLES**

S. No	Description	Vendor to confirm
1.	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools	

### **17.PERFORMANCE GUARANTEES AND SCHEDULE OF GUARANTEES**


**SCHEDULE OF GUARANTEES:**

1. All performance tests for Agitators shall be carried out in accordance with latest international codes/standards.
2. Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories
3. The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days and average target availability of 95% for 1 year.
4. Noise level  $\leq 85$  dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed.
5. 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.
6. Life of Agitator components/parts from the date of commissioning for continuous operation shall be guaranteed for 24 months.
7. Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ CUSTOMER approval.
8. In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
9. For additional details of performance guarantee please refer 'functional guarantee'.

**18. WARRANTY**

S. No	Description	Vendor to confirm
1.	The Bidder warrants that the equipment/ items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Defect Liability Period shall be thirty six (36) months from the date of supply (or any part thereof) or twenty four (24) months from the date of commissioning (or any part thereof), whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect.	
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .	



## **19. FIRST FILL OF CONSUMABLES:**

<b>S. No</b>	<b>Description</b>	<b>Vendor to confirm</b>
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.	
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the NTPC/BHEL's approval herein shall be furnished within 2 months after placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.	

## **20. TRAINING**

<b>S. No</b>	<b>Description</b>	<b>Vendor to confirm</b>
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the LGS system - Operation & Maintenance, Troubleshooting etc. and also Engineering personnel at manufacturer's works.	

## **21. CONFLICT**

<b>S. No</b>	<b>Description</b>	<b>Vendor to confirm</b>
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising NTPC in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.	



## 22. DOCUMENTATION

S. No	Description	Vendor to confirm
	Bidder shall submit necessary data, documents, GA drawings (PDF & DWG), sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC must be furnished by bidder in soft copy forms for review. The documents will be in PDF as well as editable form like DOC, XLS, DWG.	

### A. TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Purpose
1.	<b>Attachment-3K(annexure of Qualification Requirement refer Annexure-1)</b>	Qualification Requirement (QR)
2.	<b>Reference plant details of similar or higher capacity mill size supplied</b>	QR
3.	Sign & Seal of bidder on all pages specification	Technical evaluation of Bid (TEB)
4.	Deviation list (if any to be submitted by Bidder)	TEB
5.	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal, gearbox for all Agitator models	TEB
6.	Data sheet for Agitator	TEB
7.	Utility Consumption	TEB
8.	Lubricating oil list	TEB
9.	Special tools list, Start-up & Commissioning Spares	TEB
10.	Terminal point details	TEB
11.	Catalogue	TEB

### B. DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing Over of Documents after PO in weeks	Document required for
1.	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal, gearbox for all Agitator models	1	Customer Approval
2.	Data sheet for Agitator	1	Customer Approval
3.	Agitator Performance curve	1	Customer Approval
4.	Electrical motor GA drawing & Data sheet and performance curves of all motors	1	Customer Approval

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5.	Quality plan & Inspection and Test Procedure	1	Customer Approval
6.	Agitator and Motor Sizing Calculation	1	Customer Approval
7.	O&M Manual for Agitator	1	Customer Approval
8.	Utility Consumption	1	Customer Approval
9.	Foundation Data including Anchor plan	1	Customer Approval
10.	Lubricating oil list	1	Customer Approval
11.	Special tools list, Start-up & Commissioning Spares	1	Customer Approval
12.	Installation and assembly procedure including Pre Commissioning Check List	1	Customer Approval
13.	Sub vendors List	1	Customer Approval
14.	Manufacturing Schedule	1	Review
15.	Special tools list	1	E&C
16.	Start-up & Commissioning Spares	1	E&C
17.	Pre Commissioning Check List	1	E&C
18.	Installation and assembly procedure.	1	E&C
19.	Erection drawings and manual.	1	E&C
20.	Operation and Maintenance Manual with lubrication schedule.	1	E&C
21.	Recommended repair procedure.	1	E&C
22.	Electrical Load List with Single line Diagram.	1	For Feeder arrangement
23.	Control philosophy and Logic	1	For DCS program
24.	Catalogue	1	Customer Submission
25.	Pro-forma Packing List	1	Dispatch

**ANNEXURES LIST:**

Annexure Sl. No.	Description
1.	Qualification requirement.
2.	Deviation list.
3.	Circuit Tank Details and Media Analysis.
4.	Customer Specification.
5.	Indicative vendor list and Sub-questionnaire for suppliers.
6.	Packing & forwarding.
7.	Technical Data Sheet.



**VARIANT TABLE**

VAR. No.	DESCRIPTION	MATERIAL CODE	Qty /Project
<b>Main</b>			
<b>00</b>	<b>Agitator Assembly</b>	<b>BA9789257007</b>	<b>2 Sets*</b>
<b>Mandatory spares- 1 Set #</b>			
<b>01</b>	<b>Impeller Assembly</b>	<b>BA9789257015</b>	<b>1 EACH</b>
<b>02</b>	<b>Bearing Assembly</b>	<b>BA9789257023</b>	<b>1 EACH</b>
<b>03</b>	<b>Motor</b>	<b>BA9789257031</b>	<b>1 EACH</b>
<b>04</b>	<b>Gear Box Assembly</b>	<b>BA9789099053</b>	<b>1 EACH</b>
<b>05</b>	<b>Agitators shaft assembly</b>	<b>BA9789257040</b>	<b>1 EACH</b>
<b>06</b>	<b>Complete Agitator Assembly</b>	<b>BA9789257058</b>	<b>1 EACH</b>

\* Agitator assembly scope of supply per set is as per Chapter No.: 07.

# Mandatory Spares Set is as per Chapter No. 15.2

**RECORD OF REVISIONS**

Rev. No.	Date	Revision Details	Revised	Approved

CLAUSE NO.

INTENT OF SPECIFICATION



SECTION-B

PROVENNESS

The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for the items/ services listed below as per the stipulated criteria indicated in the respective clauses. For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder unless otherwise specified in the respective clauses.

**1.0 Provenness Criteria/Qualifying Requirements for Equipments/Systems**

1.1 The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for critical equipments, auxiliaries, systems and bought out items as per criteria stipulated below:

1.2 Booster Fans, Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, Agitators & Vacuum Belt Filters for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year.

Type and Rating for Qualification

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
(a)	<del>Booster Fans</del>	<del>Axial type with variable pitch control</del>	<del>Coal fired power plant</del>	<del>Unit size of 500 MW - Flow 400 m3/s (min.) with Head 400 mmwc (min.) &amp; Fan Speed 900 rpm (max.)</del>
				<del>Unit size of 210 MW &amp; Below - Flow 225 m3/s (min.) with Head 400 mmwc (min.) &amp; Fan Speed 900 rpm (max.)</del>
(b)	<del>Slurry Recirculation Pumps</del>	<del>Centrifugal type</del>	<del>Wet Limestone based FGD application in Coal fired</del>	<del>Unit size of 500 MW &amp; Above - Flow 10200 m3/hr (min.) with Head 16</del>

CLAUSE NO.

INTENT OF SPECIFICATION



Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
			<del>power plant</del>	<del>Meters of Liquid Column (min.)</del> <del>Unit size of 210 MW &amp; Below - Flow 5680 m3/hr (min.) with Head 16 Meters of Liquid Column (min.)</del>
(e)	Oxidation Blowers	Centrifugal/ positive displacement type blower	Wet Limestone based FGD application in Coal fired power plant or any other process application	<del>Unit size of 500 MW &amp; Above - Flow 7300 Nm3/hr Dry Basis (min.) with Head 8500 mmwc (min.) for spray tower process Or Head 3500 mmwc (min.) for bubbling type process</del> <del>Unit size of 210 MW &amp; Below - Flow 5000 Nm3/hr Dry Basis (min.) with Head 6500 mmwc (min.) for spray tower process Or Head 3500 mmwc (min.) for bubbling type process</del>
(d)	Wet limestone Grinding mills	Horizontal Wet Ball mill	Wet Limestone based FGD application in Coal fired power plant	<del>Station size of 2001 MW - 2600 MW Capacity 40 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh</del> <del>Station size of 1501 MW - 2000 MW Capacity 30 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh</del>

CLAUSE NO.

INTENT OF SPECIFICATION



Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
				Station Size of 1000 MW -1500 MW Capacity 20 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh
(e)	Slurry Pumps	Centrifugal type	Wet Limestone based FGD application or ash slurry application in Coal fired power plant	<del>Unit size of 500 MW &amp; Above - Flow 50 m3/hr (min.) with head 30 Meters of Liquid Column (min.)</del> <del>Unit size of 210 MW &amp; Below - Flow 25 m3/hr (min.) with head 30 Meters of Liquid Column (min.)</del>
(f)	Agitators	Vertical/Horizontal	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application
(g)	<del>Vacuum Belt filters</del>	<del>Belt type</del>	<del>Wet Limestone based FGD application in Coal fired power plant or in any other process application</del>	<del>Station size of 2001 MW- 2600 MW Capacity 65 T/hr (min.)</del> <del>Station size of 1501 MW-2000 MW Capacity 50 T/hr (min.)</del> <del>Station Size of 1000 MW - 1500 MW Capacity 35 T/hr (min.)</del>

~~The provenness criteria for equipment (Booster Fans) stipulated at Sl. No. 1.2 (a) above shall also be considered acceptable provided the rating parameters (i.e., flow, head and rated rpm) is covered within the operating regime of the respective fan performance curve of the reference plant equipment.~~

CLAUSE NO.

INTENT OF SPECIFICATION



1.3

~~The provenness criteria for equipment (Slurry Recirculation Pumps) stipulated at Sl. No. 1.2 (b) above shall also be considered acceptable provided the rating parameters (i.e., flow and head) is covered within the operating regime of the respective Slurry Recirculation Pump performance curve of the reference plant equipment.~~

~~In case the Bidder or the proposed sub vendor is not manufacturer of proven Booster Fans as per clause 1.2 (a) above but is a manufacturer of such equipment for units of at least \* MW rating, the Bidder or the proposed sub vendor shall be considered qualified for manufacturing such equipment for \*\* MW units also, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meets the requirements stipulated at clause 1.2 (a) above for the Booster Fans.~~

~~For value of \* and \*\* refer table below.~~

<del>*</del>	<del>**</del>
<del>195 MW</del>	<del>195 MW – 500 MW</del>
<del>500 MW</del>	<del>660 MW</del>


1.4


~~A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 1.2 above in India, shall also be considered qualified for manufacturing such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 1.2 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).~~

~~Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.~~

1.5

~~In case the Bidder or the proposed sub vendor is not manufacturer of proven Oxidation Blowers as per clause 1.2 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM<sup>3</sup>/min capacity, the Bidder or the proposed sub vendor shall also be considered qualified for manufacturing Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meets the requirements stipulated at clause 1.2 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder/ his sub vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.~~

CLAUSE NO.	INTENT OF SPECIFICATION	
1.6	<p><del>(i) In case the Bidder or the proposed sub-vendor is not manufacturer of proven Wet limestone Grinding mills as per clause 1.2 (d) above but is a manufacturer of dry Grinding mills for power or cement industry of minimum 20 T/h capacity, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Wet limestone Grinding mills, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Wet limestone Grinding mills in India with such manufacturer who meets the requirements stipulated at clause 1.2 (d) above for the Wet limestone Grinding mills. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licensor's design, manufacturing and quality control system for such equipments.</del></p> <p><del>In addition, the Bidder shall be required to furnish a letter of support from Collaborator(s) / Licensor / Technology provider for successful performance of the equipment valid up to the end of defect liability period of the contract as per the format enclosed in the bidding documents, at the time of placement of order on the approved sub-vendor.</del></p> <p><b>OR</b></p> <p><del>(ii) In case, the bidder or proposed sub-vendor is not a manufacturer of proven Wet Limestone Grinding Mills as per clause 1.2 (d) above, but have designed, manufactured &amp; supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Wet limestone Grinding Mills provided it has a licensing agreement with a Wet limestone Grinding mills manufacturer who meets the requirements stipulated at clause 1.2 (d) above for the Wet limestone Grinding mills and provides extended warranty of three (3) years for the Wet Limestone Grinding Mills.</del></p>	
1.7	<p>In case the Bidder or the proposed sub-vendor is not manufacturer of proven Agitators as per clause 1.2 (f) above but is a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Agitators, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Agitators in India with such manufacturer who meets the requirements stipulated at clause 1.2 (f) above for the Agitators. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licensor's design, manufacturing and quality control system for such equipments.</p>	
1.8	<p><del>In case the Bidder or the proposed sub-vendor is a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 1.2 (e) above, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Slurry Recirculation Pumps, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meets the requirements stipulated at clause 1.2 (b) above for the Slurry Recirculation Pumps. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his</del></p>	
<p style="text-align: center;">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(3)-9</p>	<p style="text-align: center;">SUB-SECTION-I INTENT OF SPECIFICATION</p> <p style="text-align: right;">PAGE 11 OF 19</p>

CLAUSE NO.	INTENT OF SPECIFICATION	
<p>1.9</p> <p>1.10</p> <p>1.11</p> <p><b>2.0</b></p> <p>2.1</p> <p>2.2</p> <p>2.3</p>	<p><del>works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.</del></p> <p>Before taking up the manufacturing of such equipment(s) as per clause 1.3, 1.4, 1.5, 1.6(i), 1.7 &amp; 1.8 above, the Bidder / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licensor shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.</p> <p>Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licensor(s) proposed by the Bidder for the above equipment(s) is qualified.</p> <p>The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.</p> <p><b>Note to clause 1.2</b></p> <p>(1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.</p> <p><b>Sub QR for Civil Works:</b></p> <p>Bidder or its agency should have in past executed civil and structural works for * or higher capacity ( applicable for project having ** MW unit rating ) coal based/Lignite based power plant including earthwork in filling involving mechanical compaction and cutting in hard rock, piling, foundations, Bulk material handling plant involving underground storage hopper and underground tunnels.</p> <p>Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 2.1. The agency being engaged for a particular work should have in the past executed such works of * or higher capacity plant (applicable for project having ** MW unit rating).</p> <p>For Chimney, Bidder or its agency should have in the past built at least one (1) reinforced concrete chimney of minimum 100m height.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(3)-9</p>	<p>SUB-SECTION-I INTENT OF SPECIFICATION</p>
		<p>PAGE 12 OF 19</p>

	TD-218 Rev.00	<h1 style="margin: 0;">PLANT STANDARD</h1> <h2 style="margin: 0;">HYDERABAD</h2>	HY 049 05 69
			REV.NO. 05
			PAGE 1 OF 5

### SEAWORTHY PACKING FOR EXPORT ORDERS

**1.0 SCOPE:**

This standard specifies the seaworthy packing methods for export orders.

**2.0 PACKING WOOD:**

2.1 The timber used shall be of non-coniferous type as per specification HY51463 for Beams & Runners.

2.2 Ply Wood planks as per specification IS:303 Gr. "MR" Type A,B are used for the Sides, Top & Bottom of the Packing Cases.

3.0 The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Sketch-I.

**4.0 PACKING CASES:**

4.1 Categorisation of Packing Cases:

The packing cases are categorised as follows:

4.1.1 Open packed consignment. Packing subjected to BHEL approval.

4.1.2 Closed packing cases:

a) All the export seaworthy packing of the items shall be covered with GI sheet covering as per the sketch – I enclosed.

b) Any other special or export seaworthy packing (improvement or equivalent to the above) shall be subjected to BHEL Engg & QC approval).

4.2 Packing procedure for closed packing cases:

4.2.1 Inner surfaces of the sides & bottoms, outer surfaces of top of all the categories of closed packing cases shall be covered with hessain bitumen coated polyethylene kraft paper/HDPE Tarpaulin 150 GSM weight (refer sketch 1).

4.2.2 Adequate battens (lined with water proof bitumenised paper/HDPE Tarpaulin 150 GSM together with rubber sheet) shall be provided at appropriate places to prevent the movement of equipment/component inside the packing cases.

<b>Revisions :</b> Revised Clauses 2.2, 8.01 and Sketch - I. Deleted Clause 8.10.			<b>Issued :</b> <b>STANDARDS ENGINEERING DEPARTMENT</b>		
Rev.No. 05	Amd.No.	Reaffirmed	Prepared	Approved	Dt.of 1 <sup>st</sup> Issue
Dt.APR.2001	Dt.	Year :	VNR, KSN	DGM (E&CC)	DEC.1989

# PLANT STANDARD HYDERABAD



### 4.3 Sealed Packing:

4.3.1 Components, sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight wherever required.

All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture wherever required.

4.3.2 The components, sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Excelsior, corrugated cardboard, felt or other hygroscopic materials shall not be used. The top surface of the case shall be free from dents to prevent rain water pockets.

**Note:** Seal tight packing case shall not be opened during transportation till destination. Therefore customs authorities and shipping agents shall be informed in advance of the arrival of item. Suitable arrangements shall be made with the authorities for customs clearance.

4.3.3 Certain special precautions are required for sealtight packing of Turbogenerator rotor and the same are specified in product standard no. TG 55507.

5.0 Turbogenerator stator is a special open consignment and the same shall be packed in accordance with product standard TG 55506 for compliance.

### 6.0 DESICCANT:

6.1 Desiccant (silicagel to spec IS:3401) is filled into dust free, air permeable linean bags. Silicagel bags inside the packing consignments such as boxes with or without sealed polyethylene sheets excluding Turbogenerator rotor and and stator need not be arranged in any particular way. However, these silicagel bags shall be arranged in a particular way as specified in the respective product standards/drawings for Turbogenerator rotor and stator.

### 6.2 Desiccant Quantity for Components:

The desiccant quantity depends on the dimensions of the polyethylene sheet as well as transit and storage time.



TD-218 Rev.00

# PLANT STANDARD HYDERABAD

HY 049 05 69

REV.NO. 05

PAGE 3 OF 5

**T A B L E - 1**

Desiccant Quantity in units of TROCKEN EINHEITN (TEH)  
(Drying Effectiveness Unit) (1 TEH = 35g)

Transit & Storage time	Upto 1 month	Upto 3 months	Upto 6 months	Upto 12 months
Parameters				
i) Sealed packages				
a) For 1m <sup>2</sup> surface area of sealed polyethylene sheet for Turbogenerator rotor.	14 TEH (450 g)	-	42 TEH (1470 g)	-
b) For 1m <sup>2</sup> surface area of sealed polyethylene sheet for other components.	-	9 TEH (315 g)	18 TEH (630 g)	36 TEH (1260 g)
c) For each kg of wood within sealed polyethylene sheet.	8 TEH (260 g)			
d) For each kg of foam rubber or other padding material within sealed polyethylene sheet.	1 TEH (35 g)			
e) For 1m <sup>3</sup> of air within the case.	15 TEH (525 g)			
ii) For closed packing cases without sealtight packing and special open consignment like Turbogenerator stator.				
a) For 1m <sup>3</sup> of air within the case.	15 TEH (525 g)			

6.3 Humidity indicators shall be fixed wherever specified in product standards, packing drawings.

## 7.0 SURFACE PROTECTION:

### 7.1 Volatile Corrosion Inhibitor (VCI) Paper:

Un-protected surfaces of steel and cast iron components, tools, bearings, shaft seals etc., are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion, protect metals in an enclosed area against corrosion.

7 m<sup>2</sup> VCI paper is necessary for 1m<sup>3</sup> of packed item approximately.

# PLANT STANDARD HYDERABAD



## 7.1.1 Application limitations:

VCI paper shall not be used for components made aluminium, aluminium alloys as well as zinc, copper, brass, cadmium and silver.

7.2 VCI powder is sprinkled inside the piping components and ends shall be protected with end covers as specified in plant standards, drawings.

## 8.0 GENERAL INSTRUCTIONS:

8.01 For packing and despatch of components, plant standard No. HY 0490572 – ‘Code of practice for storage, handling, packing and despatch of components’ shall be applicable.

8.02 For storage of different products and their components, plant standard no. HY 0490564 – ‘Code of practice for storage of different products and their components’ shall be applicable.

8.03 For handling, storage and preservation, plant standard no. HY 0490570 – ‘Instructions on handling, storage, preservation, represervation and transport of export order components at works and site, shall be applicable.

8.04 For nitrogen blanketing of heat exchangers, plant standard no. HY 0490562 – Preservation of heat exchangers prior to shipment’ shall be applicable.

8.05 All openings of components shall be blanketed to prevent the ingress of dust and moisture.

8.06 All packing cases shall contain a packing list inside a waterproof envelope. In addition, a copy of packing list will be kept in a metallic pocket outside the case.

8.07 All markings on the case shall be made of waterproof materials to prevent obliteration during transit.

8.08 All concerned designers shall identify the packing cases including direct despatch (DD) items as per the categories of packing indicated in clause 4. Components requiring special packing not included in this standard shall be covered by product standards.

Suitable instructions for packing of DD items shall be incorporated in the purchase orders as per relevant product standards.

8.09 The details of packing materials are indicated in Sketch-I.

8.10 The following details shall be marked on the packing case:

- a) W.O. No.
- b) Case No.
- c) Net weight
- d) Gross weight
- e) Dimensions of box
- f) Markings showing:
  - i) Upright position.
  - ii) Sling position
  - iii) Storage position (P, Q, R, S)
  - iv) Fragile components
  - v) Any other special markings required by the customer



TD-218 Rev.00

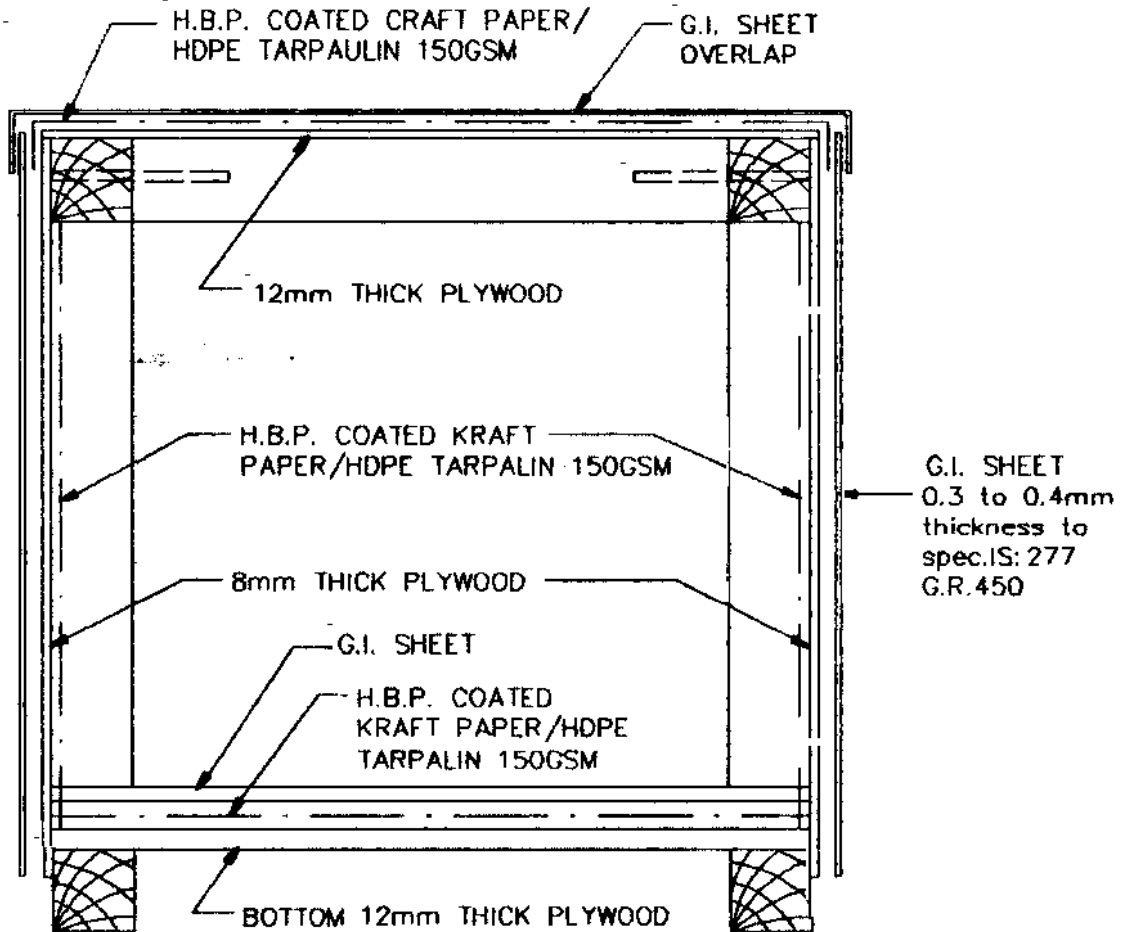
# PLANT STANDARD HYDERABAD

HY 049 05 69

REV.NO. 05

PAGE 5 OF 5

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CLOSED PACKING CASE WITH  
G.I.SHEET SHOWING LAYERS  
OF PACKING MATERIALS

SKETCH-I



**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**

**HY51463**

**REV. NO: 01**

**Page 1 of 9**

**NON-CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES**

**1. GENERAL:**

This specification governs the quality of non-coniferous timber supplied in the form of planks, battens, beams and sleepers.

**2. APPLICATION:**

Used for the manufacture of packing cases/crates.

**3. COMPLIANCE WITH NATIONAL STANDARDS:**

Assistance has been derived from the following Indian Standards in preparing this specification.

IS: 399 – 1963 : Classification of commercial timbers and their zonal distribution.

IS: 1326 – 1992 : Specification for non-coniferous sawn timber (Baulks and Scantlings)

IS: 5966 – 1993 : Specification for non-coniferous timber in converted form for general purposes.

IS: 6662 – 1993 : Timber species suitable for wooden packaging - Specification.

**4. TERMINOLOGY:**

For the purpose of this specification, the definitions given in IS: 707 (Glossary of terms applicable to timber and timber products) shall apply except for the beam which is defined as below.

Beam is defined as converted timber whose cross-sectional dimensions exceed 50 mm in both directions.

**5. SPECIES:**

The species of non-coniferous timber shall be as per annexure I.

<b>Revisions:</b> Cl. No. 11 added. Cl. No. 3, 7.1 & 12 revised. Cl. No. 7.4 Deleted.			<b>Issued :</b> <b>STANDARDS ENGINEERING &amp; IPR COORDN. DEPARTMENT</b>		
<b>Rev. No. 01</b>	<b>Amd. No.</b>	<b>Reaffirmed:</b>	<b>Prepared:</b>	<b>Approved:</b>	<b>Dt of 1<sup>st</sup> issue</b>
<b>Dt. NOV. 09</b>	<b>Dt.</b>	<b>Year</b>	<b>VNR</b>	<b>DGM(E&amp;CC)</b>	<b>MAY. 90</b>

**6. DIMENSIONS AND TOLERANCES:**

**6.1 Sizes:** Width, thickness and length of timber shall be clearly stated on the order/drawing.

**6.2 Tolerance:**

**6.2.1 Width:**

Width, mm	Tolerance, mm
50, 75, 100	+ 3
125, 150, 200, 225, 250	{ + 6 - 3

**6.2.2 Thickness:**

<u>Thickness, mm</u>	<u>Tolerance, mm</u>
20, 25, 35, 40, 50	+ 3
75, 100, 125, 150, 175, 200, 250	{ + 6 - 3

**6.2.3 Length:**

Standard length:

1 to 12 metres in multiples of 0.5 metre.

Tolerance:

± 2% or ± 50 mm whichever is less.

Note: The minus tolerances for width, thickness and length shall not be permitted in more than 10% of the timber supplied.

**7. SEASONING AND MOISTURE CONTENT:**

**7.1 Timber for packing purpose other than export orders:**

The timber shall have a moisture content of 30% maximum for planks and battens and 35% maximum for beams within a depth of 15 mm from the surface excluding a length of 30 cm from each end, at the time of inspection any time in the year. The moisture content will be determined in accordance with IS:287, IS:11215. This does not apply to timber procured in sleeper form for further conversion.

**7.2 Timber for packing purpose for export orders:**

The moisture content shall not exceed the maximum of 18%.



**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**

**HY51463**

**Rev. No. 01**

**Page 3 of 9**

**7.3** The moisture content % shall be specified in the order.

**8. FREEDOM FROM DEFECTS:**

Timber shall be free from the following defects:

Brashness, splits across the grain, shakes, cup, spring, twist insect attack, any kind of decay (rot) visible infection, open centre heart, centre heart on planks and any other defect.

The extent to which defects are permitted are given in Annexure II.

**9. END COATING:**

Timber shall be coated with any of the following effective compositions, upto a distance of 80 mm from each end or 20 mm more than the longest split, whichever is higher.

**9.1** Thick coal tar or bituminous paint.

**9.2** Resin and lamp black (10:1), melted, mixed and applied hot.

**9.3** Hardened gloss oil.

**9.4** Paraffin wax.

**9.5** Molasses and lime (3:1).

**10. END STRAPPING:**

Timber above 200 mm x 200 mm cross section shall be strapped with steel clamps to prevent end splitting.

**11. TREATMENT OF WOOD:**

Supplier shall ensure the following:

All wood packaging material used in packaging of export consignments are required to be rendered free from all pests either by heat treatment or by fumigation with Methylene Bromide as per ISPM-15 (International Standards for Phytosanitary Measures) by the accredited fumigation agencies recognised by the Government. Supplier should submit certificate to that extent.

The treated wood packaging material shall carry prescribed treatment mark as per ISPM-15 in addition to standard markings of ISPM-15 on his material.

<b>HY51463</b>	<b>PLANT PURCHASING SPECIFICATION HYDERABAD</b>	
<b>Rev. No. 01</b>		
<b>Page 4 of 9</b>		

**12. CERTIFICATES:**

The supplier shall furnish a certificate with each lot/consignment in support of the type of species, treatment (Fumigation/Chemical) and moisture content.

**13. MARKING:**

The timber shall be marked/painted in order to identify the source of supply in accordance with our instructions.



**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**

**HY51463**

**Rev. No. 01**

**Page 5 of 9**

**ANNEXURE - I**

**SPECIES OF NON-CONFEROUS TIMBER RECOMMENDED FOR HEAVY PACKING  
CASES/CRATES**

Sl. No.	Botanical Name	Standard Trade Name	Local Names	Abbreviated Symbol
1.	<u>Fagara burdrunga</u>	MULLILAM	MUTTILAM (Tamil), RHETSA (Telugu); BEPULI (Uudu)	MUY
2.	Careya arborea	KUMBI	KUMBHI (Assam & Bengali), KAMBI (Hindi)	KUM
3.	Syzygium Cumini	JAMAN	JAMUN (Hindi & MP); JAMUK (Assam); JAM (Bengali); KUDA (Koli); JAMU (Oriya); JAMBU (Gujarati); NERLU, NERULA (Kannada); JAMBUL (Marathi); NAVAL (Malayalam & Tamil); NEREDU (Telugu)	JAM
4.	Apha – namixis Polystachya	PITRAJ	BOGA, AMARI (Assam); LOCHUNI, LOSHUNE (Bengali); RAKTATOHIDA (Marathi), MULLUMUTTAGA (Kannada); KARAGIL (Malayalam), VEKKALI, VELLAKONGU (TAMIL)	PIT
5.	Albizzia procera	SAFID-SIRIS	SAFED- SIRIS (Hindi); SIT (Andamans); KOROI (Assam & Bengali); TENTHRA (Koli); DHALASIRISH (Oriya); KINHAI, KILAI (Marathi); GURER (MP); KARANGRO (Gujarati); BELLATI, SALVAGAI (Kannada); VELLAVAKA (Malayalam); VELVAGAI (Tamil); TELLACHINDUGA (Telugu)	SSI
6.	Terminalia bellirica	BAHERA	BAHERA (Hindi & Marathi); BHAIRA (Punjabi); BHOMARA (Assam); LUMPUNG (Koli); BAHADA (Oriya); BAHETA (Gujarati); THARE, TARE, TARI (Kannada); BAHELA (Marathi); THANNI (Malayalam ); TANI (Tamil & Telugu)	BAH
7.	Logerstroemia parviflora	LENDI	ASIDH, DHAURI'SIDA (Hindi); MECHI (Assam); SIDHA (Bengali & Oriya); GARASEKRE (Koli); BURI – DHAMERO (Nepali); LENDIA – SENHA (Marathi); KALIASAJA, LENDI (MP) BONDARO (Gujarati); NANAGU (Malayalam); PEIKADUKKAI (Tamil); CHENNANGI (Kannada & Telugu)	LEN

<b>HY51463</b>	<b>PLANT PURCHASING SPECIFICATION HYDERABAD</b>	
<b>Rev. No. 01</b>		
<b>Page 6 of 9</b>		

Sl. No.	Botanical Name	Standard Trade Name	Local Names	Abbreviated Symbol
8.	Acrocarpus Fraxini folius	MUNDANI	MANDANE (Nepali); BELANJI (Kannada); KURANYAN, MALAVEPPU (Malayalam); MALAMKOMAI (Tamil)	MUN
9.	Dysoxylum Mala baricum	WHITE CEDAR	BILIDEVADARI (Kannada); VELLA – GIL (Malayalam & Tamil)	WCE
10.	Mangi fera India	MANGO	AM (Hindi & Assam); AMB (Punjabi); ULI (Koli); AMBA (Oriya & Marathi); MAVU (Kannada) MAMARAM (Tamil); MAMIDI (Telugu)	MAN
11.	Lagerstroemia Speciosa	JARUL	AJHAR (Assam); GARASEKRE (Koli); PUNIPATULI (Oriya); NIRMARUTHU (Malayalam); POOMARUTHU, PUMARUDU (Tamil)	JAR
12.	Adina Corodifolia	HALDU	HALDU, KARAM (Hindi); TARAK COPA (Assam); RANGKAT (Bengali) KUMBHA (Koli); KURUMA (Oriya); HALDU, HEDU (Marathi); KARAM (MP); HALWDWAR, HALDWAN (Gujarathi); HEDDI, YETAGAL, YETTAGA (Kannada); BIMBU (Malayalam); KADAMBERI, MANJAKADAMBAI (Tamil); HALDAWA (Urdu); BANDARU (Telugu)	HAL
13.	Dipterocarpus Indicus	GURUJAN	GARJAN (Assam); YENNEMARA (Coorg); KALPAYINI, KALPINE (Malayalam); ENNEY, VELLAYINI (Tamil); KALPINE (Kannada); GURGAL (Urdu).	GUR
14.	Lagerstroemia Lonceolata	BENTEAK	Nana (Gujarati & Marathi); NANDI, BENDEKU (Kannada); VENTEAK (Malayalam); BETHEKKU, VENTHEKHU (Tamil); BILLINANDI, BOLULTAR (Telugu)	BEN
15.	Dipterocarpus macrocarpus	HOLLONG	HOLLONG (Assam)	HON
16.	Mitragyna Parvifolia	KAIM	GURI, KALAM, PHALDU (Hindi); HAMSABETI (Koli); MITUKUNIA (Oriya)	KAM



**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**

**HY51463**

**Rev. No. 01**

**Page 7 of 9**

Sl. No.	Botanical Name	Standard Trade Name	Local Names	Abbreviated Symbol
17.	Terminalia procera	WHITE BOMBWEE	DADAM (Andaman)	WBO
18.	Artocarpus hirsuta	AINI	HEBBALASU, HEBHULSINA (Kannada); PATHPHANAS (Marathi); AINIPILAVU (Malayalam); AINIPILA ANJILI (Tamil)	ANI
19.	Terminalia Myriocarpa	HOLLOCK	PANISAG (Nepali)	HOL
20.	Protium Serratum; Bursera Serreta	MURTENGA	ERRA KARRA (Telugu)	MUR
21.	Grewia- Ti Lifolia	DHAMAN	TADA (Telugu); DADSAL, THADSAL (Kannada); CHADACHI (Malayalam) THADACHI (Tamil); PEDDA JANA (Telugu)	DHA
22.	Albizialebeck	KOKKO	SIRIS (Hindi & Oriya); SARIN, SHRIN (Punjabi); HIRIH (Assam); SIRISH (Bengali); CHICHOLA (Marathi); BAGE (Kannada); VAKA (Malayalam); VAGAI (Tamil); DIRISINAM (Telugu)	KOK
23.	Holoptelea- Intergrifolia	KANJU	KANJU, PAPRI (Hindi); KUMKAR, RAJAIN (Punjabi); ANJAN (Bengali); CHIBIL, DHAURANJO (Oriya); PAPARA (Marathi); CHILWAL, CHIROL, KARANJI (MP) THAPSI (Kannada); AVAL (Malayalam) AYILI (Tamil)	KAJ
24.	Schimawallichy Choisy	CHILAUNI	GOGRA, MAKRISAL (Assam)	CHL
25.	Xyliaxylocarpa	IRUL	KONGRA, TANGAN (Oriya); SURIA (Marathi); SAURIYA (MP) JAMBE (Kannada); IRUL (Tamil), KONDATANGEDU (Telugu)	IRU
26.	Hopea	HOPEA	BOGIMAR (Kannada); IRUMBOGAM (Malayalam); VELLAI – GONGU (Tamil)	HOP
27.	Teriminalia- tomentosa	LAUREL	ASNA, SAIN (Hindi); AISAN (Punjabi); HATANA (Koli); PUCCASAJ (Nepali); SAHAJA (Oriya); AIN, SADAR, SAJ (MP) KARUMARUDU (Malayalam); KARIMARUDU, MATTI (Tamil); NALLAMADDI (Telugu)	LAU

HY51463

Rev. No. 01

Page 8 of 9

**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**



Sl. No.	Botanical Name	Standard Trade Name	Local Names	Abbreviated Symbol
28.	Shorearobusta	SAL	SAKHU, SAL, SAKHUA (Hindi); SARJAM (Koli); RAIGAL –A SARGI (Oriya)	SAL
29.	Mesuaferrea	MESUA	GANGANE (Andaman); NAHOR(Assam); NAGESWAR, NAGKESAR (Bengali); NAGESWAR (Oriya); NAGASAMPIGI (Kannada); CHURULI (Malayalam); NANGAL, NANGU (Tamil); NAGAKESARI (Telugu)	MES
30.	Terminaliapaniculata	KINDAL	HONAL, HONAGALU (Kannada); KINDAL (Marathi); PILLAMARUDU (Malayalam & Tamil); NALLAPULAGA (Telugu)	KIN
31.	Grevillea robusta	A CUNN	SILVER OAK	SOA

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**PLANT PURCHASING  
SPECIFICATION  
HYDERABAD**

**HY51463**

**Rev. No. 01**

**Page 9 of 9**

**ANNEXURE -II**

**PERMISSIBLE DEFECTS**

Sl. No.	Defects	Extent Permissible
1.	BOW	Shall be permissible upto a maximum of 2 mm for 300 mm length of the piece.
2.	CUP	Shall not be permissible.
3.	END SPLITS	The longest end split at each end shall be measured and the lengths added together. The total length of the longest end split shall not exceed 60 mm per metre of the length of the piece.
4.	KNOTS	Live knots measuring from 20 to 35 mm in diameter and dead knots measuring upto 15 mm in diameter shall be permissible provided they are not so numerous or so grouped or located as to affect unduly the strength of the pieces.
5.	BORER HOLE  (DAED INFE- STATION)	Borer holes (dead infestation) shall be permissible, on one face only provided such holes are not deeper than 10 mm and are well scattered
6.	SAP WOOD WANE	Shall be permissible.
7.	WANE	Wane shall be permissible upto 1/5 of the width on a broad face, subject to a maximum of 60 mm and upto 1/3 of the width on the narrow face provided that one broad face and one narrow face is completely free from this defect. Wane shall not be present in more than 30% of the total number of pieces accepted at any one time.
8.	CROSS GRAIN	Shall be permissible upto a maximum deviation of 1 in 10.
9.	SURFACE CRACK	Depth of the deepest crack on any one face (excluding the ends) shall be permissible upto a maximum of 2 mm in case of planks and beams upto 50 mm thick, 3 mm for beams above 50mm and upto 100mm thick and 6mm for beams above 100mm thick. A continuous crack of any depth, all along the length, is not permissible.



**PLANT STANDARD  
HYDERABAD**

**HY0490572**

**REV. NO. 01**

**PAGE 1 OF 10**

**CODE OF PRACTICE FOR STORING, HANDLING,  
PACKING AND DESPATCH OF COMPONENTS**

**1.0 SCOPE:**

This standard covers technical instructions for packing and despatch of components. The related packing materials are indicated in Annexure 1. This standard supersedes company standard HY0490301 Rev.01.

**2.0 PACKING CASE:**

2.1 Packing cases for special components like rotor, casings and other items shall be designed by central packing design cell based on the component drawing and the fixing and supporting methods indicated by engineering department.

2.2 The wood for packing cases shall conform to plant purchase specification no. HY51463 and HY51461.

2.3 Suitable stiffeners, steel brackets at corners, sides and for lifting shall be fixed to the packing case, wherever required.

**2.4 Nailing procedure:**

2.4.1 In the case of nailing two or more layers of the board together, having total thickness not exceeding 7.5 cm, the nail end shall be bent 0.9 cm or more to the direction making a right angle to the timber grain.

2.4.2 Nailing must be carried out carefully by arranging nails zigzag so as not to cause cracking of the planks. Further, each nail must be driven adequately so that its head shall not protrude above the plank surface or excessively sink below the board surface.

**3.0 ORIGINAL PACKING CASES:**

Care shall be taken while opening the packing cases at the stores receipt stage. The despatch from stores (DS) items like valves, precision instruments, condenser tubes etc. shall be despatched in the original packing cases received from supplier to avoid damage during transit, wherever possible.

<b>Revisions:</b> Annexure I & II added.			<b>Issued :</b> <b>STANDARDS ENGINEERING DEPARTMENT</b>		
<b>Rev.No. 01</b>	<b>Amd. No.</b>	<b>Reaffirmed:</b>	<b>Prepared:</b>	<b>Approved:</b>	<b>Date:</b>
<b>Dt. NOV. 95</b>	<b>Dt.</b>	<b>Year:</b>	<b>CDC</b>	<b>DGM (EC)</b>	<b>AUG. 1994</b>



**4.0 RIGDITY OF COMPONENTS IN THE CASE:**

4.1 The movement of components in the packing case shall be arrested by fixing suitable wooden sections at proper places.

**5.0 STABILITY OF THE CASE IN THE WAGON:**

The movement of case in the wagon shall be arrested by providing necessary wooden support and suitable lashing.

**6.0 PROTECTION AGAINST INGRESS OF MOISTURE:**

Component shall be wrapped with VCI paper, waxed paper polythene sheet as applicable for the components/ products. 2 bags of indicating type silicagel in bleached and finished plain weave cloth bag each containing 0.5 Kg/m<sup>3</sup> volume of the case shall be placed in the packing case, wherever required.

**7.0 MEASURING INSTRUMENTS & DELICATE ITEMS:**

7.1 Temporary preservative shall be applied on the unpainted surfaces. The instruments shall be wrapped with waxed paper and packed preferably in the original packing/ thermocol boxes with suitable cushioning.

7.2 Glass instruments shall be covered with suitable cushioning material and preferably packed in original packing cases/ thermocol boxes.

7.3 Pressure gauge connections shall be protected with plastic caps.

7.4 The packing shall be fastened with adhesive tape and placed in a wooden case with cushioning material.

7.5 Fragile items shall be packed in separate boxes.

**8.0 PUMPS, ELECTRIC MOTORS, VENTILATORS ETC.**

8.1 The components of pumps, electrical motors, ventilators etc. Shall be cleaned to remove the preservative, dust etc and re-preserved.

8.2 Spare bearings shall be cleaned and then preservative grease shall be applied. The bearing shall be packed in cartons. Heavier bearings shall be packed in wooden cases.

**9.0 LOOSE PARTS LIKE FASTENERS, PIPE UNIONS ETC:**

9.1 These items shall be suitably preserved and wrapped in waxed paper. The items shall be packed in corrugated boxes.



**PLANT STANDARD  
HYDERABAD**

**HY0490572**

**REV. NO.01**

**PAGE 3 OF 10**

9.2 Loose parts pertaining to one individual group shall be packed in one fibreboard corrugated box as far as possible.

9.3 Fibre board boxes shall be packed in wooden boxes.

**10.0 PIPES, FLATS, ANGLES:**

10.1 Pipe and flange end covers:

10.1.1 The pipe end covers (external) for pipe sizes 6-610 mm O.D shall be as per plant standard HY7790962.

10.1.2 The flange end covers (external) for flange sizes ID=45mm, OD=70mm to ID=530mm, OD=600mm shall be as per plant standard HY7790963.

10.1.3 The stub end covers (external) for stub sizes 16.3 mm OD to 83 mm OD shall be as per plant standard HY7790964.

10.1.4 The pipe end covers (internal) for pipes on nom. Size 9 mm to 75mm shall be as per plant standard HY7790965.

10.1.5 Protective caps shall be provided for pipe/flange ends.

10.2 Steel tubes for general purpose upto and including 50 mm dia shall be bundled with 2 stranded mild steel wire. The steel wire dia shall not be lesser than 2 mm.

10.2.1 The recommended bundling places are as per table below:

Product weight	Upto 200 Kg.	>200 ≤300 Kg.	>300≤500	>700≤1000 Kg.
Number of bundling places	3	4	7	8

10.2.2 Steel tubes above 50 mm dia shall be shipped loose.

**10.3 Special purpose and heat exchanger tubes & pipes:**

10.3.1 Suitable rust preventive shall be applied to the items as per HY0490563.

10.3.2 The gross weight of the standard case for HE tubes shall not exceed 1500 Kg.

10.3.3 **U Tubes:**

10.3.3.1 U tubes shall be packed in moisture proof cases. Cloth bags of silicagel shall be placed in the case as per clause 6.



10.3.3.2 Longitudinal & transverse movement of tubes within the case shall be avoided by providing soft packing.

10.3.3.3 A horizontal layer of tubes shall be separated by polythene sheet.

10.3.3.4 Vertical rows of tubes shall be separated by wooden spacers to avoid rubbing and movement of tubes.

10.3.3.5 The two legs of the inner most U tube shall be separated by wooden spacers.

#### 10.4 FIN TUBES:

10.4.1 Suitable cushioning material and soft pads shall be provided inside the case on all the sides.

10.4.2 Soft pads shall be kept between two horizontal layers of the tubes.

10.4.3 Spacers of soft material shall be kept between the 2 adjacent vertical rows to avoid interlocking of tubes.

10.5 Brass rods shall be wrapped with polythene sheet and packed in longitudinal boxes.

10.6 Straight lengths like bars, flats, angles shall be bundled with annealed steel wire of diameter 3 to 6 mm.

#### 11.0 IDENTIFICATION:

The tag number as per completion schedule shall be painted on metal tag and tied with thin wire or tack welded to the individual items being despatched.

#### 12.0 PACKING SLIP HOLDER:

The packing slip shall be fixed on the packing case at suitable location. The packing list shall be sealed in a polythene bag against the ingress of moisture and placed in the packing slip holder.

#### 13.0 MARKING:

13.1 The following data shall be marked on two opposite sides of the case with waterproof black paint.

- a) BHEL and sender's address
- b) Company Monogram
- c) Consignee's full and correct address
- d) Identification number of the case



**PLANT STANDARD  
HYDERABAD**

**HY0490572**

**REV. NO.01**

**PAGE 5 OF 10**

- e) Net weight and gross weight of the case
- f) Rough dimensions of the case in cm
- g) Position of slings or chains for handling
- h) Indication of top of the case
- i) Name of the consignment (eg: "Instrument Panel", "Middle part MP casing", "Miscellaneous" etc.)
- j) Special remarks wherever applicable (eg: "Turbine rotor with care", "Glass instruments with care" etc.)
- k) The remark "NOT TO BE LOOSE SHUNTED", wherever applicable.
- l) Storage instruction code

e.g. P - Storage in a totally enclosed shed under controlled conditions.

Q - Storage in a totally enclosed shed.

R - Storage in a shed having roof but no side walls.

S - Storage in open yard on elevated platform/ wooden sleepers.

**14.0 HANDLING:**

Procedure for handling shall be as per HY0490571.

**15.0 NOTE:**

The following are the related documents on packaging and despatch of components.

- 15.1 OMI 064 - Procedure for packing and despatch of finished products.
- 15.2 AA 0232601 - Pictorial markings for handling, labling of goods in general.
- 15.3 AA 0232801 - Technical information on loading and transportation of consignments by railway wagons.
- 15.4 AA 0232802 - Loading particulars of standard railway wagon broad gauge and metre gauge.
- 15.5 AA 0232803 - Standard moving dimensions on indian railways broad gauge and metre gauge (for bogie goods stock).
- 15.6 HY0490563 - Code of practice for preservation of different products and their components
- 15.7 HY0490564 - Code of practice for storage of different products and their components.
- 15.8 HY0490571 - Procedure for handling of components.
- 15.9 HY0490569 - Seaworthy packing for export orders.
- 15.10 HY51463 - Non - conifer timber for general packing purposes.



- 15.11 HY51461 - Rubber wood for general packing purposes.
- 15.12 HY0490562 - Preservation of heat exchangers prior to shipment
- 15.13 HY0490570 - Instructions on handling, storage, preservation, reprereservation and transport of export order components at works and sites
- 15.14 HY0490571 - Procedure for handling of components

TABLE - 1

**PACKING MATERIALS**

Sl. No.	Description	IS No. and Grade	BHEL Spec./ Std. No.
1.	Waxed grease proof paper 0.3mm thkx900mmx100 mtrs	IS: 3962	AA51407
2.	Packing paper water proof bitumen laminated type 1	IS: 1398 Type 1	AA51410
3.	Polythene coated bitumen hessian kraft paper	IS: 1398 Type 3	AA51409
4.	Pressure sensitive adhesive tapes with poly-propylene plastic base	IS:13262	AA51412
5.	Pressure sensitive adhesive cloth	IS: 3687	AA51411
6.	Cotton tape for electrical purpose	IS: 1923	AA23107
<b><u>CUSHIONERS</u></b>			
7.	Wood wool	IS:1707	AA51404
8.	Rubberised coir sheets	IS: 8391	AA51415
9.	Woolen felt hard (Proofed) (Grey colour)	IS: 1719	AA23121
10.	Polythelene air bubbled film	IS:12787/89	HY78489



**PLANT STANDARD  
HYDERABAD**

**HY0490572**

**REV. NO.01**

**PAGE 7 OF 10**

Sl. No.	Description	IS No. and Grade	BHEL Spec./ Std. No.
11.	Rubber sheets	IS: 638 Gr. 1 Type A	AA59001
12.	Expanded polysterele (Thermocol) sheet	IS: 4671 Type- 2	AA51416
<b><u>BINDING &amp; FIXING MATERIALS</u></b>			
13.	MS binding wire galvanised		AA10110
14.	Hot rolled steel strip (baling)	IS: 1029	HY10189
15.	Metal seal (Tin) with BHEL emblem to suit steel strip		HY78462
16.	Steel counter sunk head wire nails	IS: 723	AA7177001
<b><u>MARKING MATERIALS</u></b>			
17.	High quality full glossy out door paint (Block)	IS: 2932	AA56126
18..	Non - yellowing full glossy white paint		AA56127
<b><u>OTHERS</u></b>			
19.	Corrugated fibre board boxes	IS: 2771 (Part 1)	AA51414
20.	Low density polyethylene film	IS: 2508	AA51408
21.	Low density polyethylene bags with BHEL Emblem printed on one side with one colour		AA51408
22.	Bleached cloth bag		HY78464

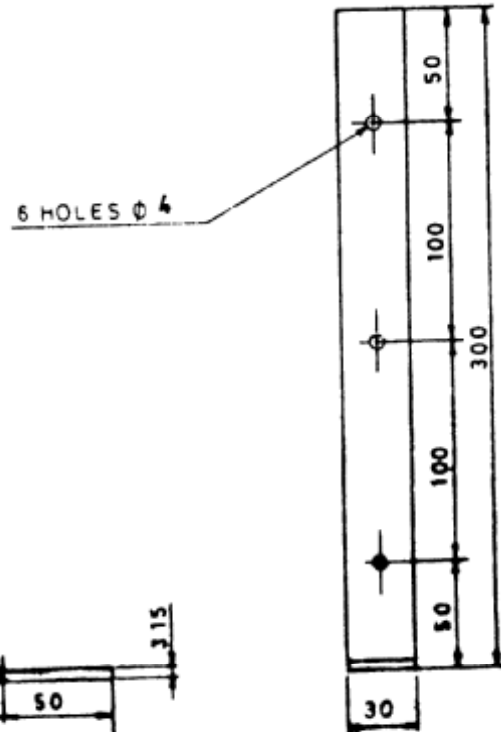
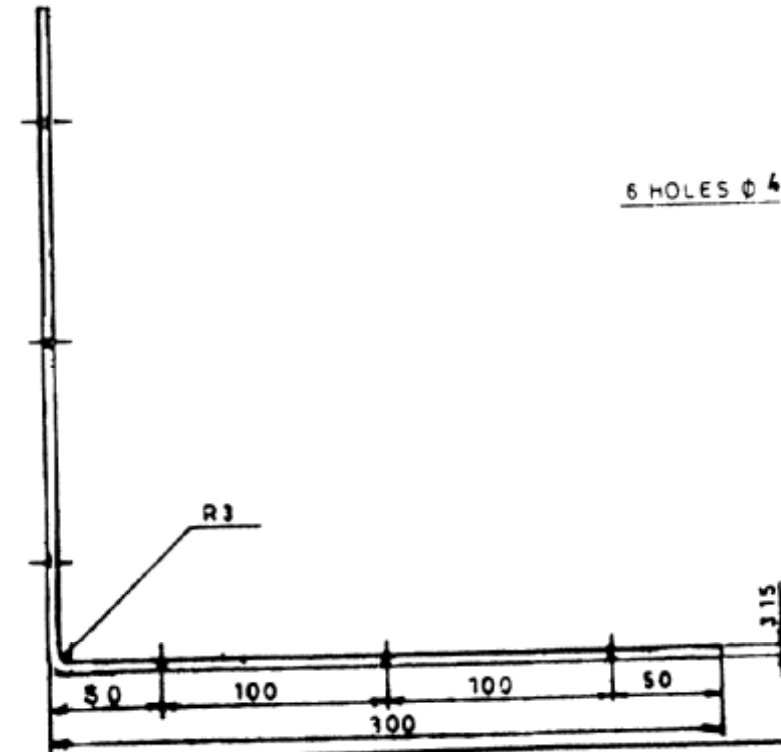
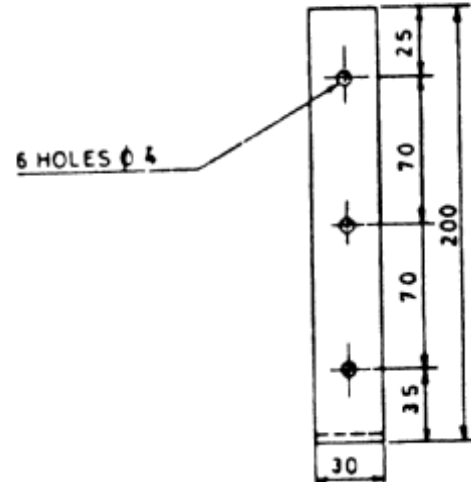
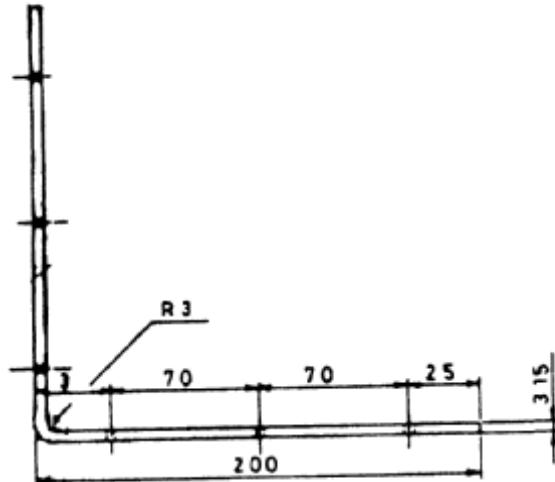
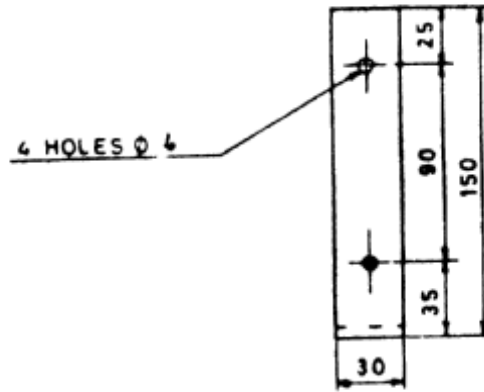
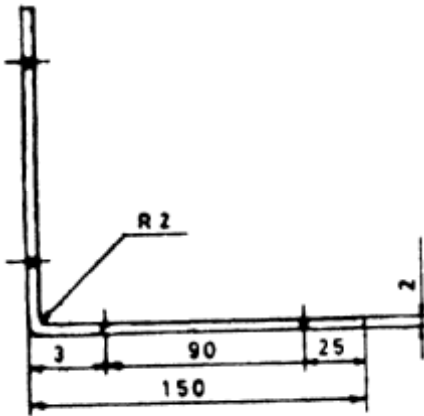
**PLANT STANDARD  
HYDERABAD**



Sl. No.	Description	IS No. and Grade	BHEL Spec./ Std. No.
23.	Plywood MR/AB	IS:303	AA51101
24.	G I sheet for name plate	IS:277	AA10166
25.	G I sheet plain		AA10166
26.	Pipe end covers (internal)		HY7790965
27.	Indicating type silicagel size 5 to 3 mm	IS: 3401	AA55619
<u>STANDARD FASTENERS</u>			
28.	Square head bolt, nut & washer		HY9601101
29.	Netlon protective sleeving		HY7840797
30.	MS clamps		
31.	HDPE Tarapaulin 60' x 40'	IS:7903	HY78133
	NYLON ROPES Ø 10 MM		HY78499
32.	VCI Rusto paper VCI Rusto powder		AA51406 AA55120
33.	Packing stud two sq. nuts & two sq. washers		HY9601411
34.	G I Binding wire		AA10110
35.	Metallic pouches Blue Red		

L CLAMPS

ANNEXURE 1



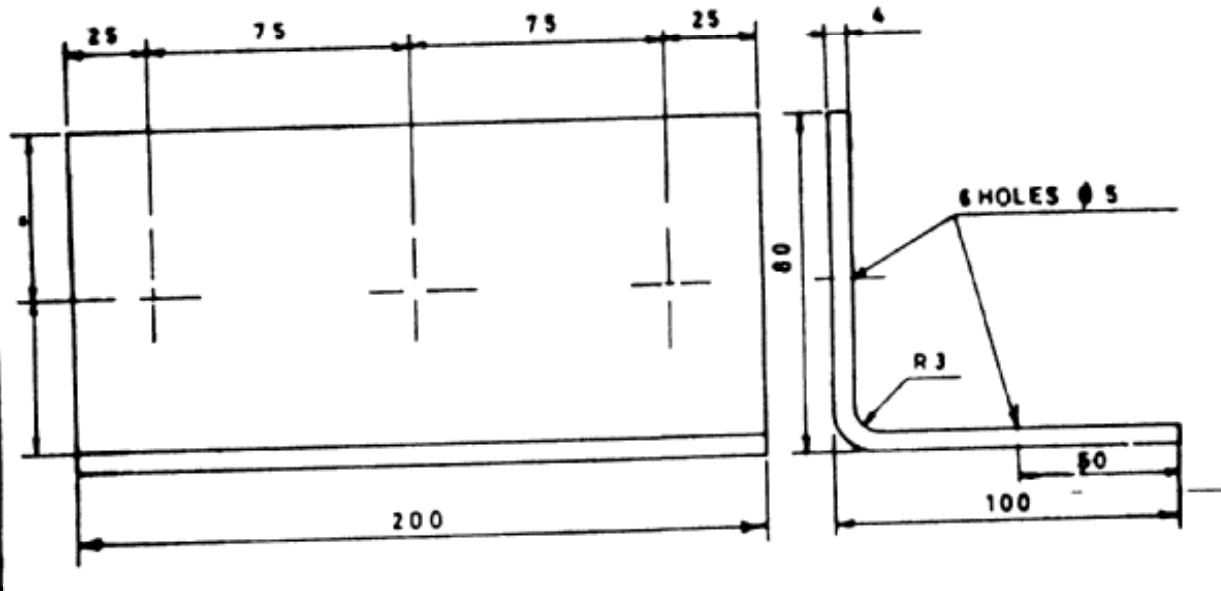
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SHIELDING PLATE  
(LIFTING ANGLE)

ANNEXURE-II



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## AMENDMENT-NOTIFICATION

HY049 05 70

REV. 00

PAGE 1 OF 1

### INSTRUCTIONS ON HANDLING, STORAGE, PRESERVATION, REPRESENTATION AND TRANSPORT OF EXPORT ORDER COMPONENTS AT WORKS AND SITES

1. In cl.1.1.1 in place of unloading read as loading/unloading.
2. In cl.1.1.1 (C) Delete “and C.G position”.

REF:	Amd.No.	APPROVED	ISSUED	DATE	CUM.Sr.No
	01	AGM (E & CC)	STDS. ENGG	OCT.93	0119



# PLANT STANDARD HYDERABAD

**HY0490570**

**REV. NO: 00**

**PAGE 1 OF 4**

## INSTRUCTIONS ON HANDLING STORAGE, PRESERVATION, REPRESENTATION AND TRANSPORT OF EXPORT ORDER COMPONENTS AT WORKS AND SITES

### 1.0 HANDLING:

#### 1.1 General:

1.1.1 Before unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) Weight of the package.
- b) The markings showing the upright position.
- c) The markings showing the sling position and C.G. position.
- d) Markings showing the fragile contents.
- e) Marking showing type of storage required as per HY 0490564.

1.2 Appropriate cranes and slings should be used for different components/cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.

1.3 Handling and lifting should be done without jerks or impacts.

1.4 Immediately after receipt of the goods the packing should be examined all-round for any sign of damage. If necessary lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

1.5 On receipt of the equipment is should be checked with the shipping list and missing or damage if any should be reported immediately.

It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and , where applicable, the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

**Revisions:**

**Issued :**

**STANDARDS ENGINEERING  
DEPARTMENT**

**Rev.No.**

**Rev. Date:**

**Revised:**

**Prepared:**

**Approved:**

**Date:**

**STDS.ENGG.**

**DGM (E & CC)**

**DEC. , 89.**

**Project Name : .....ENQ/ NIT No: \_\_\_\_\_(Vendor to fill & submit along with offer)**

**LIST OF DEVIATIONS/ EXCEPTIONS (IF ANY, vendor to fill and submit along with offer)**

<b>Sl No</b>	<b>Clause No</b>	<b>Page No</b>	<b>Description of Deviation</b>

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

COMPREHENSIVE RESPONSE SHEET		
Project ID & Description		Flue Gas Desulphurization for NTPC Korba
Equipment Name & System Details		Wet Ball Mill & Limestone Slurry Preparation System
Name of Document		Sizing & General Arrangement of Mill circuit Tank
NTPC Doc No		2100-109-PVM-B-204 Rev No : 0
BHEL Doc No		2100-109-PVM-B-204 Rev No : 0
Sl .No.	NTPC Comments dated 02.08.2022	BHEL Reply dated 29.08.2022
1	should'nt it be the gap between low-low and high high level	As per the tkll standard practice, retention time is calculated as per the effective height between pump suction nozzle to Overflow nozzle.  Based on the tkll standard and practice for close loop operation, retention time for operating volume of 5 minutes is sufficient.
2	Plot plan to be added to indicate the location and the orientation	Plot plan added.
3	Handling arrangement details for the agitator to be provided.	Handling of agitator is thru EOT crane.
4	height from the bottom appears to be on the higher side. Can be optimized.	As per design & layout requirement, height is decided.
5	earthing boss	Considered.
6	spare connection on the roof?	Spare Nozzle indicated.
7	Wear life not less than 8000 hrs	Noted & indicated.
8	gap between high-high level and overflow nozzle bottom	20mm gap is maintained between high-high level and overflow nozzle bottom.
9	holds to be removed.	Next revision it is ensured.
10	Overflow to be connected to the nearest drain	Overflow is connected to nearest drain and it is part of piping arrangement drawing.

Signature Not Verified  
 Digitally signed by  
 ARUP  
 GHOSHAL  
 Date: 2022.09.20  
 18:37:11 IST  
 Reason: CAT II  
 Location:  
 NTPCEOC

01	07.09.2022	Revised in-line customer comments	UDAY	PVS	AMAN
00	15.07.2022	First Submission	UDAY	PVS	AMAN
REV	DATE	DESCRIPTION / NOTE	PRD	CHD	APD

### REVISIONS

**DRAWING TITLE: Sizing & General Arrangement of Mill circuit Tank**



**OWNER/PROJECT:** KORBA SUPER THERMAL POWER PROJECT(KSTPP) KORBA I,II & III (3X200 MW + 3X500 MW + 1X500 MW) – FGD SYSTEM PACKAGE



**EPC CONTRACTOR:**  
**BHARAT HEAVY ELECTRICALS LTD.**

	NAME	DATE	
PREPARED BY	UDAY	15.07.2022	<b>STATUS : FOR APPROVAL</b>
CHECKED BY	PVS	15.07.2022	<b>VENDOR DRAWING No.:</b>
APPROVED BY	AMAN	15.07.2022	<b>REV NO : 01</b>

**NTPC DRG./DOC NO. : 2100-109-PVM-B-204**

### **Mill Circuit Tank Sizing and Selection:**

The Mill tank is sized and selected to hold as well as to dilute the circulating slurry of the mill circuit for desired operation of the Ball mill for limestone grinding.

Now, from the mass balance of the mill circuit, the overall circulating liquid flow rate through the mill circuit tank is 291 m<sup>3</sup>/hr. (4.85 m<sup>3</sup>/min). Refer drawing no. 2100-109-PVM-B-004.

Selected tank diameter & height considering the plant layout: Dia. 3.7m x Height 3.2m  
For this tank, overall volume =  $\pi \times 3.7 \times 3.7 \times 3.2 / 4 = 34.4 \text{ m}^3$

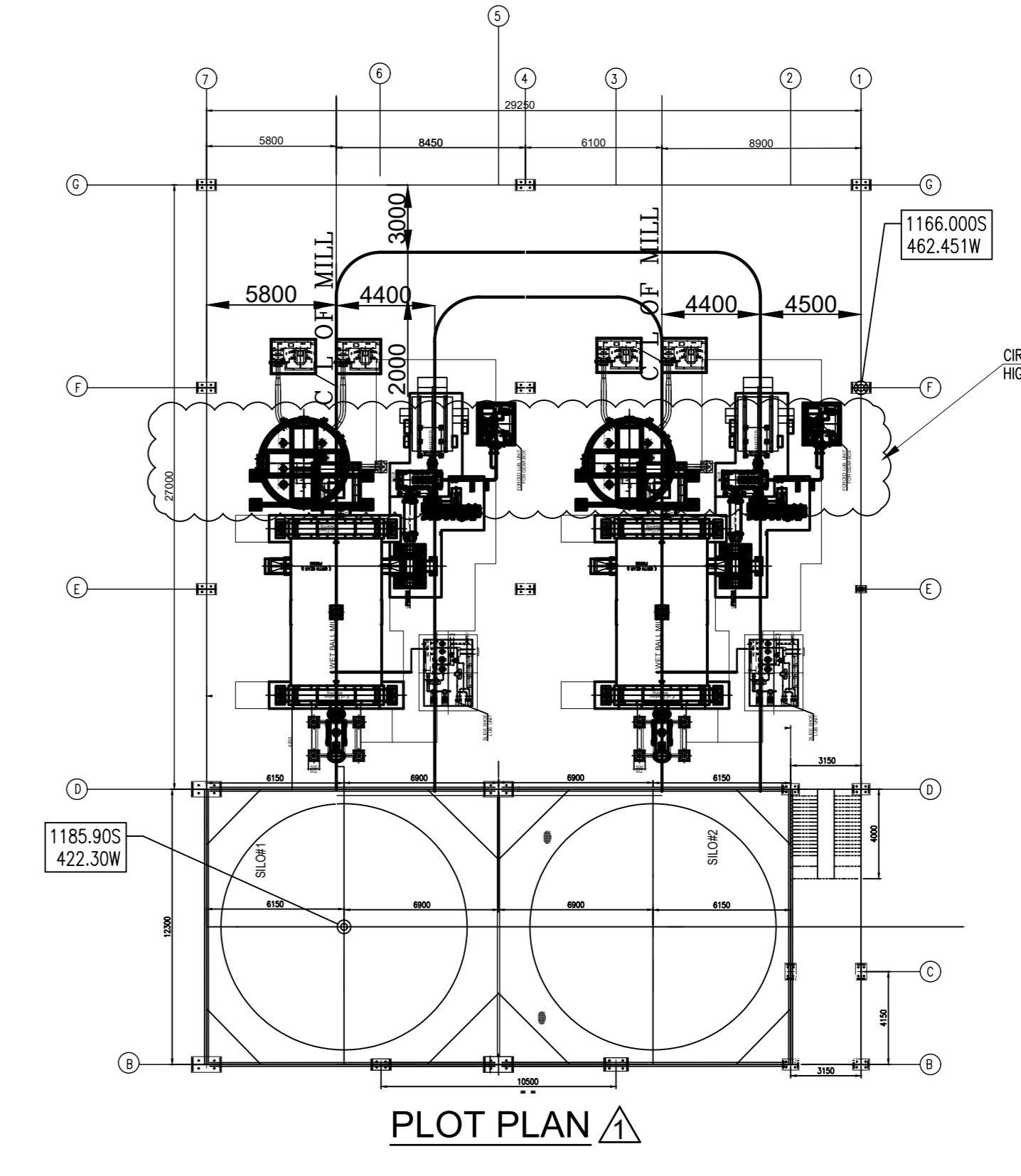
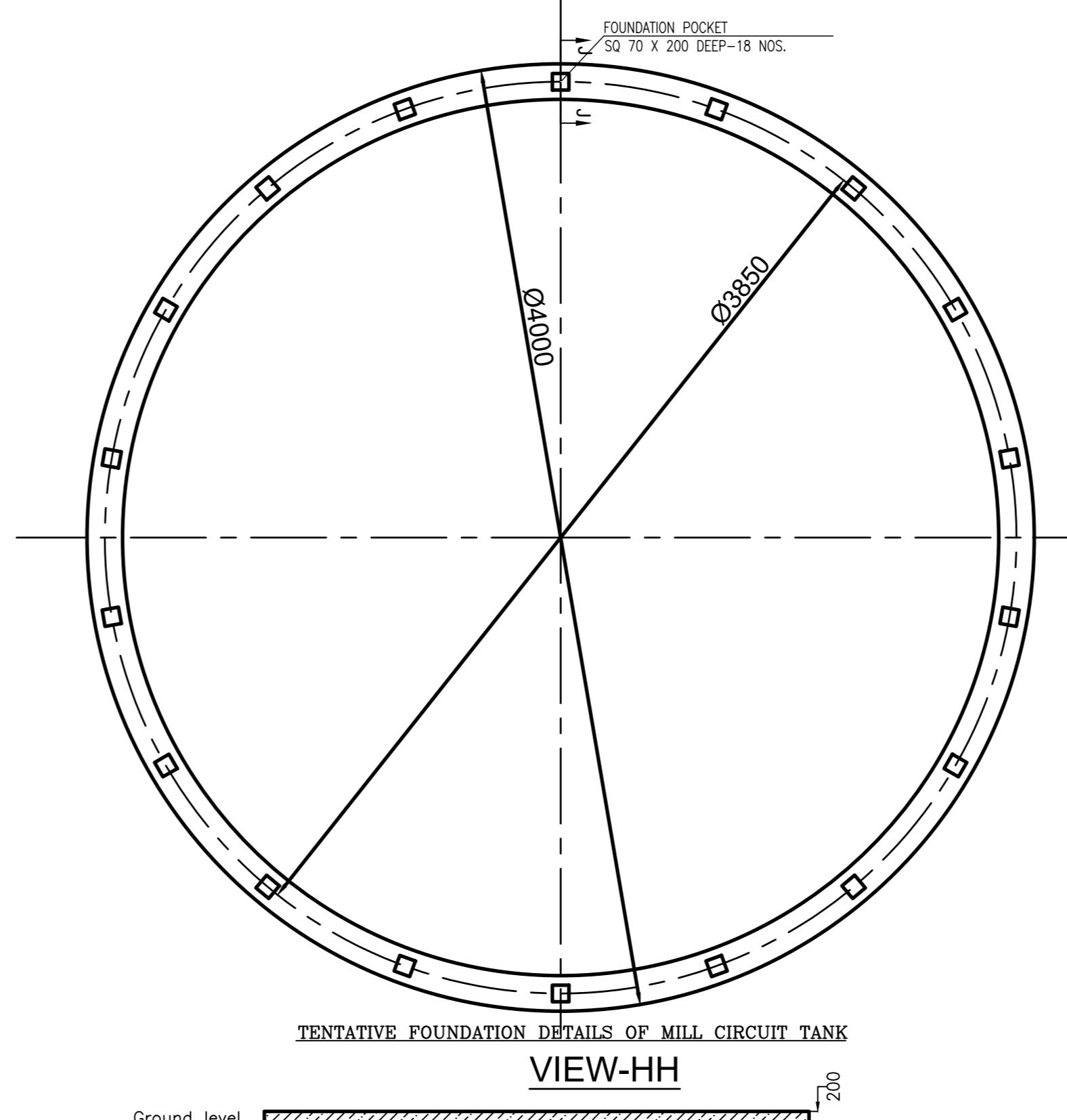
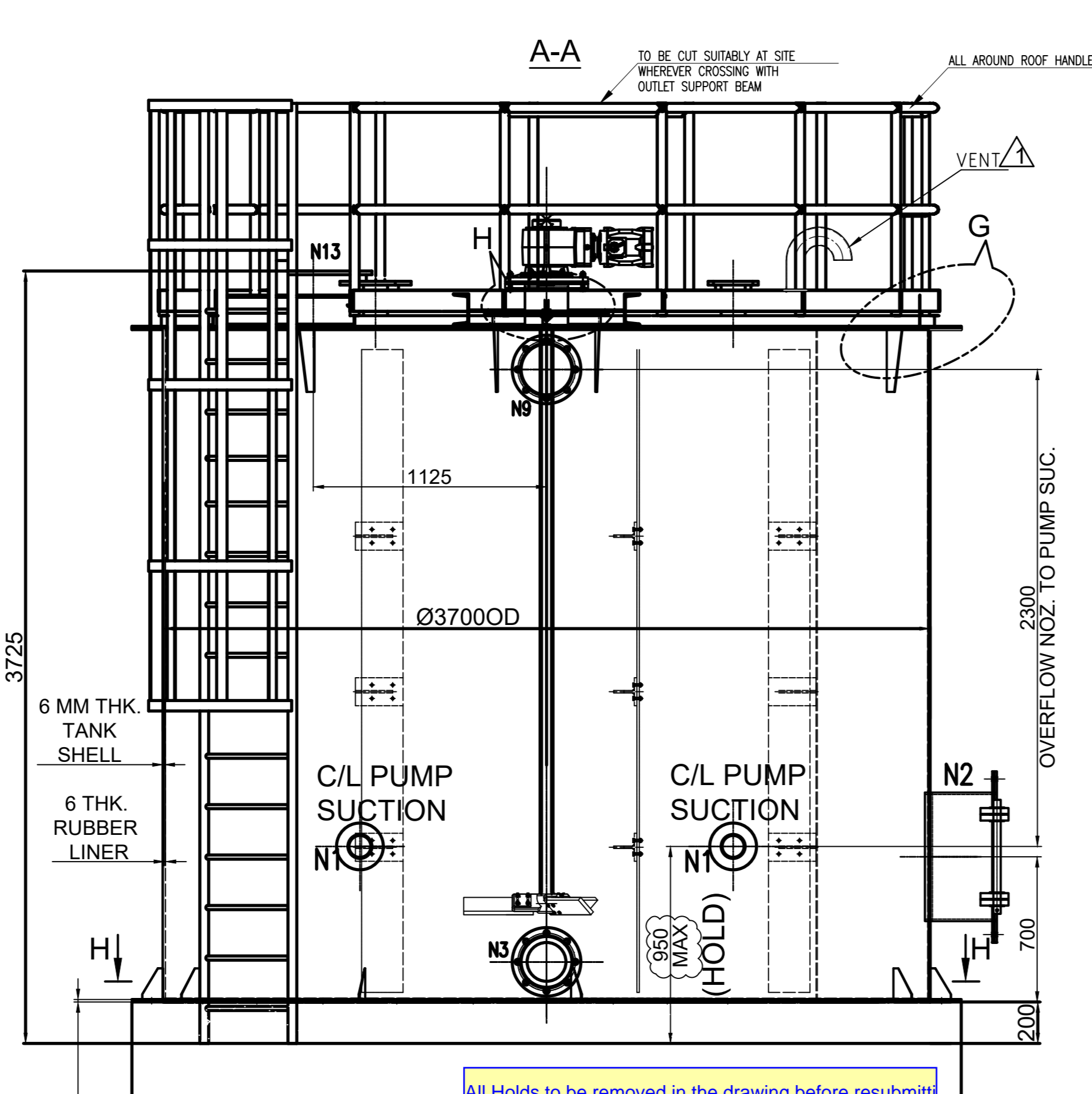
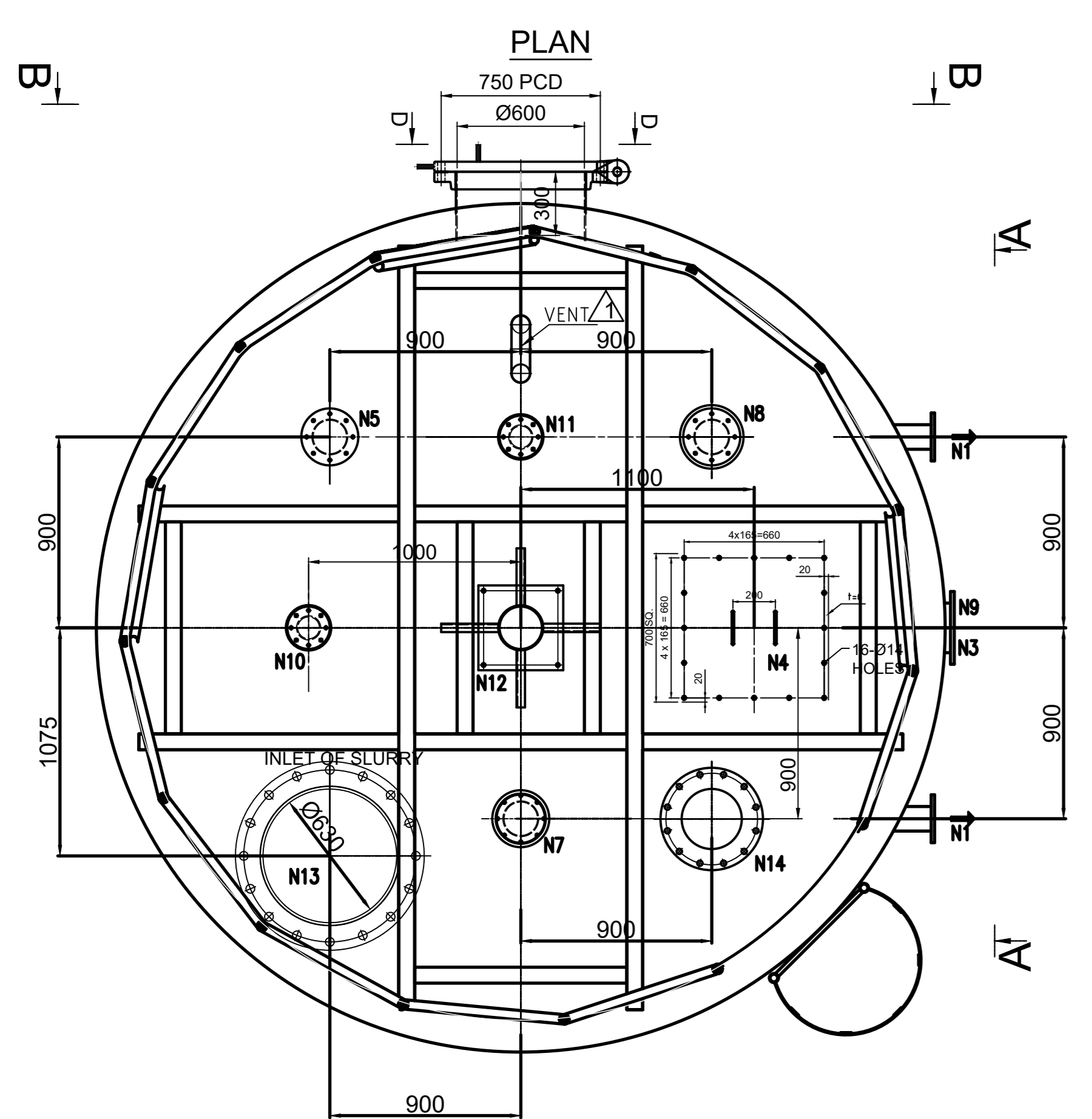
The height between Pump suction nozzles to overflow nozzle is 2.3m as per the tank GA drawing.

Accordingly, the effective capacity of mill circuit tank =  $\pi \times 3.7 \times 3.7 \times 2.3 / 4 = 24.7 \text{ m}^3$ .

The retention time =  $24.7 \text{ m}^3 / 4.85 \text{ m}^3/\text{min} = \sim 5 \text{ minutes}$ .

Based on the tkll standards for close loop operation, this time is sufficient for Wet ball mill circuit.

Hence, the selected tank size is sufficient.

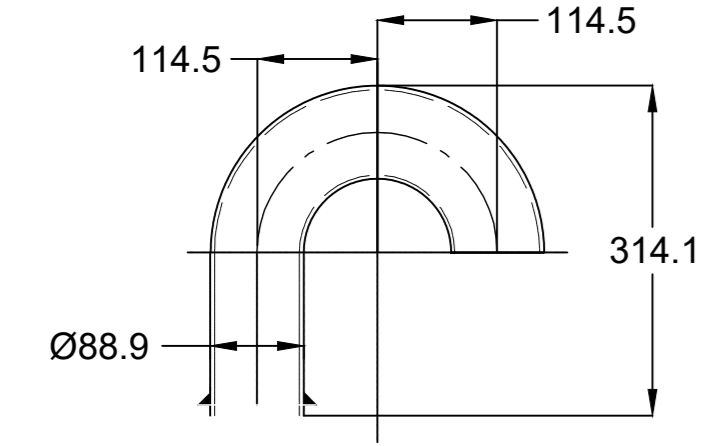
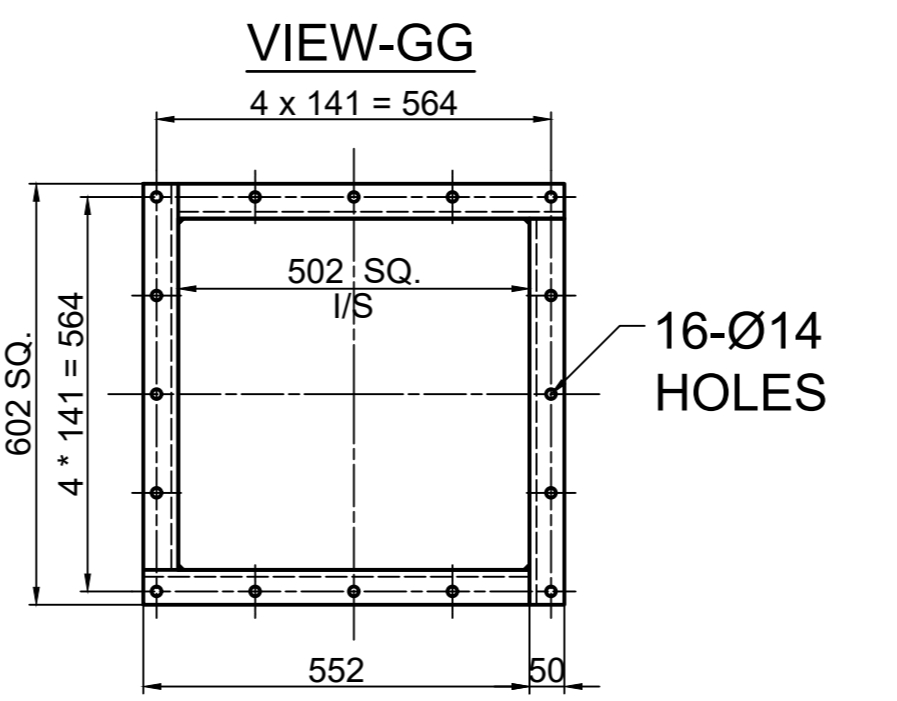
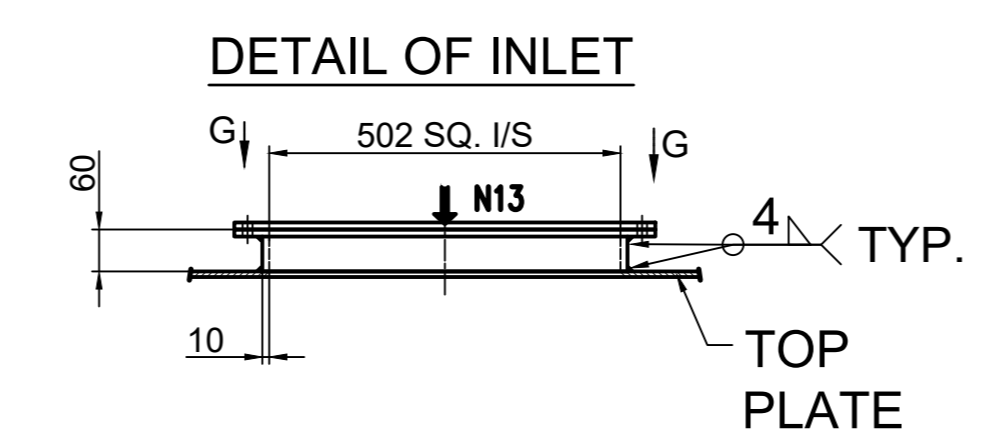
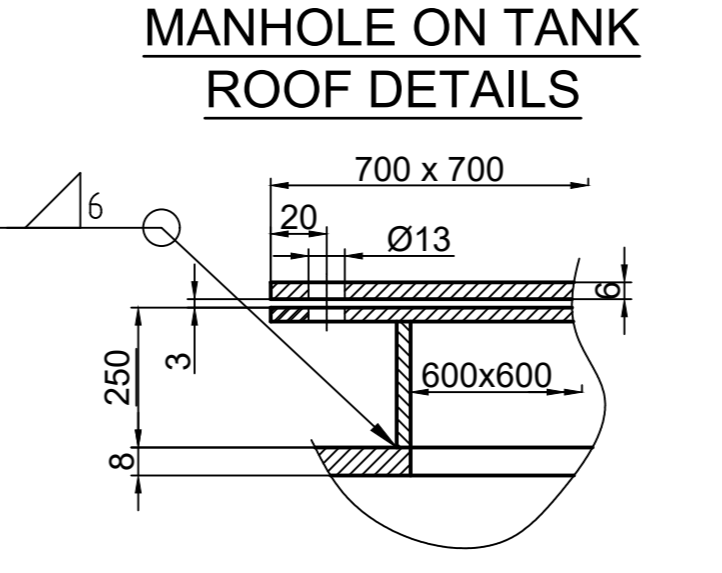
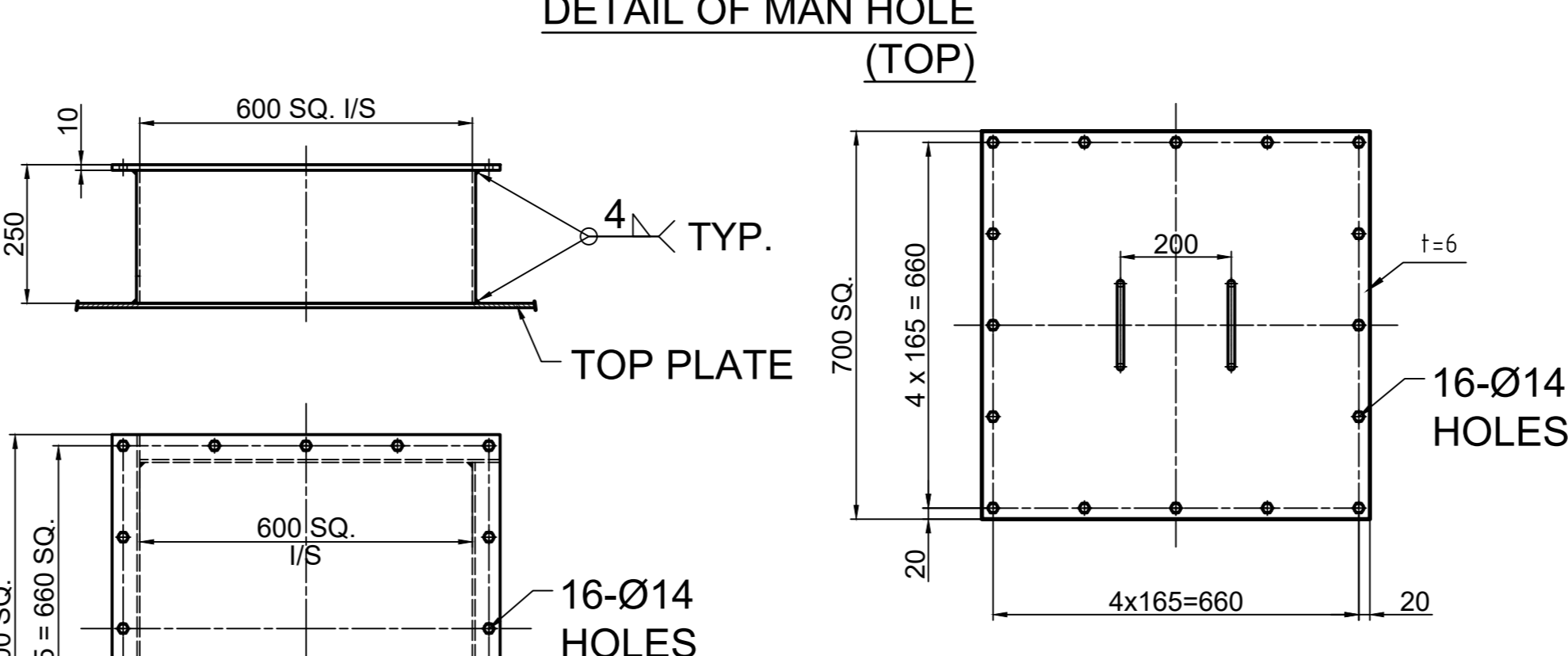
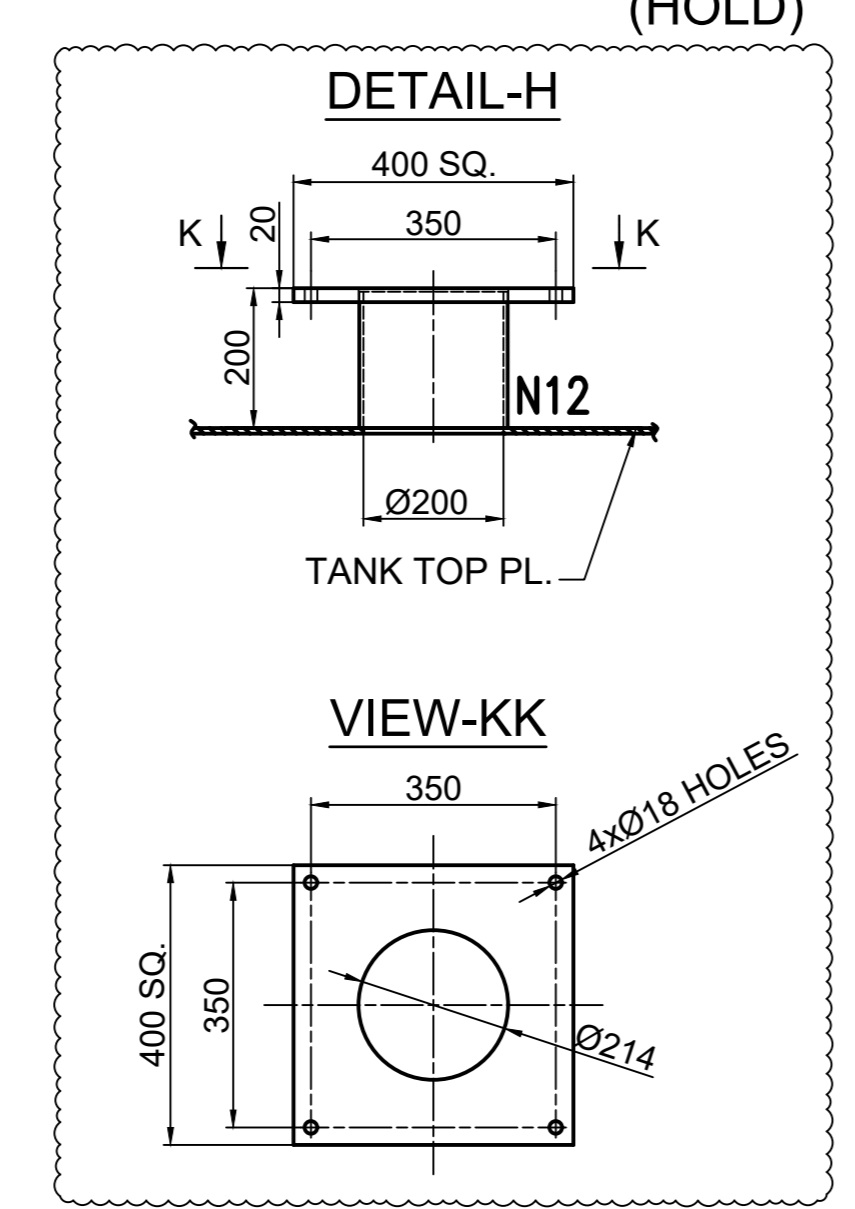
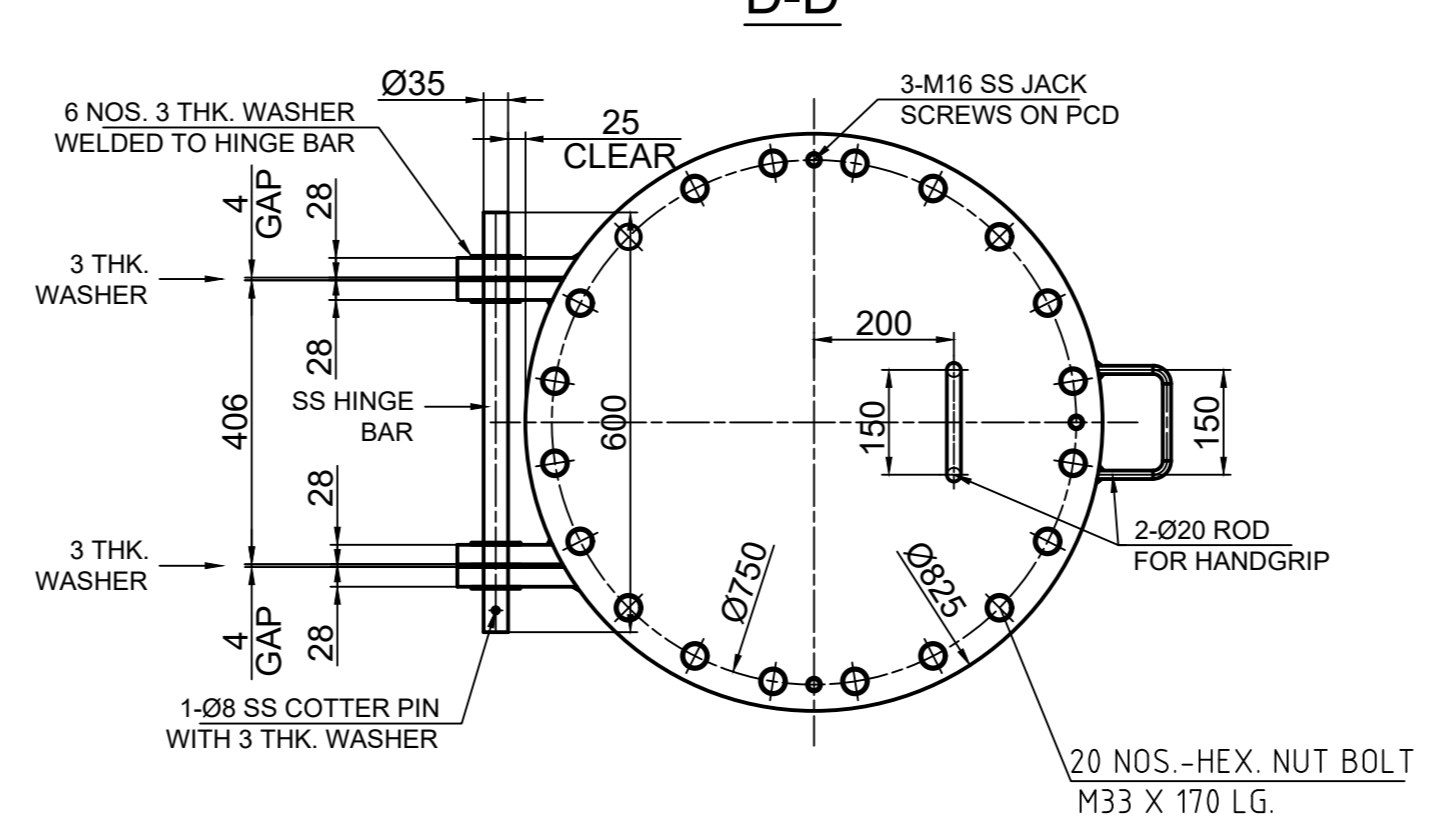
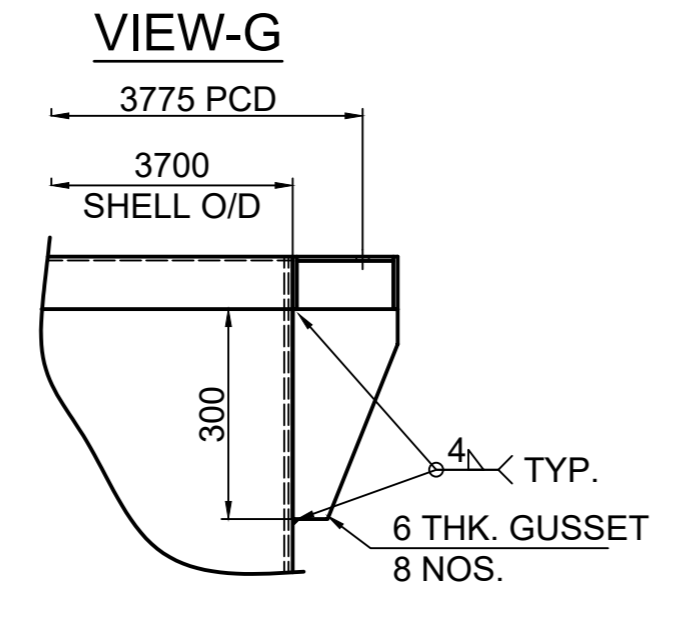
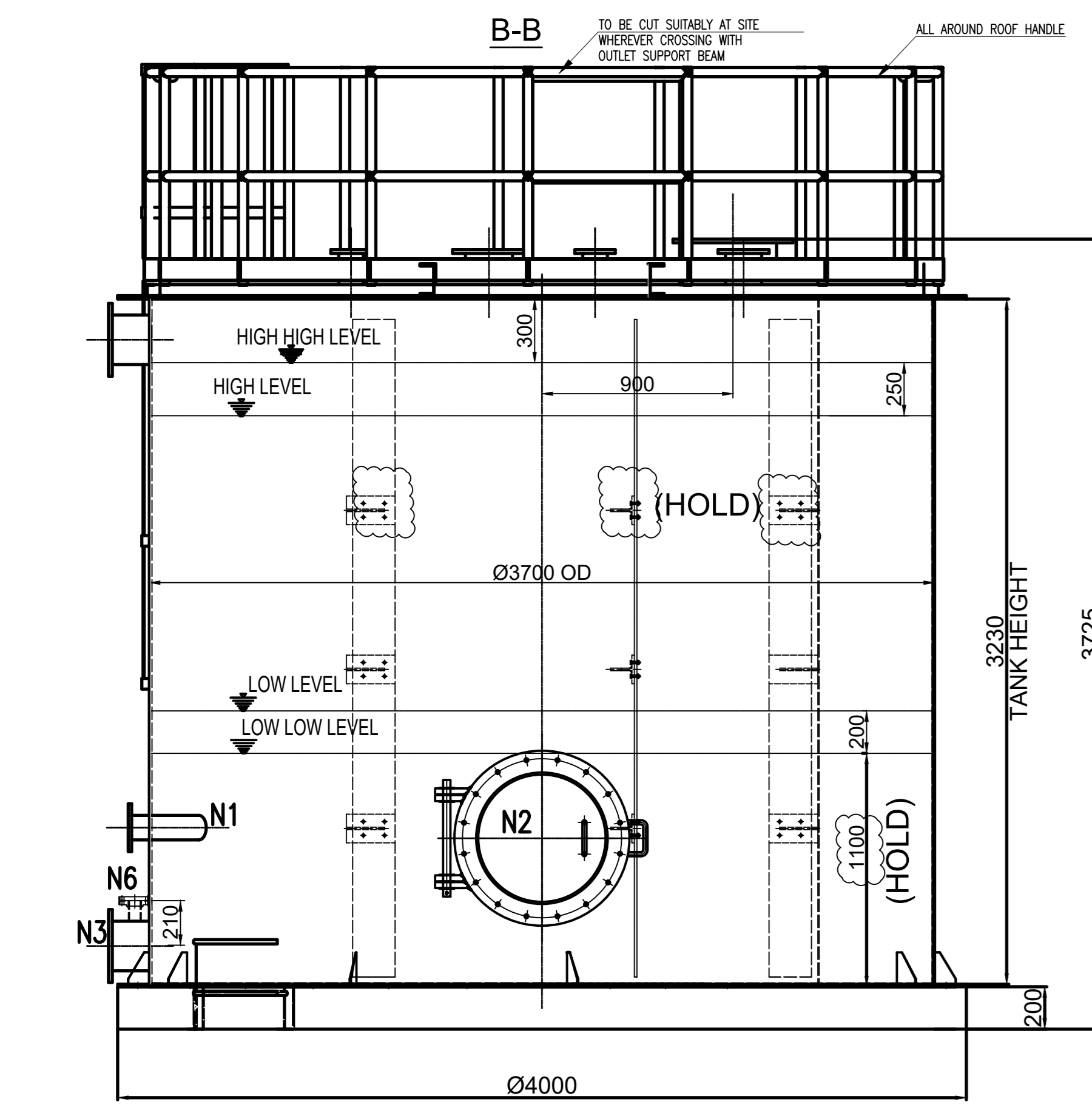


DESIGN DATA	
01 DESIGN CODE	IS: 803
02 TAG NO.	00HTK00B001 & 00HTK00B002
03 QUANTITY	2 NOS.
04 ORIENTATION	VERTICAL
05 DESIGN PRESSURE	ATMOSPHERIC + STATIC (~3300 MM)
06 DESIGN TEMPERATURE	70°
07 OPERATING TEMPERATURE	ATMOSPHERIC
08 OPERATING TEMPERATURE	61°
09 HYDRO TEST PRESSURE	FULL OF WATER
10 FLUID TYPE	LIME STONE SLURRY
11 FLUID DENSITY	1450 kg/m <sup>3</sup>
12 CORROSION ALLOWANCE	1.5 MM
13 POST WELD HEAT TREATMENT	NA
14 JOINT EFFICIENCY	0.7
15 RADIOGRAPHIC REQUIREMENT	NIL
16 EFFECTIVE CAPACITY	22 CU.M
17 TOTAL CAPACITY	32 CU.M
18 WIND DESIGN CODE	IS: 875
19 SEISMIC DESIGN CODE	IS: 1893
20 WEIGHT	
A EMPTY INC. AGITATOR & LINER	5000 KGS.(TENTATIVE)
B OPERATING (UPTO HLL)	30000 KGS(TENTATIVE)

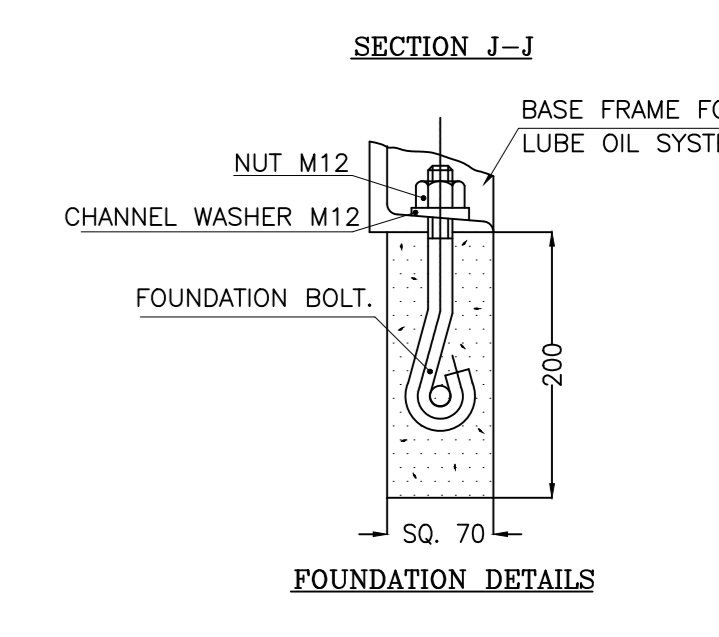
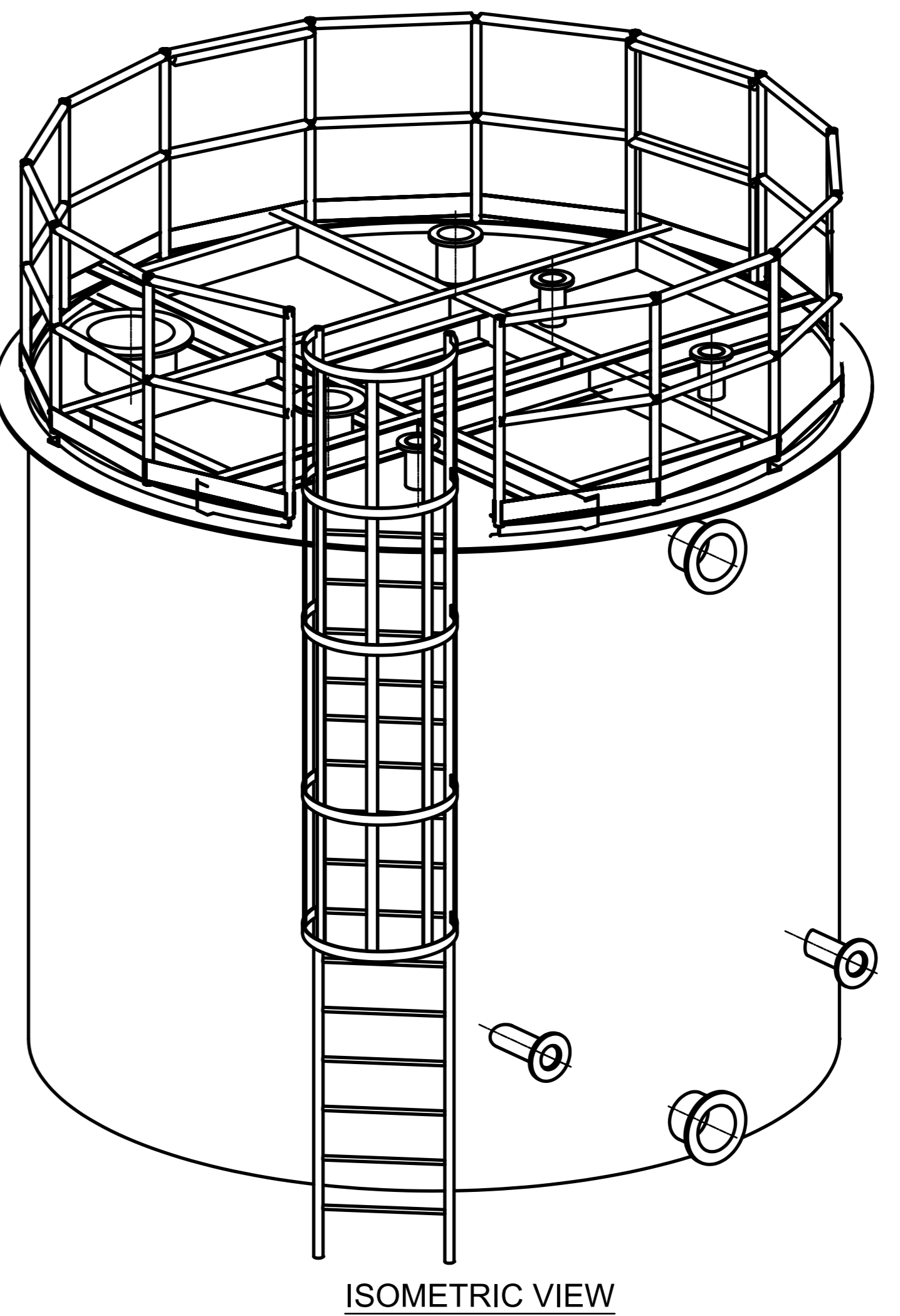
MATERIAL OF CONSTRUCTION		NOZZLE DATA	
		POSITION	LOCATION
01 SHELL /HEADS/R.F. PADS	IS: 2062 E250 GR. BR	N1	PUMP SUCTION (AT SHELL)
02 NOZZLE FROM PLATE	IS: 2062 E250 GR. BR	N2	MAN HOLE (AT SHELL)
03 NOZZLE FROM PIPE	ERW IS:1978	N3	DRAIN PIPE (AT SHELL)
04 NOZZLE FLANGE/BLIND FLANGE	IS:2062	N4	MAN HOLE (ON ROOF)
05 MANHOLE FLANGE	IS: 2062 E250 GR. BR	N5	MAN HOLE (ON ROOF)
06 FITTINGS	A 234 Gr.WPB/ASTM A105/IS: 1239 (UPTO 150 NB)	N6	MAN HOLE (ON ROOF)
07 CASKET	SPIRAL WOUND METALLIC GASKET WITH GRAPHITE FILLER	N7	MAN HOLE (ON ROOF)
08 EARTHING LUG	A240-304	N8	MAN HOLE (ON ROOF)
09 STUDS BOLT/NUTS	A 193 Gr.B7/A 194 Gr.2h	N9	MAN HOLE (ON ROOF)
10 NAME PLATE	ANSI-316	N10	MAN HOLE (ON ROOF)
11 FOUNDATION BOLT	CAST STEEL CR. 8.8	N11	MAN HOLE (ON ROOF)
12 LADDER	IS:2062	N12	MAN HOLE (ON ROOF)
13 HAND RAIL	ERW PIPE, IS:1239	N13	MAN HOLE (ON ROOF)
		N14	MAN HOLE (ON ROOF)

- NOTES:
- ALL DIMENSION ARE IN MM.
  - ALL INTERNAL SURFACES OF LIME SLURRY TANK IS LINED WITH 6MM THK. REPLACEABLE CHLOROBUTYL /BROMOBUTYL RUBBER.
  - ALL FLANGES FACES ARE LINED WITH 6MM THK CHLOROBUTYL /BROMOBUTYL RUBBER.
  - Painting-
 

Surface preparation at shop	Primer at shop	Intermediate	Final	Total DFT (In micrometer)	Paint shade
SA 2 1/2	Epoxy resin based zinc phosphate primer nominal 100 micron @ shop	Epoxy resin based paint pigmented with titanium dioxide or m10 > 100 micron @ shop	Polyamide cured colour pigmented epoxy based paint 75 micron and polyurethane based colour pigmented paint DFT=25 micron(min)	300	RAL-9002, Gray for external body
  - F.F.L. IN THIS AREA CORRESPONDS TO IS EL(+).7.5 M WHICH IS RL. 159.5M.
  - THE SHOWN ARRANGEMENT AS PER DRAWING ARE SAME FOR TANK-A & TANK-B.
  - WEAR LIFE IS NOT LESS THAN 8000 HOURS.



VENT PIPE



REV.	DATE	DESCRIPTION	ISSN	APPD	CHKD	APPRD
01	02.09.2022	REVISED AS PER NTPC COMMENTS	LEJAY	PVS	AMAN	KHRV
00	06.07.2022	ISSUED FOR APPROVAL	LEJAY	PVS	AMAN	KHRV

NTPC DRG NO: 2100-109-PVM-B-204

OWNER/ PROJECT: KOREA SUPER THERMAL POWER PROJECT(SITPP) KORBA LI & III (3X200 MW + 3X500 MW + 1X500 MW) - FGD SYSTEM PACKAGE

BRABAT HEAVY ELECTRICALS LIMITED, UNIT: HEAVY POWER EQUIPMENT PLANT, BRANCH:KORBA/PTPP/TEAM. SYSTEMS/DESIGNER

REV	CODE	NAME	DSH	DATE
01	LEJAY	LEJAY		04.07.2022
02	PVS	PVS		04.07.2022
03	AMAN	AMAN		04.07.2022

TITLE: GENERAL ARRANGEMENT OF MILL CIRCUIT TANK

DRAWING NO. 2100-109-PVM-B-204 SCALE: 1: NTS SHEET 1 OF 1 REV 01



**TITLE:**

**TECHNICAL SPECIFICATIONS FOR  
AGITATORS OF FGD SLURRY TANKS**

**SHEET : 1 OF 1**

**CUSTOMER SPECIFICATION**





**TITLE:**

**TECHNICAL SPECIFICATIONS FOR  
AGITATORS OF FGD SLURRY TANKS**

**SHEET : 1 OF 1**

**CUSTOMER SPECIFICATION:  
TECHNICAL REQUIREMENT**

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	and shall be proven in similar application.			
9.06.00	The pumps shall not be supported below the base plate level for easy withdrawal without entering the sump.			
<b>10.00.00</b>	<b>SLURRY &amp; PROCESS WATER TANKS</b>			
10.01.00	<p>All the slurry tanks (Slurry Tanks, Filtrate Tank, Secondary hydro cyclone feed tank, vacuum receiver tank, Waste water Tank, Lime Neutralization tanks etc.) shall be designed, fabricated, erected and tested in accordance with the IS:803, latest edition. Additional Corrosion allowance of 1.5 mm on the minimum tank shell thickness as calculated by IS:803, latest edition shall be provided by the Contractor. Tanks shall be made from IS:2062 quality mild steel plates of tested quality. The tanks shall be of welded construction. Interior surface of the tanks shall be lined with the following:</p> <p>Wastewater tank, Filtrate tank, Secondary hydro cyclone feed tank: Vinyl Ester based flake glass lining of minimum 3 mm thickness</p> <p>Slurry tanks: Replaceable Chlorobutyl/ Bromobutyl rubber lining of minimum 4 mm thickness</p> <p>The outside surface of the tanks shall be coated with paint as approved by the Employer.</p> <p>Coarse-screen(s) at suction-side of slurry recirculation pumps shall be provided.</p>			
<b>11.00.00</b>	<b>AGITATORS</b>			
11.01.00	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the absorber vessel, limestone mill recycle tanks, limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.			
11.02.00	All agitators shall be designed for continuous operation unless otherwise specified. Horizontal agitators shall be used for Absorber. Vertical agitators can also be used for Absorber, if it is only the standard & proven practice of the Contractor for the offered Absorber design. In other vessels and tanks vertical agitators are also acceptable if they are of proven make and the Bidders standard practice which can be proven by means of suitable references. The design of the agitators shall be of proven type.			
11.03.00	Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, mechanical seal (for side entry agitators), impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.			
11.04.00	All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion.			
11.05.00	The material for the shaft (which is continuously in contact with slurry) and agitator			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.:CS-0011-109(3)-9	PART-B SUB-SECTION-I-M1 (FGD)	PAGE 32 OF 51	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>blades of the Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades shall be made with Alloy 926 or better material &amp; shaft can be rubber lined. This does not release the Contractor of the responsibility for selecting the correct materials.</p>			
11.06.00	<p>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. It shall be possible to remove the sealing devices of the Agitators of the absorber vessel without having to drain completely the absorber.</p>			
11.07.00	<p>To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.</p>			
11.08.00	<p>Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.</p>			
11.09.00	<p>Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.</p>			
11.10.00	<p>All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.</p>			
11.11.00	<p>All exposed moving parts shall be covered by guards.</p>			
11.12.00	<p>Side entry agitator shall be flange mounted.</p>			
11.13.00	<p>The shape of the impeller blades of side entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal &amp; limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.</p>			
11.14.00	<p>Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions</p>			
<b>12.00.00</b>	<b><del>SLURRY LINES AND VALVES</del></b>			
12.01.00	<p><del>Slurry pipes shall be designed to keep the velocity above the settling velocity under all operating conditions. The contractor may provide a recirculation line with motorized isolation valve / restriction orifice made of erosion resistant material for the above purpose.</del></p>			
12.02.00	<p><del>All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The Contractor can provide slurry pipes of size lower than 300 NB made up of FRP material (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same. Outer surface of the pipes should be fire retardant.</del></p>			
12.03.00	<p><del>The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly</del></p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-B SUB-SECTION-I-M1 (FGD)</p>	<p>PAGE 33 OF 51</p>	



**TITLE:**  
  
**TECHNICAL SPECIFICATIONS FOR  
AGITATORS OF FGD SLURRY TANKS**

**SHEET : 1 OF 1**

**CUSTOMER SPECIFICATION: PROJECT SPECIFIC  
GENERAL REQUIREMENTS**



**TITLE:**

**TECHNICAL SPECIFICATIONS FOR  
AGITATORS OF FGD SLURRY TANKS**

**SHEET : 1 OF 1**

**CUSTOMER SPECIFICATION:  
GENERAL TECHNICAL REQUIREMENT**



## GENERAL TECHNICAL REQUIREMENTS

### PART - C

### CONTENTS

<b>Clause No.</b>	<b>Description</b>	<b>Page No.</b>
1.00.00	Introduction	1
2.00.00	Brand Name	1
3.00.00	Base Offer & Alternate Proposals	1
4.00.00	Completeness of Facilities	1
5.00.00	Codes & Standards	2
6.00.00	Equipment Functional Guarantee	4
7.00.00	Design of Facilities/ Maintenance & Availability Considerations	5
8.00.00	Documents, Data and Drawings to be furnished by Contractor	5
9.00.00	Technical Co-ordination Meeting	21
10.00.00	Design Improvements	22
11.00.00	Equipment Bases	22
12.00.00	Protective Guards	22
13.00.00	Lubricants, Servo fluids and Chemicals	23
14.00.00	Lubrication	23
15.00.00	Material of Construction	23
16.00.00	Rating Plates, Name Plates & Labels	23
17.00.00	Tools and Tackles	25
18.00.00	Welding	25

LOT-3 PROJECTS  
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI, PART-C  
BID DOC NO: CS-0011-109(3)-9



<b>Clause No.</b>	<b>Description</b>	<b>Page No.</b>
19.00.00	Colour Code for All equipments/Pipings/PIpeServices	25
20.00.00	Protection and Preserveative shop Coating	25
21.00.00	Quality Assurance Programme	26
22.00.00	General Requirements - Quality Assurance	27
23.00.00	Quality Assurance Documents	32
24.00.00	Project Manager's Supervision	34
25.00.00	Inspection, Testing and Inspection Certificates	34
26.00.00	Pre-commissioning and Commissioning Facilities	37
27.00.00	Taking over	40
28.00.00	Training of Employer's Personnel	40
29.00.00	Safety Aspects during Construction and Erection	41
30.00.00	Noise Level	42
31.00.00	Packaging and Transportation	42
32.00.00	Electrical Equipments/Enclosures	42
33.00.00	Instrumentation and Control	42
34.00.00	Electrical Noise Control	43
35.00.00	Surge protection for solid state equipment	44
36.00.00	Instrument Air System	44
37.00.00	Tapping Points for Measurements	44
38.00.00	System Documentation	44
39.00.00	Maintenance Manuals of Electronic Modules	45


<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC NO: CS-0011-109(3)-9</b>
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<b>Clause No.</b>	<b>Description</b>	<b>Page No.</b>
Annexure - I		76
Annexure - II		77
Annexure - III		78
Annexure - IV		79
Annexure - V		80
Annexure - VI		81
Annexure - VII		83


  


<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION-VI, PART-C BID DOC NO: CS-0011-109(3)-9</b>
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
1.00.00	<p><b>INTRODUCTION</b></p> <p>This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.</p>			
2.00.00	<p><b>BRAND NAME</b></p> <p>Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.</p>			
3.00.00	<p><b>BASE OFFER &amp; ALTERNATE PROPOSALS</b></p> <p>The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognised that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.</p>			
4.00.00	<p><b>COMPLETENESS OF FACILITIES</b></p>			
4.01.00	<p>Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.</p>			
4.02.00	<p>All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.</p> <p>All same standard components/ parts of same equipment provided, shall be interchangeable with one another.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 1 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
4.03.00	For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.			
5.00.00	<b>RULES, REGULATIONS, CODES &amp; STANDARDS</b>			
5.01.00	<p>In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India, NTPC rules/codes of practices as well as of the locality where they will be installed, including the following:</p> <ul style="list-style-type: none"> <li>a) Indian Electricity Act</li> <li>b) Indian Electricity Rules</li> <li>c) Indian Explosives Act</li> <li>d) Indian Factories Act and State Factories Act</li> <li>e) Indian Boiler Regulations (IBR)</li> <li>f) Regulations of the Central Pollution Control Board, India</li> <li>g) Regulations of the Ministry of Environment &amp; Forest (MoEF), Government of India</li> <li>h) Pollution Control Regulations of Department of Environment, Government of India</li> <li>i) State Pollution Control Board.</li> <li>(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).</li> <li>(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996</li> <li>(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998</li> <li>(m.) Explosive Rules, 1983</li> <li>(n.) Petroleum Act, 1984</li> <li>(o.) Petroleum Rules, 1976,</li> </ul>			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 2 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
5.02.00	<p>(p.) Gas Cylinder Rules, 1981</p> <p>(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981</p> <p>(r.) Workmen's Compensation Act, 1923</p> <p>(s.) Workmen's Compensation Rules, 1924</p> <p>(t.) NTPC Safety Rules for Construction and Erection</p> <p>(u.) NTPC Safety Policy</p> <p>(v.) Any other statutory codes / standards / regulations, as may be applicable.</p> <p>Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:</p> <p>a) Bureau of Indian standards (BIS)</p> <p>b) Japanese Industrial Standards (JIS)</p> <p>c) American National Standards Institute (ANSI)</p> <p>d) American Society of Testing and Materials (ASTM)</p> <p>e) American Society of Mechanical Engineers (ASME)</p> <p>f) American Petroleum Institute (API)</p> <p>g) Standards of the Hydraulic Institute, U.S.A.</p> <p>h) International Organisation for Standardisation (ISO)</p> <p>i) Tubular Exchanger Manufacturer's Association (TEMA)</p> <p>j) American Welding Society (AWS)</p> <p>k) National Electrical Manufacturers Association (NEMA)</p> <p>l) National Fire Protection Association (NFPA)</p> <p>m) International Electro-Technical Commission (IEC)/European Norm (EN)</p> <p>n) Expansion Joint Manufacturers Association (EJMA)</p> <p>o) Heat Exchange Institute (HEI)</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 3 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
<p>5.03.00</p> <p>5.04.00</p> <p>5.05.00</p> <p>5.06.00</p> <p>5.07.00</p> <p>5.08.00</p> <p>6.00.00</p> <p>6.01.00</p> <p>6.02.00</p>	<p>p) IEEE standard</p> <p>q) JEC standard</p>	<p>Other International/ National standards such as DIN, JIS, VDI, EN, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.</p> <p>Not used.</p> <p>In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.</p> <p>Two (2) English language copies of all national and international codes and/or standards used in the design of the plant, equipment, civil, structural and architectural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.</p> <p>In case of any change in codes, standards &amp; regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.</p> <p>A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification.</p> <p><b>EQUIPMENT FUNCTIONAL GUARANTEE</b></p> <p>The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.</p> <p>Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.</p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 4 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
7.00.00	<b>DESIGN OF FACILITIES/ MAINTENANCE &amp; AVAILABILITY CONSIDERATIONS</b>			
7.01.00	<p><b>DESIGN OF FACILITIES</b></p> <p>All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.</p> <p>The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.</p>			
7.02.00	<p><b>MAINTENANCE AND AVILABILITY CONSIDERATIONS</b></p> <p>Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.</p> <p>Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours , clearly defining the spare parts and man-hour requirement for each stage.</p> <p>Lifting devices i.e. hoists and chain pulley jacks ,etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.</p> <p>Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.</p>			
8.00.00	<b>DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR</b>			
8.01.00	<p>Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely</p>			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 5 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.02.00	<p>engineered plant shall be provided in respect of mechanical, electrical, control &amp; instrumentation, civil &amp; structural works as per the scope.</p> <p>Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated.</p> <p>The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.</p> <p>A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.</p>			
8.02.00	<p>The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in <b>Annexure-VI</b> to this Part-C, Section-VI of the Technical Specification.</p>			
8.03.00	<p>The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:</p>			
8.03.01	A)	<p><b>BASIC ENGINEERING DOCUMENTATION</b></p> <p>Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:</p>	<ul style="list-style-type: none"> <li>i) System description of all the mechanical, electrical, control &amp; instrumentation &amp; civil systems.</li> <li>ii) Technology scan for each system / sub-system &amp; equipment.</li> <li>iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.</li> <li>iv) Optimisation studies including thermal cycle optimisation.</li> <li>v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins.</li> <li>vi) Schemes and Process &amp; Instrumentation diagrams for the various systems/ sub-system with functional write-ups.</li> </ul>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 6 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>vii) Operation Philosophy and the control philosophy of the equipments/system covered under the scope.</p> <p><del>ix) General Layout plan of the FGD System incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope.</del></p> <p><del>x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the bidder.</del></p> <p>xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.</p> <p>The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed &amp; finalised with the Employer.</p> <p><b>B) DETAILED ENGINEERING DOCUMENTS</b></p> <p><del>i) General layout plan of the FGD System.</del></p> <p>ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.</p> <p>iii) Flow diagram, process and instrumentation diagrams along with write up and system description.</p> <p><del>iv) Performance curves for Absorber</del></p> <p>v) Piping isometric, composite layout and fabrication drawings.</p> <p>vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.</p> <p>vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors.</p> <p>viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like mills, fans etc. as per criteria specified elsewhere in specification.</p> <p><del>ix) Absorber sizing calculations. Absorber performance data.</del></p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 7 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	<p><del>x) Mass Balance Diagram</del></p> <p>xi) Characteristic Curves/ Performance Correction Curves.</p> <p>xii) Comprehensive list of all terminal points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled &amp; end connection details, forces, moments etc.</p> <p>xiii) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.</p> <p>xiv) Protection system diagrams and relay settings.</p> <p>xv) Cables schedules and interconnection diagrams.</p> <p><del>xvii) Cable routing plan.</del></p> <p>xviii) Instrument schedule, measuring point list, I/O list, Interconnection &amp; wiring diagram, functional write-ups, and installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.</p> <p>xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms &amp; trip set points.</p> <p>xx) Sequence and protection interlock schemes.</p> <p>xxi) Type test reports, insulation co-ordination study report</p> <p>xxii) Control system configuration diagrams and card circuit diagrams and maintenance details.</p> <p>xxiii) Detailed Control system manuals.</p> <p>xxiv) Detailed flow chart for digital control system.</p> <p>xv) Mimic diagram layout, Assignment for other application engg. drawings and documents.</p> <p><del>xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super structural works as included in the</del></p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 8 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
8.03.02	<p><del>scope of the bidder civil calculation sheets including structural analysis and design along with output results.</del></p> <p><del>xxvii) Underground facilities, levelling, sanitary, land scaping drawings.</del></p> <p><del>xxviii) Geotechnical investigation and site survey reports (if and as applicable).</del></p> <p>xxix) Model study reports wherever applicable.</p> <p>xxx) Functional &amp; guarantee test procedures and test reports.</p> <p>xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.</p> <p>xxxii) Maintenance schedule for Absorber &amp; auxiliaries clearly indicating interval, duration if shutdown required, manhours required and tools &amp; tackles required for maintenance.</p> <p>The Contractor's while submitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.</p> <p><b>INSTRUCTION MANUALS</b></p> <p>The Contractor shall make first submission of instruction manual for all the equipments covered under the Contract as per agreed engineering information schedule. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in <b>Annexure-IV</b>. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.</p> <p><b>A) ERECTION MANUALS</b></p> <p>The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.</p> <p>a) Erection strategy.</p> <p>b) Sequence of erection.</p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 9 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>c) Erection instructions.</p> <p>d) Critical checks and permissible deviation/tolerances.</p> <p>e) List of tool, tackles, heavy equipments like cranes, dozers, etc.</p> <p>f) Bill of Materials</p> <p>g) Procedure for erection and General Safety procedures to followed during erection/installation.</p> <p>h) Procedure for initial checking after erection.</p> <p>i) Procedure for testing and acceptance norms.</p> <p>j) Procedure / Check list for pre-commissioning activities.</p> <p>k) Procedure / Check list for commissioning of the system.</p> <p>l) Safety precautions to be followed in electrical supply distribution during erection.</p> <p><b>B) OPERATION &amp; MAINTENANCE MANUALS</b></p> <p>a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.</p> <p>b) The arrangement and contents of O &amp; M manuals shall be as follows:</p> <p>1) <u>Chapter 1 - Plant Description</u>: To contain the following sections specific to the equipment/system supplied</p> <p>(a) Description of operating principle of equipment / system with schematic drawing / layouts.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 10 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>(b) Functional description of associated accessories / controls. Control interlock protection write up.</p> <p>(c) Integrated operation of the equipment alongwith the intended system. (This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).</p> <p>(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.</p> <p>(e) Design data against which the plant performance will be compared.</p> <p>(f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.</p> <p>(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).</p> <p>(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).</p> <p>2) <u>Chapter 2.0 - Plant Operation:</u> To contain the following sections specific to the equipment supplied</p> <p>(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.</p> <p>(b) Limiting values of all protection settings.</p> <p>(c) Various settings of annunciation/interlocks provided.</p> <p>(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.</p> <p>(e) Do's and Don'ts related to operation of the equipment.</p> <p>(f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.</p> <p>(g) Parameters to be monitored with normal value and limiting values.</p> <p>(h) Equipment isolating procedures.</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 11 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<ul style="list-style-type: none"> <li>(i) Trouble shooting with causes and remedial measures.</li> <li>(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.</li> <li>(k) Routine Operational Checks, Recommended Logs and Records</li> <li>(l) Change over schedule if more than one auxiliary for the same purpose is given.</li> <li>(m) Preservation procedure on long shut down.</li> <li>(n) System/plant commissioning procedure.</li> </ul> <p>3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied.</p> <ul style="list-style-type: none"> <li>(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. &amp; population.</li> <li>(b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.</li> <li>(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.</li> <li>(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.</li> <li>(e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.</li> <li>(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.</li> <li>(g) Long term maintenance schedules</li> <li>(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.</li> <li>(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly &amp; at</li> </ul>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 12 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.03.03	<p>longer intervals to ensure trouble free operation and quantity required for complete replacement.</p> <p>(j) Tolerance for fitment of various components.</p> <p>(k) Details of sub vendors with their part no. in case of bought out items.</p> <p>(l) List of spare parts with their Part No, total population, life expediency &amp; their interchangeability with already supplied spares to NTPC.</p> <p>(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification &amp; quality plan for fast moving consumable spares.</p> <p>(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.</p> <p>(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.</p> <p>After finalization and approval of the Employer, the O &amp; M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O &amp; M manuals have been supplied to the Employer.</p> <p>If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &amp;M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.</p>			
8.03.03	<b>PLANT HANDBOOK AND PROJECT COMPLETION REPORT</b>			
8.03.03.01	<p><b>PLANT HANDBOOK</b></p> <p>The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including</p> <p>i) Design and performance data.</p> <p>ii) Process &amp; Instrumentation diagrams.</p> <p>iii) Single line diagrams.</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 13 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	iv) Sequence & Protection Interlock Schemes. v) Alarm and trip values. vi) Performance Curves. vii) General layout plan and layout of main plant building and auxiliary buildings viii) Important Do's & Don't's  The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.			
8.03.03.02	<b>PROJECT COMPLETION REPORT</b>  The Contractor shall submit a Project Completion Report at the time of handing over the plant.			
8.03.04	<b>DRAWINGS</b>  a) i) <del>All the FGD plant layouts shall be made in computerised 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check.</del>  ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per <b>Annexure-VI</b> of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC.  Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site.  The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats.  iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per <b>Annexure-VI</b> of Part-C.  iv) Contractor shall prepare the model of all the facilities located in FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE (including all			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 14 OF 83	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>facilities), and any other facility in an integrated &amp; intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, intelligent P&amp;ID correlated with intelligent 3D Model, BOQ, schematics and logic diagrams etc. attached to the respective equipment / systems in the aforesaid 3D model. Contractor shall make a presentation on 3D model every 3 months from LOA to enable NTPC to review the progress of engineering. After the completion of engineering the corresponding complete 3D review model shall be handed over to the employer for its reference.</p> <p>Contractor shall provide 3D model (which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as &amp; when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings of major buildings, structural arrangement drawings and RCC layout drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings.</p> <p>b) All documents/text information shall be in latest version of MS Office / MS Excel / PDF FORMAT as applicable.</p> <p>c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.</p> <p>d) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.</p> <p>e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 15 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Employer. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".</p> <p>Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission. Further, space shall be identified on each drawing for Approval stamp and electronic signature.</p> <p>f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections &amp; dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.</p> <p>g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.</p> <p>h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.</p> <p>i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process &amp; Instrumentation Diagrams and/or the requirements cropping up for draining &amp; venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 16 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Assessing &amp; anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping &amp; equipment erection, subsequent system charging and its effective draining &amp; venting arrangement as per site suitability.</p> <p>j) As Built Drawings</p> <p>After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per <b>Annexure VI</b>.</p> <p>k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems &amp; facilities within his scope of work as well as interface engineering &amp; integration of systems, facilities, equipment &amp; works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.</p> <p>m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.</p> <p>n) The Contractor shall submit drawings in line with the suggestive MDL covered in Part-B, Section-VI of Technical Specification and which shall be duly integrated with approved PERT network.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 17 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.04.00	<p><b>ENGINEERING INFORMATION SUBMISSION SCHEDULE</b></p> <p>Prior to the award of Contract, a Detailed Engineering Information Submission Scheduler/Master Drawing List duly integrated with approved PERT network shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorized into the following parts.</p> <ul style="list-style-type: none"> <li>i) Information that shall be submitted for the approval to the Employer before proceeding further, and</li> <li>ii) Information that would be submitted for Employer's information only.</li> </ul> <p>The Master Drawing List (MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL.</p> <p>The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.</p>			
8.05.00	<p><b>ENGINEERING PROGRESS AND EXCEPTION REPORT</b></p>			
8.05.01	<p>The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including</p> <ul style="list-style-type: none"> <li>a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission</li> <li>b) Drawings which were not submitted as per agreed schedule.</li> </ul>			
8.05.02	<p>The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.</p>			
8.06.00	<p><b>Engineering Co-ordination Procedure</b></p>			
8.06.01	<p>The following principal coordinators will be identified by respective organizations at time of award of contract:</p> <p>NTPC Engineering Coordinator (NTPC EC):</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 18 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.06.02	<p>Name :</p> <p>Designation :</p> <p>Address :</p> <p>a) Postal :</p> <p>b) Telegraphic / e-Mail :</p> <p>c) FAX : TELEPHONE :</p> <p>Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):</p> <p>Name :</p> <p>Designation :</p> <p>Address :</p> <p>a) Postal :</p> <p>b) Telegraphic / e-Mail :</p> <p>c) FAX : TELEPHONE :</p> <p>All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.</p>			
8.06.03	<p>Contractor's/Vendor's Drawing Submission and Approval Procedure:</p> <p>a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings".</p> <p>b) The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.</p> <p>c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 19 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>d) Employer and contractor shall follow their own numbering systems for the drawings. However, Employer shall intimate the contractor, NTPC drawing number on receipt of the first submission of each drawing. Vendor, thereafter, shall indicate NTPC's drawing number in subsequent Submission, in the space provided for this purpose in title plate, in addition to his own drawing number.</p> <p>e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems &amp; facilities within his scope of work as well as interface engineering &amp; integration of systems, facilities, equipment &amp; works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.</p> <p>g) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within four (4) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories :</p> <p>CATEGORY- I:      Approved</p> <p>CATEGORY- II      Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.</p> <p>CATEGORY –III    Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.</p> <p>CATEGORY -IV     For information and records.</p> <p>h) Contractor shall resubmit the drawings approved under Category II, III &amp; IV within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 20 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. <b>Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.</b></p> <p>i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.</p> <p>j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I &amp; IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.</p> <p>k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.</p> <p>l) These comments will be taken care by the contractor while submitting the revised drawing.</p> <p>The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.</p>			
9.00.00	<b>TECHNICAL CO-ORDINATION MEETING</b>			
9.01.00	<p>The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.</p>			
9.02.00	<p>The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing .The</p>			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 21 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.</p>			
9.02.01	<p>The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.</p>			
9.02.02	<p>Should any drawing remain unapproved for more than six (6) weeks after it's first submission ,this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.</p>			
9.03.0	<p>Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.</p>			
10.00.00	<p><b>DESIGN IMPROVEMENTS</b></p> <p>The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.</p> <p>If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.</p>			
11.00.00	<p><b>EQUIPMENT BASES</b></p> <p>A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.</p>			
12.00.00	<p><b>PROTECTIVE GUARDS</b></p> <p>Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 22 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
13.00.00	<b>LUBRICANTS, SERVO FLUIDS AND CHEMICALS</b>			
13.01.00	<p>I. All the first fills of consumables and one years topping requirement of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.</p> <p>Bidder shall supply a quantity not less than 10 % of the full charge or one (1) year topping requirement mentioned above ( whichever is higher) of each variety of lubricants, servo fluids, gases, chemicals etc ( as detailed above) which is expected to be utilized during the first year of operation. The additional quantity shall be supplied in separate container.</p>			
13.02.00	<p>As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.</p> <p>Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.</p>			
14.00.00	<b>LUBRICATION</b>			
14.01.00	<p>Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.</p>			
15.00.00	<b>MATERIAL OF CONSTRUCTION</b>			
15.01.00	<p>All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.</p>			
16.00.00	<b>RATING PLATES, NAME PLATES &amp; LABELS</b>			
16.01.00	<p>Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.</p>			
<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>		<b>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-C GENERAL TECHNICAL REQUIREMENTS</b>	<b>PAGE 23 OF 83</b>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
16.02.00	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.			
16.03.00	Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear side.			
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.			
16.05.00	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support or hanger.			
16.06.00	Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.			
16.07.00	<p>Safety and relief valves shall be provided with the following:</p> <ul style="list-style-type: none"> <li>a) Manufacturer's identification.</li> <li>b) Nominal inlet and outlet sizes in mm.</li> <li>c) Set pressure in Kg/cm<sup>2</sup> (abs).</li> <li>d) Blowdown and accumulation as percentage of set pressure.</li> <li>e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.</li> </ul>			
16.08.00	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.			
16.09.00	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.			
<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>		<b>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-C GENERAL TECHNICAL REQUIREMENTS</b>	<b>PAGE 24 OF 83</b>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
17.00.00	<p><b>TOOLS AND TACKLES</b></p> <p>The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.</p> <p>The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. In case these tools and tackles are used by the Contractor during erection, commissioning or initial operation the same shall be refurbished repaired/replaced as required to the satisfaction of the Employer before handing over to the Employer. All the tools and tackles shall be of reputed make acceptable to the Employer.</p>			
18.00.00	<p><b>WELDING</b></p>			
18.01.00	<p>If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be per formed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.</p>			
19.00.00	<p><b>COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES</b></p>			
19.01.00	<p>All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.</p>			
20.00.00	<p><b>PROTECTION AND PRESERVATIVE SHOP COATING</b></p>			
20.01.00	<p><b>PROTECTION</b></p> <p>All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive &amp; alkaline, subsoil or over ground environment as the case may be. The requirements for</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 25 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>painting specification shall be complied with as detailed out in Part-A &amp; B of the Technical Specification.</p>			
20.02.00	<p><b>PRESERVATIVE SHOP COATING</b></p>			
	<p>All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.</p>			
	<p>Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.</p>			
20.03.00	<p>Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.</p>			
20.04.00	<p>All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.</p>			
20.05.00	<p>All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.</p>			
20.06.00	<p>Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.</p>			
21.00.00	<p><b>QUALITY ASSURANCE PROGRAMME</b></p>			
21.01.00	<p>To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS-14001. A</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 26 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>quality assurance programme of the contractor shall generally cover the following:</p> <ul style="list-style-type: none"> <li>a) His organisation structure for the management and implementation of the proposed quality assurance programme</li> <li>b) Quality System Manual</li> <li>c) Design Control System</li> <li>d) Documentation Control System</li> <li>e) Qualification data for Bidder's key Personnel.</li> <li>f) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.</li> <li>g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.</li> <li>h) Control of non-conforming items and system for corrective actions.</li> <li>i) Inspection and test procedure both for manufacture and field activities.</li> <li>j) Control of calibration and testing of measuring testing equipments.</li> <li>k) System for Quality Audits.</li> <li>l) System for indication and appraisal of inspection status.</li> <li>m) System for authorising release of manufactured product to the Employer.</li> <li>n) System for handling storage and delivery.</li> <li>o) System for maintenance of records, and</li> <li>p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per formats enclosed as <b>Annexure-I</b> and <b>Annexure-II</b> respectively.</li> </ul>			
22.00.00	<b>GENERAL REQUIREMENTS - QUALITY ASSURANCE</b>			
22.01.00	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 27 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-1/F3-R0. Monthly progress reports shall be furnished.</p>			
22.02.00	<p>Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM (As per format at Annexure-I)</p>			
22.03.00	<p>Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site (As per format at Annexure – II).</p>			
22.04.00	<p>The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.</p>			
22.05.00	<p>The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at <b>Annexure-V</b>. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.</p>			
22.06.00	<p>The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP)</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 28 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.</p>			
22.07.00	<p>No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).</p>			
22.08.00	<p>All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details</p>			
22.09.00	<p>All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.</p> <p>All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.</p>			
22.10.00	<p>All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.</p>			
22.11.00	<p>Welding procedure qualification &amp; Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorized representative.</p>			
22.12.00	<p>For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping system ASME B31.1 or other relevant code as applicable shall be followed. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding</p>			
22.13.00	<p>All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.</p>			
22.14.00	<p>No welding shall be carried out on cast iron components for repair.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 29 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
22.15.00	<p>Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.</p>			
22.16.00	<p>All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination) or equivalent. NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.</p> <p>In general all plates of thickness greater than 40mm &amp; for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be ultrasonically tested.</p>			
22.17.00	<p>The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Monthly progress reports on sub-contractor detail submission / approval shall be furnished preferably on enclosed format at <b>Annexure-IV</b>. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.</p>			
22.18.00	<p>For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.</p> <p>Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 30 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
			
22.19.00	<p>monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.</p> <p>Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.</p>		
22.20.00	<p>The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.</p>		
22.21.00	<p>Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.</p>		
22.22.00	<p>For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.</p>		
22.23.00	<p>Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.</p>		
22.24.00	<p><b>Environmental Stress Screening</b></p> <p><del>Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system &amp; for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be necessarily furnished for any sub vendors proposed for vendor assessment and approval for this contract. For other approved sub vendors of above mentioned systems, contractor shall furnish the test procedure for eliminating infant mortile components in case, if it is asked for by the employer before these items are offered for inspection / dispatched to site.</del></p>		
22.25.00	<p>The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine &amp; acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.</p>		
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 31 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
22.26.00	<p><del><b>Software Reliability / Quality Certification</b></del></p> <p><del>Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of <math>\beta</math>-version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.</del></p>			
23.00.00	<p><b>QUALITY ASSURANCE DOCUMENTS</b></p>			
23.01.00	<p>The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick ( ✓ )mark.</p>			
23.01.01	<p>Each QA Documentation shall have a project specific Cover Sheet bearing name &amp; identification number of equipment and including an index of its contents with page control on each document.</p> <p>The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.</p> <p>The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD-Rom may be issued not later than three weeks.</p>			
23.02.00	<p>Typical contents of QA Documentation is as below:-</p> <ul style="list-style-type: none"> <li>(a.) Quality Plan</li> <li>(b.) Material mill test reports on components as specified by the specification and approved Quality Plans.</li> <li>(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.</li> <li>(d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.</li> <li>(e.) Heat Treatment Certificate/Record (Time- temperature Chart)</li> <li>(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).</li> <li>(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.</li> </ul>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 32 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
<p>23.03.00</p> <p>23.04.00</p> <p>23.05.00</p>	<p>(h.) Certificate of Conformance (COC) wherever applicable.</p> <p>(i.) MDCC</p> <p>Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.</p> <p>Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.</p> <p>(a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.</p> <p>(b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.</p> <p>(c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions &amp; submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the despatch of equipment.</p> <p><b>TRANSMISSION OF QA DOCUMENTATION</b></p> <p>On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.</p> <p>For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 33 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
24.00.00	<b>PROJECT MANAGER'S SUPERVISION</b>			
24.01.00	To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.			
24.02.00	<p>The work shall be performed under the supervision of the Project Manager.</p> <p>The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>(a.) Interpretation of all the terms and conditions of these documents and specifications</li> <li>(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc</li> <li>(c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract</li> <li>(d.) Inspect, accept or reject any equipment, material and work under the contract</li> <li>(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates</li> <li>(f.) Review and suggest modifications and improvement in completion schedules from time to time, and</li> <li>(g.) Supervise Quality Assurance Programme implementation at all stages of the works.</li> </ul>			
25.00.00	<b>INSPECTION, TESTING AND INSPECTION CERTIFICATES</b>			
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.			
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 34 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.</p>			
25.03.00	<p>The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.</p>			
25.04.00	<p>The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.</p>			
25.05.00	<p>When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.</p>			
25.06.00	<p>In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.</p>			
25.07.00	<p>The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 35 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
25.08.00	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 25.03.00 of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.			
25.09.00	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.			
25.10.00	<b>Associated document for Quality Assurance programme</b>			
25.10.01	Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at <b>Annexure-I.</b>			
25.10.02	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at <b>Annexure-II.</b>			
25.10.03	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 ( <b>Annexure-III</b> ).			
25.10.04	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at <b>Annexure-IV.</b>			
25.10.05	Field Welding Schedule Format enclosed at <b>Annexure-V.</b>			
25.11.00	<b>Not Used</b>			
25.12.00	<b>DEMONSTRATION OF APPLICATION ENGINEERING</b>			
25.12.01	<p>Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system &amp; HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.</p> <p>(i) Logics/Loops:</p> <ul style="list-style-type: none"> <li>a) Drive logics implementation for each type of binary drive along with its display in HMI.</li> <li>b) Sequence implementation along with its display in HMI.</li> <li>c) Single non-cascade controller implementation.</li> <li>d) Cascade loop implementation.</li> </ul>			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 36 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
25.12.02	<p>e) Master slave implementation with different slave combination.</p> <p>f) Temperature &amp; pressure compensation for flow signals &amp; pressure compensation for level signals as applicable.</p> <p>(ii) HMI Functions:</p> <p>a) LVS Annunciation.</p> <p>b) Graphics.</p> <p>c) HSR</p> <p>d) Logs/Reports.</p> <p>e) Calculations ( Basic &amp; Performance Calculations).</p> <p>The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.</p> <p>After review and finalization of the typical cases, the implementation of each logic &amp; control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics &amp; loops, the Contractor shall test each logic /loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises &amp; the results shall be documented as part of test report.</p>			
25.12.03	<p>During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.</p>			
26.00.00	<p><b>PRE-COMMISSIONING AND COMMISSIONING FACILITIES</b></p>			
26.01.00	<p>(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 37 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
26.01.00	<p>(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.</p> <p>(c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.</p> <p>(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.</p> <p>(e) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs(standard check list)/TS(testing schedule)/CS(commissioning schedule)] approved by the employer.</p> <p>(f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.</p> <p>Contractor shall furnish the commissioning organization chart for review &amp; acceptance of employer at least twelve months prior to the schedule date of commissioning of 1st unit. The chart should contain:</p> <p>(1.) Biodata including experience of the Commissioning Engineers.</p> <p>(2.) Role and responsibilities of the Commissioning Organisation members.</p> <p>(3.) Expected duration of posting of the above Commissioning Engineers at site.</p>			
26.02.00	<p><b>Initial Operation</b></p> <p>(a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 38 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
26.03.00	<p>which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.</p> <p>(b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the FGD System shall operate continuously at full load for a period not less than 72 hours.</p> <p>The Initial Operation shall be considered successful, provided that each item/part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.</p> <p>The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.</p> <p>(c) Any operational interruption in the FGD System due to constraints attributable to the Employer shall be construed as Deemed to be in operation.</p> <p>(d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.</p> <p><b>Guarantee Tests</b></p> <p>a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up Engineer shall make the unit ready to conduct such test before start of initial operation. Such test shall be conducted along with the Initial Operations.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 39 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.</p> <p>c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.</p> <p>d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.</p> <p>e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.</p>			
27.00.00	<p><b>TAKING OVER</b></p> <p>Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be with held nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.</p>			
28.00.00	<p><b>TRAINING OF EMPLOYER'S PERSONNEL</b></p>			
28.01.00	<p><b>Training for Employers O&amp;M Personnel</b></p> <p>The scope of service under training of Employer's engineers shall include a training module covering upto six (6) man months in the areas of Operation &amp; Maintenance.</p> <p>Such training should enable the personnel to individually take the responsibility of operating and maintaining the FGD system in a manner acceptable to the Employer.</p>			
28.02.00	<p><b>Training for Employers Engineering Personnel</b></p> <p>The scope of services under training for Employer's engineering personnel shall also necessarily include three (3) man months. This shall cover all disciplines viz, Mechanical, Electrical, C&amp;I, &amp; QA etc. and shall include all the related areas like</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 40 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
30.00.00	<p><b>NOISE LEVEL</b></p> <p>The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA . However for Ball Mills the noise levels as per following shall also be acceptable:</p> <p>a) Ball Mill &lt; 90 dBA</p>			
31.00.00	<p><b>PACKAGING AND TRANSPORTATION</b></p> <p>All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting &amp; preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.</p>			
32.00.00	<p><b>ELECTRICAL EQUIPMENTS/ENCLOSURES</b></p>			
32.01.00	<p>All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.</p>			
33.00.00	<p><b>INSTRUMENTATION AND CONTROL</b></p> <p>All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.</p>			
33.01.00	<p>All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.</p> <p>All scales and charts shall be calibrated and printed in Metric Units as follows:</p> <p>1 Temperature - Degree centigrade (deg C)</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 42 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<del>2. Pressure</del> <del>3. Draught</del> <del>4. Vacuum</del> <del>5. Flow (Gas)</del> <del>6. Flow (Steam)</del> <del>7. Flow (Liquid)</del> <del>8. Flow base</del> <del>9. Density</del>		<ul style="list-style-type: none"> <li>- Kilograms per square centimetre (Kg/cm<sup>2</sup>). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.</li> <li>- Millimetres of water column (mm wc).</li> <li>- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).</li> <li>- Tonnes/ hour</li> <li>- Tonnes/ hour</li> <li>- Tonnes / hour</li> <li>- 760 mm Hg. 0 deg.C</li> <li>- Grams per cubic centimeter.</li> </ul>	
33.02.00	All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.			
33.03.00	All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.			
34.00.00	<p><b>ELECTRICAL NOISE CONTROL</b></p> <p>The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).</p>			
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 43 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
35.00.00	<p><b>SURGE PROTECTION FOR SOLID STATE EQUIPMENT</b></p> <p>All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.</p>			
36.00.00	<p><del><b>INSTRUMENT AIR SYSTEM</b></del></p> <p>The instrument air supply system as supplied by the Bidder for various pneumatic control &amp; instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.</p> <p>Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.</p>			
37.00.00	<p><b>TAPPING POINTS FOR MEASUREMENTS</b></p> <p>Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.</p> <p>For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted.</p> <p>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.</p> <ul style="list-style-type: none"> <li>i) Temperature test pockets with stub and thermowell</li> <li>ii) Pressure test pockets</li> </ul>			
38.00.00	<p><del><b>SYSTEM DOCUMENTATION</b></del></p> <p>The Bidder shall provide drawings, system overview &amp; description, hardware/software details, technical literature, functional &amp; hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C&amp; I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&amp;I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation &amp; Maintenance (including quick diagnostics &amp; trouble shooting) of these C&amp;I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&amp;I systems shall be as stipulated under C&amp;I</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 44 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
38.01.00	<p>"Technical Data Sheets" Part of specifications. In addition to this, system documentation for control system shall include as a minimum to that specified elsewhere in the Technical Specification.</p> <p>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.</p> <p>Bill of material (instrument list) for all C&amp;I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.</p>			
39.00.00	<p><b>MAINTENANCE MANUALS OF ELECTRONIC MODULES</b></p> <p>The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further , the contractor shall furnish a set of operating manuals which should include block diagrams ,make, model/type ,details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 45 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
<b>LIST OF CODES AND STANDARDS</b>				
	<b>Indian Standards</b>	<b>Title</b>	<b>International and Internationally recognised standards</b>	
	IS:277	Galvanised steel sheets (plain or corrugated)		
	IS:655	Specification for metal air duct		
	IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952	
	IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc.No. BU/4 Rev	
	IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV  Design section 4.1	
<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-C GENERAL TECHNICAL REQUIREMENTS</b>	<b>PAGE 46 OF 83</b>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)	
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
	IS:2825	Code for unfired vessels		
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water		
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose		
	IS:1601	Specification for performance of constant speed IC Engines for general Purpose		
	IS:1893	Criteria for earthquake resistant design of structures		
	IS1978-1971	Line Pipe April 1969.	API Standards 5L	
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954	
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968	
	IS:2312	Propellant type Ventilation fans		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957	
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 47 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>IS:3346</p> <p>IS:3354</p> <p>IS:3401</p> <p>IS:3588</p> <p>IS:3589</p> <p>IS:3677</p> <p>IS:3815</p> <p>IS:3895</p> <p>IS:3963</p> <p>IS:3975</p> <p>IS:4503</p>	<p>Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)</p> <p>Outline dimensions for electric lifts.</p> <p>Silica gel</p> <p>Specification for electrical axial flow fans</p> <p>Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)</p> <p>Unbonded rock and slag wool for thermal insulation</p> <p>Point hook with shank for general engineering purposes</p> <p>Specification for monocrystalline semiconductor rectifier cells and stacks</p> <p>Roof extractor unit</p> <p>Mild steel wires, strips and tapes for armouring cables</p> <p>Shell and tube type heat Exchanger</p>	<p>DIN 52612 (Deutscher Normenausschuss)</p> <p>ASTM C 163-1964 (American Society of Testing and materials)</p> <p>ASTM C 167-1974</p> <p>ASTM C 177-1963</p> <p>BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 48 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
IS:4540	Specification for monory-stallines rectifire assembly equipment		
IS:4671	Expanded polystyrene for thermal insulation purpose		
IS:4736	Hot dip zinc coating on steel tubes		
IS:4894	Centrifugal fans		
IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)		
IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958	
IS:6392	Steel pipe flanges	BS 4504 : 1969	
IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956	
IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524	
IS:7373	Specification for wrought aluminium and aluminium sheet and strips		
IS:7938	Air receivers for compressed air installation		
ISO:1217	Displacement compressor-Acceptance test		
ASHRAE-33 and air heating coils.	Methods of testing for rating of forced circulation air cooling		
ASHRAE-52-76	Air cleaning device used in general ventilation for removing particle matter.		
<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-C GENERAL TECHNICAL REQUIREMENTS</b>	<b>PAGE 49 OF 83</b>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>ASHRAE-22-72</p> <p>ASHRAE 23-67</p> <p>ARI-450-6</p> <p>ARI-550</p> <p>ARI-410</p> <p>ARI-430/435 BS:848 (Part-1,2)</p> <p>BS:400</p> <p>BS:401</p> <p>CTI Code ACT-105</p> <p>ANSI-31.5</p> <p>ASME-PTC- 23-1958</p> <p>AMCA A-21C</p> <p>API:618</p> <p>HYDRAULIC INSTITUTE STANDARDS.</p> <p>HYDRANT SYSTEM MANUALS OF TAC.</p> <p>TAC MANUALS OF SPRAY SYSTEM</p> <p>NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.</p> <p>INDIAN EXPLOSIVES ACT.</p> <p>INDIAN FACTORIES ACT.</p> <p>STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.</p>	<p>Method of testing for rating of water cooled refrigerant condensers.</p> <p>Methods of testing for rating of positive displacement refrigerant compressors.</p> <p>Standard for water cooled refrigerant condensers.</p> <p>Standard for centrifugal water chilling packages.</p> <p>Standard for forced circulation air cooling and air heating coils</p> <p>Central station AHU/Application of Central Station AHU Fans</p> <p>Low carbon steel cylinders for the storage &amp; transport of permanent gases.</p> <p>Low carbon steel cylinders for the storage &amp; transport of liquified gases.</p> <p>Acceptance test code for Water Cooling Tower.</p> <p>Refrigerant piping</p> <p>Atmospheric Water Cooling Equipment</p> <p>Test Code for air moving devices</p> <p>Reciprocating Compressor for general refinery services.</p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 50 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p><b>CODE AND STANDARD FOR CIVIL WORKS</b></p> <p>Some of the applicable Standards, Codes and references are as follows:</p> <p><b>Excavation &amp; Filling</b></p> <p>IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.</p> <p>IS: 4701                    Code of practice for earth work on canals.</p> <p>IS: 9758                    Guide lines for Dewatering during construction.</p> <p>IS: 10379                  Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.</p> <p><b>Properties, Storage and Handling of Common Building Materials</b></p> <p>IS: 269                    Specification for ordinary Portland cement, 33 grade.</p> <p>IS: 383                    Specification for coarse and fine aggregates from natural sources for concrete.</p> <p>IS: 432                    Specification for mild steel and (Parts 1&amp;2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.</p> <p>IS: 455                    Specification for Portland slag cement.</p> <p>IS: 702                    Specification for Industrial bitumen.</p> <p>IS: 712                    Specification for building limes.</p> <p>IS: 808                    Rolled steel Beam channel and angle sections.</p> <p>IS: 1077                  Specification for common burnt clay building bricks.</p> <p>IS: 1161                  Specification of steel tubes for structural purposes.</p> <p>IS: 1363                  Hexagon head Bolts, Screws and nuts of production grade C.</p> <p>IS: 1364                  Hexagon head Bolts, Screws and Nuts of Production grade A &amp; B.</p> <p>IS: 1367                  Technical supply conditions for Threaded fasteners.</p> <p>IS: 1489                  Specification for Portland-pozzolana cement: (Part-I)                  Fly ash based.</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 51 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part-II)  IS: 1542  IS: 1566  IS: 1786  IS: 2062  IS: 2116  IS: 2386 (Parts-I to VIII)  IS: 3150  IS: 3495 (Parts-I to IV)  IS: 3812  IS: 4031  IS: 4032  IS: 4082  IS: 8112  IS: 8500  IS: 12269  IS: 12894  <b>Cast-In-Situ Concrete and Allied Works</b>  IS: 280  IS: 456	Calcined clay based.  Specification for sand for plaster.  Specification for hard-drawn steel wire fabric for concrete reinforcement.  Specification for high strength deformed bars for concrete reinforcement.  Specification for steel for general structural purposes.  Specification for sand for masonry mortars.  Testing of aggregates for concrete.  Hexagonal wire netting for general purpose.  Methods of tests of burnt clay building bricks.  Specification for fly ash, for use as pozzolana and admixture.  Methods of physical tests for hydraulic cement.  Methods of chemical analysis of hydraulic cement.  Recommendations on stacking and storage of construction materials at site.  Specification for 43 grade ordinary portland cement.  Medium and high strength structural steel.  53 grade ordinary portland cement.  Specification for Fly ash lime bricks.  Specification for mild steel wire for general engineering purposes.  Code of practice for plain and reinforced concrete.	
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 52 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS: 457</p> <p>IS: 516</p> <p>IS: 650</p> <p>IS: 1199</p> <p>IS: 1791</p> <p>IS: 1838 (Part-I)</p> <p>IS: 2204</p> <p>IS: 2210</p> <p>IS: 2438</p> <p>IS: 2502</p> <p>IS: 2505</p> <p>IS: 2506</p> <p>IS: 2514</p> <p>IS: 2645</p> <p>IS: 2722</p> <p>IS: 2750</p> <p>IS: 2751</p> <p>IS: 3025</p> <p>IS: 3366</p> <p>IS: 3370</p>	<p>Code of practice for general construction of plain &amp; reinforced concrete for dams &amp; other massive structures.</p> <p>Method of test for strength of concrete.</p> <p>Specification for standard sand for testing of cement.</p> <p>Methods of sampling and analysis of concrete.</p> <p>General requirements for batch type concrete mixers.</p> <p>Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).</p> <p>Code of practice for construction of reinforced concrete shell roof.</p> <p>Criteria for the design of reinforced concrete shell structures and folded plates.</p> <p>Specification for roller pan mixer.</p> <p>Code of practice for bending and fixing of bars for concrete reinforcement.</p> <p>General requirements for concrete vibrators, immersion type.</p> <p>General requirements for concrete vibrators, screed board type.</p> <p>Specification for concrete vibrating tables.</p> <p>Specification for Integral cement water proofing compounds.</p> <p>Specification for portable swing weigh batches for concrete. (single and double bucket type)</p> <p>Specification for Steel scaffolding.</p> <p>Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.</p> <p>Methods of sampling and test waste water.</p> <p>Specification for Pan vibrators.</p> <p>Code of practice for concrete structures for the storage of</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 53 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part I to IV)  IS: 3414  IS: 3550  IS: 3558 concrete.  IS: 4014 (Parts I & II)  IS: 4326 of buildings.  IS: 4461  IS: 4656  IS: 4925  IS: 4990  IS: 4995 (Parts I & II)  IS: 5256  IS: 5525 concrete work.  IS: 5624  IS: 6461  IS: 6494  IS: 6509  IS: 7861  IS: 9012  IS: 9103	liquids.  Code of practice for design and installation of joints in buildings.  Methods of test for routine control for water used in industry.  Code of practice for use of immersion vibrators for consolidating concrete.  Code of practice for steel tubular scaffolding.  Code of practice for earthquake resistant design and construction of buildings.  Code of practice for joints in surface hydro-electric power stations.  Specification for form vibrators for concrete.  Specification for batching and mixing plant.  Specification for plywood for concrete shuttering work.  Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.  Code or practice for sealing joints in concrete lining on canals.  Recommendations for detailing of reinforcement in reinforced concrete work.  Specification for foundation bolts.  Glossary of terms relating to cement concrete.  Code of practice for water proofing of underground water reservoirs and swimming pools.  Code of practice for installation of joints in concrete pavements.  Code of practice for extreme weather concreting. (Parts I & II)  Recommended practice for shot concreting.  Specification for admixtures for concrete.	
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 54 OF 83


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS: 9417</p> <p>IS: 10262</p> <p>IS: 11384</p> <p>IS: 11504</p> <p>IS: 12118</p> <p>IS: 12200</p> <p>IS: 13311</p> <p>Part-1</p> <p>Part-2</p> <p>SP:23</p> <p>SP: 24</p> <p>SP: 34</p> <p><b>Precast Concrete Works</b></p> <p>SP: 7(PartVI/</p> <p>IS: 10297</p> <p>IS: 10505</p> <p><b>Masonry and Allied Works</b></p> <p>IS: 1905</p> <p>IS: 2212</p>	<p>Recommendations for welding cold worked steel bars for reinforced concrete construction.</p> <p>Recommended guidelines for concrete mix design.</p> <p>Code of practice for composite construction in structural steel and concrete.</p> <p>Criteria for structural design of reinforced concrete natural draught cooling towers.</p> <p>Specification for two-parts poly sulphide.</p> <p>Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.</p> <p>Method of non-destructive testing of concrete.</p> <p>Ultrasonic pulse velocity.</p> <p>Rebound hammer.</p> <p>Handbook of concrete mixes</p> <p>Explanatory Handbook on IS: 456-1978</p> <p>Handbook on concrete reinforcement and detailing.</p> <p>National Building Code- Structural design of prefabrication and Sec.7) systems building.</p> <p>Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.</p> <p>Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.</p> <p>Code of Practice for Structural Safety of Buildings-Masonry walls.</p> <p>Code of Practice for Brickwork.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 55 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.	
	SP: 20	Explanatory hand book on masonry code.	
	<b>Sheeting Works</b>		
	IS:277	Galvanised steel sheets (plain or corrugated).	
	IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.	
	IS: 513	Cold-rolled carbon steel sheets.	
	IS: 730	Specification for fixing accessories for corrugated sheet roofing.	
	IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.	
	IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.	
	IS: 3007	Code of practice for laying of asbestos cement sheets.	
	IS: 5913	Methods of test for asbestos cement products.	
	IS: 7178	Technical supply conditions for tapping screw.	
	IS: 8183	Bonded mineral wool.	
	IS: 8869	Washers for corrugated sheet roofing.	
	IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.	
	IS: 12866	Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).	
	IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.	
	<b>Fabrication and Erection of Structural Steel Work</b>		
	IS: 2016	Specification for plain washers.	
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 56 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS: 814</p> <p>IS: 1852</p> <p>IS: 3502</p> <p>IS: 6911</p> <p>IS: 3757</p> <p>IS: 6623</p> <p>IS: 6649</p> <p>IS: 800</p> <p>IS: 816</p> <p>IS: 4000</p> <p>IS: 9595</p> <p>IS: 817</p> <p>IS: 1811</p> <p>IS: 9178</p> <p>IS: 9006</p> <p>IS: 7215</p> <p>IS: 12843</p> <p>IS: 4353</p> <p>SP: 6 (Part 1 to 7)</p>	<p>Specification for covered Electrodes for Metal Arc Welding for weld steel.</p> <p>Specification for Rolling and Cutting Tolerances for Hot rolled steel products.</p> <p>Specifications for chequered plate.</p> <p>Specification for stainless steel plate, sheet and strip.</p> <p>Specification for high strength structural bolts</p> <p>Specification for high strength structural nuts.</p> <p>High Tensile friction grip washers.</p> <p>Code of practice for use of structural steel in general building construction.</p> <p>Code of practice for use of Metal Arc Welding for General Construction.</p> <p>Code of practice for assembly of structural joints using high tensile friction grip fasteners.</p> <p>Code of procedure of Manual Metal Arc Welding of Mild Steel.</p> <p>Code of practice for Training and Testing of Metal Arc Welders.</p> <p>Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).</p> <p>Criteria for Design of steel bins for storage of Bulk Materials.</p> <p>Recommended Practice for Welding of Clad Steel.</p> <p>Tolerances for fabrication steel structures.</p> <p>Tolerance for erection of structural steel.</p> <p>Recommendations for submerged arc welding of mild steel and low alloy steels.</p> <p>ISI Hand book for structural Engineers.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 57 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS: 1608</p> <p>IS: 1599</p> <p>IS : 228</p> <p>IS : 2595</p> <p>IS : 1182</p> <p>IS : 3664</p> <p>IS : 3613</p> <p>IS : 3658</p> <p>IS : 5334</p> <p><b>Plastering and Allied Works</b></p> <p>IS : 1635</p> <p>IS : 1661</p> <p>IS : 2333</p> <p>IS : 2402</p> <p>IS : 2547</p> <p>IS : 3150</p> <p><b>Acid and Alkali Resistant Lining</b></p> <p>IS : 158</p> <p>IS : 412</p>	<p>Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.</p> <p>Method of Bend Tests for Steel products other than sheet, strip, wire and tube</p> <p>Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.</p> <p>Code of Practice for Radio graphic testing.</p> <p>Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.</p> <p>Code of practice for Ultra sonic Testing by pulse echo method.</p> <p>Acceptance tests for wire flux combination for submerged Arc Welding.</p> <p>Code of practice for Liquid penetrant Flaw Detection.</p> <p>Code of practice for Magnetic Particle Flaw Detection of Welds.</p> <p>Code of practice for field slaking of Building lime and preparation of putty.</p> <p>Application of cement and cement lime plaster finishes.</p> <p>Plaster-of-paris.</p> <p>Code of practice for external rendered finishes.</p> <p>Gypsum building plaster.</p> <p>Hexagonal wire netting for general purpose.</p> <p>Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali &amp; heat resisting.</p> <p>Specification for expanded metal steel sheets for general purpose.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 58 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS : 4441</p> <p>IS : 4443</p> <p>IS : 4456</p> <p>IS : 4457</p> <p>IS : 4832</p> <p>IS : 4860</p> <p>IS : 9510</p> <p><b>Water Supply, Drainage and Sanitation</b></p> <p>IS : 458</p> <p>IS : 554</p> <p>IS : 651</p> <p>IS : 774</p> <p>IS : 775</p> <p>IS : 778</p> <p>IS : 781</p> <p>IS : 782</p> <p>IS : 783</p>	<p>Code of practice for use of silicate type chemical resistant mortars.</p> <p>Code of practice for use of resin type chemical resistant mortars.</p> <p>Method of test for chemical resistant tiles. (Part I &amp; II)</p> <p>Specification for ceramic unglazed vitreous acid resistant tiles.</p> <p>Specification for chemical resistant mortars.</p> <p>Part I Silicate type</p> <p>Part II Resin type</p> <p>Part III Sulphur type</p> <p>Specification for acid resistant bricks.</p> <p>Specification for bitumasitc, Acid resisting grade.</p> <p>Specification for concrete pipes.</p> <p>Dimensions for pipe threads, where pressure tight joints are made on thread.</p> <p>Specification for salt glazed stoneware pipes.</p> <p>Flushing cisterns for water closets and urinals.</p> <p>Cast iron brackets and supports for wash basins and sinks.</p> <p>Copper alloy gate, globe and check valves for water works purposes.</p> <p>Cast copper alloy screw down bib taps and stop valves for water services.</p> <p>Caulking lead.</p> <p>Code of practice for laying of concrete pipes.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 59 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS : 1172</p> <p>IS : 1230</p> <p>IS : 1239</p> <p>IS : 1536</p> <p>IS : 1537</p> <p>IS : 1538</p> <p>IS : 1703</p> <p>IS : 1726</p> <p>IS : 1729</p> <p>IS : 1742</p> <p>IS : 1795</p> <p>IS : 1879</p> <p>IS : 2064</p> <p>IS : 2065</p> <p>IS : 2326</p> <p>IS : 2470 (Part-I &amp; II)</p> <p>IS : 2501</p> <p>IS : 2548</p> <p>IS : 2556 (Part 1 to 15)</p> <p>IS : 2963</p>	<p>Basic requirements for water supply, drainage and sanitation.</p> <p>Cast iron rain water pipes and fittings.</p> <p>Mild steel tubes, tubulars and other wrought steel fittings.</p> <p>Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.</p> <p>Vertically cast iron pressure pipes for water, gas and sewage.</p> <p>Cast iron fittings for pressure pipe for water, gas and sewage.</p> <p>Ball valves (horizontal plunger type) including float for water supply purposes.</p> <p>Cast iron manhole covers and frames.</p> <p>Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.</p> <p>Code of practice for building drainage.</p> <p>Pillar taps for water supply purposes.</p> <p>Malleable cast iron pipe fittings.</p> <p>Code of practice for selection, installation and maintenance of sanitary appliances.</p> <p>Code of practice for water supply in building.</p> <p>Automatic flushing cisterns for urinals.</p> <p>Code of practice for installation of septic tanks.</p> <p>Copper tubes for general engineering purposes.</p> <p>Plastic seat and cover for water-closets.</p> <p>Vitreous sanitary appliances (vitreous china).</p> <p>Non-ferrous waste fittings for wash basins and sinks.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 60 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS : 3114</p> <p>IS : 3311</p> <p>IS : 3438</p> <p>IS : 3486</p> <p>IS : 3589</p> <p>IS : 3989</p> <p>IS : 4111 (Part I to IV)</p> <p>IS : 4127</p> <p>IS : 4764</p> <p>IS : 4827</p> <p>IS : 5329</p> <p>IS : 5382</p> <p>IS : 5822</p> <p>IS : 5961</p> <p>IS : 7740</p> <p>IS : 8931</p> <p>IS : 8934</p> <p>IS : 9762</p> <p>IS : 10446</p>	<p>Code of practice for laying of cast iron pipes.</p> <p>Waste plug and its accessories for sinks and wash basins.</p> <p>Silvered glass mirrors for general purposes.</p> <p>Cast iron spigot and socket drain pipes.</p> <p>Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).</p> <p>Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.</p> <p>Code of practice for ancillary structure in sewerage system.</p> <p>Code of practice for laying of glazed stone-ware pipes.</p> <p>Tolerance limits for sewage effluents discharged into inland-surface waters.</p> <p>Electro plated coating of nickel and chromium on copper and copper alloys.</p> <p>Code of practice for sanitary pipe work above ground for buildings.</p> <p>Rubber sealing rings for gas mains, water mains and sewers.</p> <p>Code of practice for laying of welded steel pipes for water supply.</p> <p>Cast iron grating for drainage purpose.</p> <p>Code of practice for road gullies.</p> <p>Cast copper alloy fancy bib taps and stop valves for water services.</p> <p>Cast copper alloy fancy pillar taps for water services.</p> <p>Polyethylene floats for ball valves.</p> <p>Glossary of terms for water supply and sanitation.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 61 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS : 10592	Industrial emergency showers, eye and face fountains and combination units.		
	IS : 12592	Specification for precast concrete manhole covers and frames.		
	IS : 12701	Rotational moulded polyethylene water storage tanks.		
	SP: 35	Hand book on water supply and drainage.		
	-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.		
	<b>Doors, Windows and Allied Works</b>			
	IS : 204	Tower Bolts		
	Part-I	Ferrous metals.		
	Part-II	Nonferrous metals.		
	IS : 208	Door Handles.		
	IS : 281	Mild steel sliding door bolts for use with padlocks.		
	IS : 362	Parliament Hinges.		
	IS : 420	Specification for putty, for use on metal frames.		
	IS : 1003	Specification for timber panelled and glazed shutters-		
	Part-I door	(Part-I) shutters.		
	IS : 1038	Steel doors, windows and ventilators.		
	IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.		
	IS : 1341	Steel butt hinges.		
	IS : 1361	Steel windows for industrial buildings.		
	IS : 1823	Floor door stoppers.		
	IS : 1868	Anodic coatings on Aluminium and its alloys.		
	IS : 2202	Specification for wooden flush door shutters (solid core type);		
	(Part-II)	particle board face panels and hard board face panels		
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 62 OF 83</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS:2209</p> <p>IS:2553</p> <p>IS:2835</p> <p>IS:3548</p> <p>IS:3564</p> <p>IS : 3614</p> <p>IS:4351</p> <p>IS:5187</p> <p>IS:5437</p> <p>IS:6248</p> <p>IS:6315</p> <p>IS:7196</p> <p>IS:7452</p> <p>IS:10019</p> <p>IS:10451</p> <p>IS:10521</p> <p><b>R oof Water Proofing and AlliedWorks</b></p> <p>IS:1203</p> <p>IS:1322</p> <p>IS:1346</p> <p>IS:1580</p>	<p>Mortice locks (vertical type).</p> <p>Safety glass</p> <p>Flat transparent sheet glass.</p> <p>Code of practice for glazing in buildings.</p> <p>Door closers (Hydraulically regulated).</p> <p>Fire check doors; plate, metal covered and rolling type.</p> <p>Steel door frames.</p> <p>Flush bolts.</p> <p>Wired and figured glass</p> <p>Metal rolling shutters and rolling grills.</p> <p>Floor springs (hydraulically regulated) for heavy doors.</p> <p>Hold fasts.</p> <p>Hot rolled steel sections for doors, windows and ventilators.</p> <p>Mild steel stays and fasteners.</p> <p>Steel sliding shutters (top hung type).</p> <p>Collapsible gates.</p> <p>Methods of testing tar and bitumen.</p> <p>Specification for bitumen felts for water proofing and damp proofing.</p> <p>Code of practice for water proofing of roofs with bitumen felts.</p> <p>Specification for bituminous compound for water proofing and caulking purposes.</p>	
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 63 OF 83</p>

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.	
	IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.	
	<b>Floor Finishes and Allied Works</b>		
	IS:1237	Specification for cement concrete flooring tiles.	
	IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.	
	IS:2114	Code of practice for laying in-situ terrazzo floor finish.	
	IS:2571	Code of practice for laying in-situ cement concrete flooring.	
	IS:3462	Specification for unbacked flexible PVC flooring.	
	IS:4971	Recommendations for selection of industrial floor finishes.	
	IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.	
	IS:8042	Specification for white portland cement.	
	IS:13801	Specification for chequered cement concrete flooring tiles.	
	<b>Painting and Allied Works</b>		
	IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.	
	IS:1477	Code of practice for painting of ferrous metals in buildings.	
	Part-I	Pretreatment.	
	Part-II	Painting.	
	IS:1650	Specification for colours for building and decorative finishes.	
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.	
	IS:2338	Code of practice for finishing of wood and wood based materials.	
	Part-I	Operations and workmanship	
<p align="center">LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 64 OF 83</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	Part-II  IS:2395  Part-I Part-II  IS:2524  Part-I  Part-II  IS:2932  IS:2933 IS:4759  IS:5410 IS:5411 (Part-I) IS:6278 IS:10403  <b>Piling and Foundation</b>  IS:1080  IS:1904  IS:2911  IS:2950  IS:2974  (Part-I TO V)  IS:6403	Schedules  Code of practice for painting concrete, masonry and plaster surfaces.  Operations and workmanship. Schedule.  Code of practice for painting of nonferrous metals in buildings.  Pretreatment.  Painting.  Specification of synthetic enamel paint, exterior, under-coating and finishing.  Specification enamel paint, under coating and finishing. Code of practice for hot dip zinc coating on structural steel and other allied products.  Specification for cement paint Specification for plastic emulsion paint-for exterior use  Code of practices for white washing and colour washing. Glossary of terms relating to building finishes.  Code of practice for design and construction of simple spread foundations.  Code of practice for design and construction of foundations in Soils; General Requirements.  Code of practice for designs and construction of Pile foundations (Relevant Parts).  Code of practice for designs and construction of Raft (Part-I) foundation.  Code of practice for design and construction of machine foundations.  Code of practice for determination of Allowable Bearing pressure on Shallow foundation.	
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>IS:8009</p> <p>Part-I</p> <p>Part-II</p> <p>IS:12070</p> <p>DIN:4024</p> <p>VDI:2056</p> <p>VDI:2060</p> <p><b>Stop Log and Trash Rack</b></p> <p>IS:4622</p> <p>IS:5620</p> <p>IS:11388</p> <p>IS:11855</p> <p><b>Roads</b></p> <p>IRC:5</p> <p>IRC:14</p> <p>IRC:16</p> <p>IRC:19</p> <p>IRC:21</p> <p>IRC:34</p> <p>IRC:36</p> <p>IRC:37</p> <p>IRC:56</p> <p>IRC:73</p> <p>IRC:86</p>	<p>Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.</p> <p>Shallow foundations.</p> <p>Deep foundations.</p> <p>Code of practice for design and construction of shallow foundations on rocks.</p> <p>Flexible supporting structures for machines with rotating machines.</p> <p>Criteria for assessing mechanical vibrations of machines.</p> <p>Criteria for assessing rotating imbalances in machines.</p> <p>Recommendations for fixed - wheel gates structural design.</p> <p>Recommendations for structural design criteria for low head slide gates.</p> <p>Recommendations for design of trash rack for intakes.</p> <p>General requirements for rubber seals for hydraulic gates.</p> <p>Standard specifications and Code of practice for road bridges, section-I general Features of Design.</p> <p>Recommended practice of 2cm thick bitumen and tar carpets.</p> <p>Specification for priming of base course with bituminous primers.</p> <p>Standard specifications and code of practice for water bound macadam.</p> <p>Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).</p> <p>Recommendations for road construction in waterlogged areas.</p> <p>Recommended practice for the construction of earth embankments for road works.</p> <p>Guidelines for the Design of flexible pavements.</p> <p>Recommended practice for treatment of embankment slopes for erosion control.</p> <p>Geometric design standards for rural (non-urban) highways.</p> <p>Geometric Design standards for urban roads in plains.</p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 66 OF 83</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>IRC:SP:13</p> <p>IRC - Public- ation</p> <p>IS:73</p> <p><b>Loadings</b></p> <p>IS:875 (Pt. I to V)</p> <p>IS:1893</p> <p>IS:4091</p> <p>IRC:6</p> <p>M.O.T.</p> <p><b>Safety</b></p> <p>IS:3696 (Part I &amp; II)</p> <p>IS:3764</p> <p>IS:4081</p> <p>IS:4130</p> <p>IS:5121</p> <p>IS:5916</p> <p>IS:7205</p> <p>IS:7293</p> <p>IS:7969</p> <p>IS:11769</p> <p>- Indian Explosives Act. 1940 as updated.</p> <p><b>Architectural design of buildings</b></p> <p>SP:7</p> <p>SP:41</p>	<p>Guidelines for the design of small bridges &amp; culverts.</p> <p>Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.</p> <p>Specification for paving bitumen</p> <p>Code of practice for design loads other than earthquake) for buildings and structures.</p> <p>Criteria for earthquake resistant design of structures.</p> <p>Code of Practice for design and construction of foundation for transmission line towers &amp; poles.</p> <p>Standard specifications &amp; code of practice for road bridges, Section-II Loads and stresses.</p> <p>Deptt. of railways Bridge Rules.</p> <p>Safety code for scaffolds and ladders.</p> <p>Safety code for excavation work.</p> <p>Safety code for blasting and related drilling operations.</p> <p>Safety code for demolition of buildings.</p> <p>Safety code for piling and other deep foundations.</p> <p>Safety code for construction involving use of hot bituminous materials.</p> <p>Safety code for erection on structural steelwork.</p> <p>Safety code for working with construction machinery.</p> <p>Safety code for handling and storage of building materials</p> <p>Guidelines for safe use of products containing asbestos.</p>		
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 67 OF 83</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p><b>Miscellaneous</b></p> <p>IS:802                      Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers.</p> <p>IS:803                      Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.</p> <p>IS:10430                    Creteria for design of lined canals and liner for selection of type of lining.</p> <p>IS:11592                    Code of practice for selection and design of belt conveyors.</p> <p>IS:12867                    PVC handrails covers.</p> <p>CIRIA                        Design and construction of buried thin-wall pipes.</p> <p>Publication</p>			
<p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 68 OF 83</p>	

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

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C / N				M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	**	10.	11.	
<b>LEGEND:</b> * RECORDS, IDENTIFIED WITH "TICK" ( ✓ ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS 'W'													
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE				DOC. NO.: _____		REV..... CAT.....			
REVIEWED BY		APPROVED BY		FOR NTPC USE		APPROVAL SEAL		ENGG. DIV./QA&I					

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1

LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI BID DOC. NO.: CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENT
		PAGE 76 OF 83

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS  ITEM :  SUB-SYSTEM:	<b>FIELD QUALITY PLAN</b>  PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:
QP NO.: REV. NO.: DATE: PAGE: ... OF ...		

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

MANUFACTURER/ SUB-SUPPLIER SIGNATURE	MAIN-SUPPLIER  SIGNATURE	FOR NTPC USE	DOC. NO.:  REV.....
--	--------------------------------	--------------	---------------------------

LEGEND: \* RECORDS, IDENTIFIED 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)

1/1

FORMAT NO.: QS-01-QAI-P-09/F2-R1

ENGG. DIV./QA&I

LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI BID DOC. NO.: CS-0011-109(3)-9	PART-C GENERAL TECHNICAL REQUIREMENT
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ANNEXURE-V

Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Mati. Spec.	Dimensions	Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/Quantum	REF	Remarks
										Temp.	Holding time			
NOTES:														
SIGNATURE														
FORMAT														
										1/1		Engg. Div. / QA&I		

FIELD WELDING SCHEDULE  
 (To be raised by the contractor)  
 Welding Code: .....

Project :  
 Contractor :  
 Contractor No. :  
 System :  
 Stage :  
 DOC. NO. :  
 REV. NO. :  
 DATE :  
 PAGE : OF

CLAUSE NO.

**GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)**




S.No	Description of Drgs/Docs	No of Prints	No of ROMs/DVDs/Portable Hard Disk	CD
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents			
	First submission and submission with major changes			
	▪ Layout (A0&A1 sizes)	4	-	
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-	
	▪ P&ID (All sizes)	4	-	
	a) Final drawings/documents (Directly to site)	6	2	
	b) "As Built" Drawing/Documents (Directly to site)	6	2	
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2	
2	Erection Manual (Directly to site)	4 sets	2	
3	Operation & Maintenance manual	1 set	--	
	i) First Submission			
	ii) Final Submission (Directly to site)	4 sets	2	
4	Plant Hand Book			
	i) First Submission	1	1	
5	Commissioning and Performance Test Procedure manual			
	i) First Submission	1 set	--	
	ii) Final Submission (Directly to site)	4 sets	2	

LOT-3 PROJECTS  
FLUE GAS DESULPHURISATION (FGD)  
SYSTEM PACKAGE

TECHNICAL SPECIFICATION  
SECTION – VI  
BID DOC. NO.:CS-0011-109(3)-9

PART-C  
GENERAL TECHNICAL  
REQUIREMENTS  
Annexure-VI

PAGE  
81 OF 83

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)																																																								
	<table border="1"> <thead> <tr> <th>S.No</th> <th>Description of Drgs/Docs</th> <th>No of Prints</th> <th>No of CD ROMs/DVDs/Portable Hard Disk</th> </tr> </thead> <tr> <td>6</td> <td>Performance and Functional Guarantee Test Report i) First Submission</td> <td>2 sets</td> <td>-</td> </tr> <tr> <td></td> <td>ii) Approved Copies (Direct to Site)</td> <td>4 sets</td> <td>2</td> </tr> <tr> <td>7</td> <td>Project Completion Report (Directly to site)</td> <td>6 sets</td> <td>2</td> </tr> <tr> <td>8</td> <td>QA programme including Organisation for implementation and QA system manual(with revisions)</td> <td>1</td> <td>-</td> </tr> <tr> <td>9</td> <td>Vendor details in respect of proposed vendors including contractor's evaluation report.</td> <td>2</td> <td>-</td> </tr> <tr> <td>10</td> <td>Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc</td> <td></td> <td></td> </tr> <tr> <td></td> <td>i) For review/comment</td> <td>1</td> <td>-</td> </tr> <tr> <td></td> <td>ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)</td> <td>4</td> <td>2</td> </tr> <tr> <td>11</td> <td>Welding Manual, Heat Treatment Manuals, Storage &amp; preservation manuals</td> <td></td> <td></td> </tr> <tr> <td></td> <td>i) For review/comment</td> <td>1 set</td> <td>-</td> </tr> <tr> <td></td> <td>ii) Approved copies (Direct to Site)</td> <td>4 sets</td> <td>2</td> </tr> <tr> <td>12</td> <td>QA Documentation Package for items / equipment manufactured and despatched to site</td> <td>2 sets</td> <td>2</td> </tr> <tr> <td>13</td> <td>QA Documentation Package for field activities on equipment/systems at site</td> <td>2 sets</td> <td>2</td> </tr> </table>	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	-		ii) Approved Copies (Direct to Site)	4 sets	2	7	Project Completion Report (Directly to site)	6 sets	2	8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	-	9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	-	10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc				i) For review/comment	1	-		ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2	11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals				i) For review/comment	1 set	-		ii) Approved copies (Direct to Site)	4 sets	2	12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2	13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2
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  |  || **LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE** | **TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9** | **PART-C GENERAL TECHNICAL REQUIREMENTS Annexure-VI** | **PAGE 82 OF 83** |

GENERAL TECHNICAL REQUIREMENTS		ANNEXURE-VII	
CLAUSE NO.	AREAS OF TRAINING REQUIREMENT		
PRODUCT	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
<b>PRODUCT DESIGN</b>  Layout & model of FGD area, cable & piping trestles etc. <b>FGD</b> <ul style="list-style-type: none"> <li>• Mass balance, Design, selection and sizing calculations of FGD system,</li> <li>• Training on factors affecting sizing/ efficiency of FGD system, equipments &amp; auxiliaries</li> <li>• Materials for FGD &amp; selection</li> <li>• Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc.,</li> <li>• FGD electrical system</li> <li>• FGD control system</li> </ul> Erection strategies, erection procedures Performance as per applicable code and demonstration tests.	Familiarization with various system and equipment Performance, data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process of Absorber and equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization
<b>MANMONTH</b>	<b>2</b>	<b>0.5</b>	<b>6</b>
<b>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-C GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VII</b>	<b>PAGE 83 OF 83</b>



**TITLE:**  
**KORBA SUPER THERMAL POWER PLANT**  
**TECHNICAL SPECIFICATIONS FOR**  
**AGITATORS OF FGD SLURRY TANKS**

**SPECIFICATION No: PE-TS-466-571-18000-**  
**A002**

**SECTION-I, SUB-SECTION-C2B**


**REV. 00**


**DATE: OCT 2021**


**SHEET : 1 OF 1**

## **PROJECT SPECIFIC GENERAL REQUIREMENTS**

### **QUALITY ASSURANCE**

CLAUSE NO.	QUALITY ASSURANCE			
<b>1.08.00</b>	<b>STRUCTURES , DUCTS, HOPPERS:</b>			
1.08.01	All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.			
1.08.02	Visual inspection of all welds shall be performed in accordance with AWS D1.1.			
1.08.03	NDT requirements of structural steel welds shall be as under: <ul style="list-style-type: none"> <li>i) 100% RT/UT on butt-welds of plate thickness <math>\geq 32</math>mm.</li> <li>ii) For plates of <math>25\text{mm} \leq \text{thickness} &lt; 32\text{mm}</math> - 10% RT and 100% MPI.</li> <li>iii) For plates of thickness <math>&lt; 25\text{mm}</math> - 10% MPI/LPI.</li> </ul>			
1.08.04	Edge for shop and field weld shall be examined by MPI for plate thickness $\geq 32$ mm.			
<b>1.09.00</b>	<b>VACUUM BELT FILTER SYSTEM:</b>			
1.09.01	Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% Ultrasonically tested.			
1.09.02	UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.			
1.09.03	All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.			
1.09.04	Filter cloths and belts shall be tested for physical properties as per relevant standard			
1.09.05	Hydro cyclones shall be checked by visual, dimensional etc.			
<b>1.10.00</b>	<b>SPRAY NOZZLES:</b>			
1.10.01	Spray nozzles shall be tested for physical properties			
1.10.02	Spray nozzles also shall be subjected to performance test.			
<b>1.11.00</b>	<b>AGITATORS:</b>			
1.11.01	Rubber lining shall be tested for hardness and spark test			
1.11.02	Impellers shall be tested for dimensional and balancing check			
1.11.03	Gear Boxes shall be tested for run test as per standard practice			
<b>1.12.00</b>	<b>FANS:</b>			
1.12.01	Rotor components shall be subjected to ultrasonic test at mill and magnetic particle inspection / liquid penetrant examination after rough machining.			
1.12.02	Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving.			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.: CS-0011-109(3)-9	PART-B SUB-SECTION-V-QM1 FGD SYSTEM	Page 3 of 4	

CLAUSE NO.	QUALITY ASSURANCE			
1.12.03	All rotating components and assemblies of fan shall be balanced dynamically			
1.12.04	Performance test shall be carried out on fans as per Technical specification/ Relevant standard			
1.12.05	Test for Natural Frequency and hardness of Fans blades shall be carried out as per Technical specification/ Relevant standard			
1.13.00	<p><b>Thermal Insulation, Lagging &amp; Cladding:</b></p> <p>(a) <b>Lightly resin bonded mineral wool:</b></p> <p>LRB mattresses/sections of Rockwool/ Glasswool shall conform to &amp; tested as per relevant clauses of Indian Standards and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Steam Generator &amp; Auxiliaries.</p> <p>(b) <b>Lagging &amp; Cladding:</b></p> <p>All insulation shall be protected by means of an outer covering of Aluminium sheeting conforming to ASTM B-209-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.</p>			
1.14.00	<b>OTHER CRITICAL EQUIPMENTS:</b>			
1.14.01	Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.			
LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(3)-9	PART-B SUB-SECTION-V-QM1 FGD SYSTEM	Page 4 of 4

CLAUSE NO.	<p style="text-align: center;"><b>QUALITY ASSURANCE</b></p> 		
	<p>(b.) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out.</p> <p>(c.) All welds shall be subjected to 100% magnetic particle/dye penetrant check and butt welds shall be subjected to 100% radiographic testing.</p> <p>(d.) All the bellows subjected to vacuum service shall be subjected to vacuum test.</p> <p>(e.) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.</p> <p>(f.) The testing of MEJ shall be as per Expansion joint Manufacturer Association (EJMA) standard.</p>		

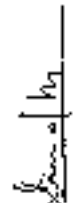




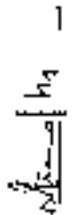

Agitator inspection requirement-Please note that attached QP is indicative only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN										
ITEM: AGITATOR		QIP NO	FCG: 720		REV. NO: 00		DATE: 12.02.2019		PAGE NO: Page 2 of 2		REMARKS	
M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		SYSTEM: FGD	FORMAT OF RECORD	M	C	M	Y	P	Y	P	Y	Y
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	7.	8.	9.	D	11.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	Horizontal	
4.2	Free Air Run Test of complete assembly	Measurement Current, RPM, Noise & Vibration	MA	Measurement	100%	Vendor Standard / Approved Drawing / Data Sheet		CR	Y	W	Y	W
4.3	Review of QA Documents	Verification of QA Documents	MA	Verification	100%	As per Approved		CR	Y	Y	Y	Y
<b>5.0 Painting &amp; Preservation</b>												
5.1		Painting Material	MI	Review of MTC	100%	Approved Painting Schedule		CR	Y	P	Y	-
5.2		Surface treatment and inspection	MI	Visual	100%			CR	Y	P	Y	-
5.3		DFT Check	MI	Measurement	100%			CR	Y	P	Y	-
5.4		Painting Surface Quality	MI	Visual	100%			CR	Y	P	Y	-
<b>6.0 Inspection before Delivery</b>												
6.1	Packing	Size, appearance & firmness	MI	Measurement	100%	As per "Packing Procedure"		CR	Y	P	Y	-
6.2	Deliver Documents	Markings, Packing List & Details Packing List, etc., Check	MI	Verification	100%	As per "Packing Procedure"		CR	Y	P	Y	-

**NOTES:**

1. For Agitator Motor rating is 45KW and motor make NTPC/B-11 Approved supplier.
2. Routine test report duly witnessed by main contractor as per applicable standards shall be reviewed during inspection (rating less than 30 Kw (Kilowatt)).

<p>LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.  <b>M:</b> MANUFACTURER / SUB SUPPLIER, <b>C:</b> MAIN CONTRACTOR.  <b>N:</b> CUSTOMER/CONSULTANT <b>P:</b> PERFORM <b>W:</b> WITNESS <b>V:</b> REVIEW OF RECORDS  <b>MA:</b> MAJOR AND <b>MI:</b> MINOR</p>	<p>PREPARED BY </p> <p>Rakesh Kumar Madhu, (SE/ QA)</p>	<p>REVIEWED &amp; APPROVED BY </p> <p>K.C. Gandhi Parimalam, (DGM/QA)</p>
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MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN							
 <b>Ranipet</b> M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		ITEM: AGITATOR		QP NO	FGS: 720				
		SYSTEM: FGD		REV. NO:	00				
				DATE:	12.02.2019				
				PAGE NO:	Page 1 of 2				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	AGENCY	REMARKS
					M   B			M   C   N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
<b>1.0 Raw Material Inspection</b>									
1.1	All materials including casting & forgings	Chem. & Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Recastment Visual	100% 100% 100%	100%	As per Spec. & Appnt. Dwg	TC: V TR: P TR: P	V V V
<b>2.0 Motor : Review Of Manufacture Test Certificate</b>									
<b>3.0 In Process Inspection</b>									
3.1	Welding Qualifications	WPS & PQR	MA	WPS, PQR & WPO	100%	As per Spec DR		TR	Recent Qualific WPS, PQR and WPO shd be submitted for review during inspection
3.2	Marking, Cutting, Edge Preparation Tacking	Dimensions	MA	Measurement	100%	App. Dwg.		DR	
3.3	Welds	Dimensions & Surface Quality	MA	Measurement	100%	Aspd. Dwg. & ISMIL Sec VIII		DR	
3.4	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%	Appd. Dwg.		TR	
3.5	Impeller	Static balance test	MA	Measurement	100%	As per Specs.		TR	
3.6	Rubber Lining	Hardness test & Spark test	MA	Measurement	100%	As per Specs.		TR	
3.7	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%	Appd. Dwg.		TR	
<b>4.0 Final Inspection</b>									
4.1	Final Assembly	Overall Dimensions & Completeness	MA MA	Measurement Visual	100% 100%	Appd. Dwg		TR	100% of ASPT 100% of ASPT
<p>LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'J' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.</p> <p>M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR.</p> <p>N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS</p> <p>MA: MAJOR AND MI: MINOR</p>									
PREPARED BY						REVIEWED & APPROVED BY			
 Rakesh Kumar Madhu, (SER/QA)						 K.C. Gandhi Parimalam, (UGM/QA)			

#### **QUALITY REQUIREMENT**

- (a) Since this items comes under Sub-QR Category, hence inspection at vendor works is applicable by BHEL/BHEL TPI and NTPC as per NTPC Approved Quality plan.
- (b) Supplier shall submit the MQP in NTPC Format (Sample QP attached herewith) for approval of NTPC. Please note that attached QP is indicative and minimum requirement only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).
- (c) Painting : Painting details in the specification are minimum requirement. Painting shall be as per approved schedule which will be submitted by successful bidder during detail engg.
- (d) In case of order placed on foreign vendors, vendor has to finalize Inspection agency at their own cost and carry out inspection as per the approved Quality plan . Further, the list of third party insection agencies (as applicable) shall be provided by BHEL during detail engineering. Vendor has to furnish BHEL the inspection reports and other documents required as per approved Quality plan duly signed by the Inspection Agency after their witness for BHEL's review and acceptance.



**QUALITY ASSURANCE**

CLAUSE NO.

**MOTOR**

TESTS/CHECKS	Visual	Dimensional	Make/Type/Rating /General	Physical Inspection	Mech/Chem. Properties	NDT /DP/PI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS-2148/IEC60034/IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion			
<b>TEMS/COMPONENTS</b> Plates for stator frame, end shield, spider etc. Shaft Magnetic Material Rotor Copper/Aluminium Stator copper SC Ring Insulating Material Tubes, for Cooler Sleeve Bearing Stator/Rotor, Exciter Coils Castings, stator frame, terminal box and bearing housing etc. Fabrication & machining of stator, rotor, terminal box	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

<b>LOT-3 PROJECTS</b> <b>FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</b>	<b>TECHNICAL SPECIFICATION</b> <b>SECTION – VI</b> <b>BID DOC. NO.:CS-0011-109(3)-9</b>	<b>PART-B</b> <b>SUB-SECTION-V-QE1</b> <b>MOTORS</b>	<b>PAGE 1 OF 2</b>
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**TITLE:**  
**KORBA SUPER THERMAL POWER PLANT**  
**TECHNICAL SPECIFICATIONS FOR**  
**AGITATORS OF FGD SLURRY TANKS**

**SPECIFICATION No: PE-TS-466-571-18000-A002**


**SECTION-I, SUB-SECTION-C2C**


**REV. 00**


**DATE: OCT 2021**

**SHEET : 1 OF 1**

## **CUSTOMER SPECIFICATION: PAINTING SPECIFICATION**

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
<b>1.00.00</b>	<b>SPECIFICATION OF SURFACE PREPARATION &amp; PAINTING</b>		
<b>1.01.00</b>	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.		
<b>1.02.00</b>	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.		
<b>1.03.00</b>	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.		
<b>1.04.00</b>	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.		
<b>1.05.00</b>	<b>SURFACE PREPARATION</b>		
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.		
1.05.02	<p>The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.</p> <p>SP1            Solvent cleaning</p> <p>SP2            Application of rust converter (Ruskil or equivalent grade)</p> <p>SP3            Power tool cleaning</p> <p>SP4            Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)</p> <p>SP4*          Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns</p> <p>SP5            Shot blasting/ abrasive blasting.</p> <p>SP6            Emery sheet cleaning/Manual wire brush cleaning.</p>		
<b>1.06.00</b>	<b>APPLICATION OF PRIMER/PAINT</b>		
<b>1.06.01</b>	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.		
<b>1.06.02</b>	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.		
<b>1.06.03</b>	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day		

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
<p><b>1.06.04</b></p> <p><b>1.06.05</b></p> <p><b>1.06.06</b></p> <p><b>1.06.07</b></p> <p><b>1.06.08</b></p> <p><b>1.06.09</b></p>	<p>as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.</p> <p>Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.</p> <p>Following are the Primer/painting schemes envisaged herein:</p> <p>PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.</p> <p>PS3* - Zinc Chrome primer (Alkyd base) by dip coat.</p> <p>PS4 - Synthetic Enamel (long oil alkyd) to IS2932.</p> <p>PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744</p> <p>PS9 - Aluminium paint to IS 2339.</p> <p>PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1</p> <p>PS13 - Rust preventive fluid by spray, dip or brush.</p> <p>PS14 - weldable primer-Deoxaluminat or equivalent.</p> <p>PS16 - High Build Epoxy CDC mastic `15' .</p> <p>PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)</p> <p>PS18 - Epoxy based TiO2 pigmented coat</p> <p>PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.)</p> <p>PS-20 - Epoxy based finish paint</p> <p>All weld edge preparation for site welding shall be applied with one coat of weldable primer.</p> <p>For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.</p> <p>SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.</p> <p>a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine &amp; Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:</p> <ul style="list-style-type: none"> <li>▪ Primer coat – Epoxy based zinc phosphate</li> <li>▪ Intermediate - Epoxy based TiO2 pigmented coat</li> <li>▪ Finish coat - Epoxy based finish coat</li> </ul> <p>b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.</p> <p>c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard</p>		
	<p style="text-align: center;">Page 38 of 364</p>		<p style="text-align: right;">220 of 397</p>

CLAUSE NO.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 		
<p><b>1.06.10</b></p>	<p>A) Specification for the application of Epoxy coating for internal protection of DM tank &amp; other vessels/tanks (as applicable) shall be as follows:</p> <p>Primer : One coat of unmodified epoxy resin along with polyimide hardener.</p> <p>Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener.</p> <p>Total thickness of primer and paint should not be less than 400 microns.</p> <p>B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves &amp; other equipments shall be as follows:</p> <p>i) For Indoor vessel, tanks, piping, valves &amp; other equipments:</p> <p>(a) Surface preparation shall be done either manually or by any other approved method.</p> <p>(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.</p> <p>(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.</p> <p>(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.</p> <p>Total DFT of paint system shall not be less than 150 microns.</p> <p>ii) For Outdoor vessel, tanks, piping, valves &amp; other equipments:</p> <p>(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.</p> <p>(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.</p> <p>(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.</p> <p>(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.</p> <p>The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.</p> <p>Total DFT shall not be less than 300 microns.</p>		



ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

**F) FGD System**

- (i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard.
- (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.
- (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.
- (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.



**TITLE:**  
  
**TECHNICAL SPECIFICATIONS FOR  
AGITATORS OF FGD SLURRY TANKS**

**SHEET : 1 OF 1**

**LIST OF MAKES OF SUB-VENDOR ITEMS**

Sl.no.	Item	Category of Inspection	Sub-vendor	Place	Remarks
1.	PAINT	III	ASIAN PAINT		
		III	BERGER		
		III	KANSAI NEROLAC		
		III	JOTUN		
		III	SHALIMAR		
		III	JENSON & NICHOLSON (I) LTD		
		III	CDC CARBOLINE (I) LTD.		
		III	ADDISON PAINTS LTD		
		III	GRAND POLYCOAT		
<b>NOTES: INSPECTION CATEGORIZATION</b>					
CAT I: INSPECTION BY OWNER, BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.					
CAT II: INSPECTION BY BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.					
CAT III: MDCC WILL BE ISSUED BASED COC & MTC ISSUED BY VENDOR AND VERIFICATION BY BHEL / OWNER IN LINE WITH APPROVED QAP/CHECK LIST					

PROJECT :		LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR :				REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 20 <sup>th</sup> April 2017				
PACAKGE : EPC Sub Package: MOTORS & VVF Drive Panels CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2		CONTRACTOR-M/S BHEL								
Sl. No.	ITEM	QP / INS CAT.	QP No:- 9585-001-QVE-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHE DULE	REMARKS
1)	L.T (415 V) Motors	Refer Note 1				ABB ABB BHARAT BIJLEE CGL JYOTI KEC KEC	FARIDABAD BANGALORE MUMBAI AHMEDNAGAR BARODA BANGALORE HUBLI	^ ^ ^ ^ ^ ^ ^		UPTO 55KW 55KW - 200KW RQP, FOR FLAME PROOF ALSO FOR FLAME PROOF ALSO FOR FLAMEPROOF ALSO UPTO 90KW: FOR FLAME PROOF ALSO UPTO 200KW FOR FLAME PROOF ALSO UPTO 15KW
2)	LHT MOTOR					BHEL	BIOPAL	^		
3)	DC MOTOR	Refer Note 1				BHEL CGL KEC	HARIDWAR AHMEDNAGAR BANGLORE/ HUBLI	^ ^ DR		
4)	VARIABLE FREQUENCY DRIVES PANELS	1				L&T-YASHKAWA DANFOSS SCHNEIDER ROCKWELL ALLEN BRADLEY ABB SIEMENS GE	INDIA CHIENAI NASHIK DELHI- SHAHIBABAD BANGALORE NASHIK	^ ^ ^ ^ ^ ^ DR		



169

PROJECT :		PACAKGE : EPC				LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR :				REF NO : 9585-001-QOE-R-01	
Sub Package: MOTORS & VVf Drive Panels		CONTRACTOR : M/S BHFL				CONTRACTOR-M/S BHFL				REVISION NO. 00	
CONT. NO. CS-9585-001-2		QP / INS CAT.		QP SUB. SCH.		QP APPL SCHE DULE		SUB-SUPPLIERS		PLACE	
SUB-SUPPLIERS		PLACE		SUB-SUPPLIERS		QP APPL SCHE DULE		SUB-SUPPLIERS		PLACE	
Sl. No.	ITEM	QP No:- 9585-001-0VE:-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIERS	PLACE	SC APPL SCHE DULE	REMARKS	
					HITACHI-HIREL	GANDHINAGAR/					
					INGETTEAM	SANAND					
					TECHNOLOGIES	SPAIN					
					NIDEC(ANSALDO)	ITALY					
					FUJI ELECTRIC	JAPAN					
					SYSTEMS	BANGALORE					
					TMEIC	MUMBAI					
					L&T						

NOTE 1 : FOR LT MOTORS

a) Less than 30 KW

Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets.

b) 30 KW -50KW

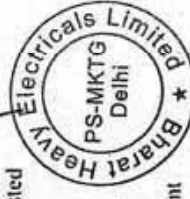
Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets.

c) Above 50 KW as per NTPC approved quality plan

Approval Conditions attached to above vendors-as applicable shall prevail.

General Notes:


- 1) Vendor list & category of the mandatory spares shall be as mentioned above.
- 2) For item not appearing in the above list, main contractor to approach NTPC for acceptable vendors & inspection category of the same.
- 3) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be performed on Specific request of Main Contractor.



Jatin Gahlawat  
(JATIN GAHLAWAT)





		Project : EPC Package : EPC Contractor : BHEL, Hyderabad Contract No.:		LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: BFP, Drive Turbine, Heaters (HP, LP) Drain Cooler and Deaerator					Ref No.: 9585-001-02 Revision No.: 00 Date: 05.04.2017		REMARKS	
SN	ITEM	QP/INS-PN CAT	QP No. XXXX-110	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS /CAT	SS DETAIL SUB-SCHEDULE	SC APPL SCHEDULE	REMARKS	
						EDELSTAHLWERKE	GERMANY	A				
						GROEDITZ	GERMANY	DR				
						PILSON STEEL (VHS,SKODA)	CZECHSLOVAKIA	A				
						JCFE	JAPAN	A				
						JSC ENERGO MASH	UKRAIN	DR				
						JSW	JAPAN	A				
						KOBE STEEL	JAPAN	A				
						CRUIST FORGE	FRANCE	A				
						PETRO ROSA	GERMANY	A				
						FINE FORGE	HYDERABAD	A				
						C BLADE	ITALY	A				
						WUXI	CHINA	A			AS PER NTPC APPROVAL CONDITIONS FOR MACHINING ONLY	
						AZAO ENGG	HYDERABAD	A				
						WALZWERK-EINSL	GERMANY	A				
						BOEHLER	AUSTRIA	A				
						BGH	GERMANY	A				
						BREITENFIELD	AUSTRALIA	A				
						STARWIRE	BALLABHARH	A				
						FIAY	ITALY	A				
						LEISTRITZ	GERMANY	A				
						BOEHLER	AUSTRIA	A				
						TRIVENI ENGG	MYSORE	A				
						FLENDER	FRANCE	A				
						GRAFFENSTADEN						
33	PRECISION BLADE FORGINGS		QVM-Q-308									
34	BAR STOCK FOR BLADES		QVM-Q-308									
35	DRAWN PROFILE FOR GUIDE BLADES (DRIVE TURBINE)		QVM-Q-308									
36	GEAR BOX		QVM-Q-308									



105



## ANNEXURE-A

- The list of all bought out items like gearbox, coupling, bearings etc. with makes and country of origin and contact details of the manufacturers to be mentioned along with offer to be submitted in the format attached in section II Annexure-6 as an information to BHEL.
- Bidder has to submit the sub-vendor questionnaire (attached herewith) along with necessary credentials in case the proposed sub-vendor is not as per the list provided.
- Acceptance of makes shall be subject to BHEL/ End customer acceptance during the detailed engineering without cost and delivery implication to BHEL.
- The complete list will be necessarily submitted within one month of placement of LOI to ensure timely placement of order for BOIs. Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.



**CORPORATE QUALITY ASSURANCE**  
**SUB-VENDOR QUESTIONNAIRE**

<b>i.</b>	<b>Item/Scope of Sub-contracting</b>	
<b>ii.</b>	<b>Address of the registered office</b>	<b>Details of Contact Person</b> (Name, Designation, Mobile, Email)
<b>iii.</b>	<b>Name and Address of the proposed Sub-vendor's works where item is being manufactured</b>	<b>Details of Contact Person:</b> (Name, Designation, Mobile, Email)
<b>iv.</b>	<b>Annual Production Capacity for proposed item/scope of sub-contracting</b>	
<b>v.</b>	<b>Annual production for last 3 years for proposed item/scope of sub-contracting</b>	
<b>vi.</b>	<b>Details of proposed works</b>	
1.	<b>Year of establishment of present works</b>	
2.	<b>Year of commencement of manufacturing at above works</b>	
3.	<b>Details of change in Works address in past (if any)</b>	
4.	<b>Total Area</b>	
	<b>Covered Area</b>	
5.	<b>Factory Registration Certificate</b>	<b>Details attached at Annexure – F2.1</b>
6.	<b>Design/ Research &amp; development set-up</b> (No. of manpower, their qualification, machines & tools employed etc.)	<b>Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design)</b> <b>Details attached at Annexure – F2.2</b> <b>(if applicable)</b>
7.	<b>Overall organization Chart with Manpower Details</b> (Design/Manufacturing/Quality etc)	<b>Details attached at Annexure – F2.3</b>
8.	<b>After sales service set up in India, in case of foreign sub-vendor</b> (Location, Contact Person, Contact details etc.)	<b>Applicable / Not applicable</b> <b>Details attached at Annexure – F2.4</b>
9.	<b>Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any</b>	<b>Details attached at Annexure – F2.5</b>



**CORPORATE QUALITY ASSURANCE**  
**SUB-VENDOR QUESTIONNAIRE**

10.	Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing	Details attached at Annexure – F2.6			
11.	Manufacturing facilities (List of machines, special process facilities, material handling etc.)	Details attached at Annexure – F2.7			
12.	Testing facilities (List of testing equipment)	Details attached at Annexure – F2.8			
13.	If manufacturing process involves fabrication then-	Applicable / Not applicable			
	List of qualified Welders	Details attached at Annexure – F2.9			
	List of qualified NDT personnel with area of specialization	(if applicable)			
14.	List of out-sourced manufacturing processes with Sub-Vendors' names & addresses	Applicable / Not applicable  Details attached at Annexure. –F2.10 (if applicable)			
15.	Supply reference list including recent supplies	Details attached at Annexure – F2.11 (as per format given below)			
<i>Project/ package</i>	<i>Customer Name</i>	<i>Supplied Item (Type/Rating/Model /Capacity/Size etc)</i>	<i>PO ref no/date</i>	<i>Supplied Quantity</i>	<i>Date of Supply</i>
16.	Product satisfactory performance feedback letter/certificates/End User Feedback	Attached at annexure - F2.12			
17.	Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating) Note:- Reports need not to be submitted	Applicable / Not applicable  Details attached at Annexure – F2.13 (if applicable)			
18.	Statutory / mandatory certification for the proposed product	Applicable / Not applicable  Details attached at Annexure – F2.14 (if applicable)			
19.	Copy of ISO 9001 certificate (if available)	Attached at Annexure – F2.15			
20.	Product technical catalogues for proposed item (if available)	Details attached at Annexure – F2.16			
<b>Name:</b> _____ <b>Desig:</b> _____ <b>Sign:</b> _____ <b>Date:</b> _____					

Company's Seal/Stamp:-



1.6 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

1.7 Silicagel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

## **2.0 STORAGE AND PRESERVATION INSTRUCTIONS:**

2.1 Storage of different products and their components shall be as per HY0490564.

### **2.2 General Instructions:**

2.2.1 The ware house or the covered area where equipment is to be stored should be clean, dry and well ventilated. The platform and the store house should be built in conformity with the fire prevention rules and standards. It must be treated with pesticides/insecticides against white ants other insects, fungus etc. The stage premises should be kept rodent free as far as possible. Adequate gateway should be left for inspection and cleaning.

2.2.2 Immediately after receipt of the packing cases the condition of the desiccant shall be ascertained by examining the humidity indicator which are visible outside the packing case (see cl.6.0 of the standard) and take correct action as required. The packing cases should be periodically inspected specially after damp weather for fungus, dampness or any sign of deterioration of packing material. If desired the ware house should be suitably fumigated.

2.2.3 Periodic inspection at least once in three months should be carried out for all the components to ensure that the protective coating (preservation) etc. are intact and no damage has occurred to the equipment. If any damages are observed the same shall be repaired/ preserved immediately.

2.2.4 Pipes including lubricating oil pipes are supplied in cleaned, pickled, sprinkled with VCI powder inside and protected at ends. They should not be kept open to rain and inclement weather. It is recommended all pipes should be stored in suitable racks to facilitate access and easy handling. It must be ensured that ends of the pipes are properly blanked before storing to prevent ingress of dirt, dust and moisture.

NOTE: For steam turbine rotor preservation and preservation refer Std. No. TC51761.



## PLANT STANDARD HYDERABAD

HY0490570

REV. NO: 00

PAGE 3 OF 4

2.2.5 Insulating materials sent loose before curing have definite shelf life. It is recommended not to send these materials such as epoxy resins, resin treated tapes bitumen varnishes etc. too early to site. Still there might be some occasion when these materials have to reach site early. These materials are usually sent in sealed tins with a label indicating shelf life. If these materials can not be used immediately these are to be stored preferably at a temperature not exceeding 5° C.

2.2.6 While opening the cases of such materials care should be taken not to push the tool too deep in the box.

2.2.7 When the case is to be reclosed for further storage after inspection, case should be taken to cover these items with polyethylene sheets fully, leaving no gaps. The desiccants such as silicagel have to be reactivated if necessary and restored in the packing.

2.2.8 Motors and windings in storage should be inspected and I.R. values checked at periodic intervals. The suggested intervals are once in two months in dry weather and monthly in humid weather. These readings should be preferably recorded in a log. Any significant drop in I.R. values should be reported immediately.

2.2.9 A few roles of VPI coated paper should always be kept at site for replacing spoiled or ineffective paper due to expiry of shelf life.

### 3.0 PRESERVATION:

3.1 Preservation of different products and their components shall be as per HY0490563.

3.2 For steam turbine component refer product Std. No. ST33004.

3.3 For preservation of components like stampings and punchings a special TRP "SPRAY PEEL" of M/s. PLASTIPEEL CHEMICAL, PLASTIC INDIA LIMITED, THANE may be adopted.

### 4.0 TAKING OUT OF STORAGE:

4.1 Remove any rust from painted area with a steel wire, brush or sand paper. Treated area must be bright and free from grease. Give them a new coat of primer and the requisite No. of finishing coats of paints.

The machined parts should be removed from their packings only just before they are required for installation. They should preferably be brought to the point of installation still packed and arranged in the sequence in which they are to be installed. Heavy parts should be secured against slipping or over turning.



## 5.0 TRANSPORT:

- 5.1 Greatest care and attention should be exercised when transporting the materials to the site. The means of transport must be suitable for the purpose with regard to weight, lifting and to the any marking with regard to permissible method of transport.

When loading and unloading particularly, heavy machine parts must removed with the aid of wrenches, jacks, crow bars and the like, the transport vehicle should be packed up with props and jacks to prevent subsidence or the tilting of the loading surface when the brakes are applied. The machine parts should be so secured that they can not move in transit. Steel ropes should be cushioned with wooden block to prevent any damage by rubbing.

- 5.2 Special methods if any for transporting for different product components shall be given in each product standard.

## 6.0 CHECKING AND REACTIVATION:

- 6.1 The moisture absorption capacity of the desiccant must be checked after completion of shipment, after interruption in transit involving a storage period of more than one month and during normal storage at the site. To do this use the moisture indicator inserted in the plastic sheeting cover at a distance of not less than 5 cm. from the sheeting. The moisture indicators are marked with their respective location and show the relative humidity inside the cover in three ranges (>30%, >40% and >50%). With the packing in dry condition all circles are blue. A change in colour to pink in the respective circle indicates the relative humidity in percent. As soon as the 40% indicator changes to the pink colour the desiccants must be removed and replaced or reactivated by drying.

Make sure that sufficient replacements, desiccants or the necessary drying facility for reactivation is available. After opening the plastic sheeting cover should be provisionally resealed, but shall not be left in sealed condition for more than 20 hours.

For reactivation of desiccant the pouches should be dried in a drying oven at a temperature of 110° C for 12 hours. If a drying oven is not available the desiccant should be removed from the pouch, spread out in a thin layer on a metal plate and dried at 110° C to 130° C for several hours until the weight of the desiccants remains constant. The desiccants should then be filled back into the pouches which are to be closed and reinstalled into the plastic sheeting cover as quickly as possible. Care should be taken to ensure that the pouches do not come in contact with metal parts. The opening in the plastic sheeting cover should then be resealed with a heat sealing unit.

**TECHNICAL DATA SHEET**

Annexure-12

Sl. No.	Description	Data To be filled by Bidder
	<b>Agitators</b>	
1.	No./Make/Model	
2.	Type	
3.	Speed (rpm)	
4.	Drive Mechanism	
5.	Shaft Material	
6.	Material / Thickness (mm) of Impeller / Lining	
7.	Power Consumption	
8.	Motor Rating (KW)	
9.	Motor Speed (rpm)	
10.	Maximum solid particle size ( for pump design)	
11.	Normal solid particle size,d50	
12.	Slurry concentration not more than	
13.	Chloride concentration	
14.	SiO2 concentration	
15.	PH	
16.	Operating temperature range	
17.	Agitator Mounting Orientation	
18.	Number of Agitator ( for one ball mill 1 nos)	
19.	Agitator Model number- vendor to specify.	
20.	Gearbox make & model - vendor to specify.	
21.	Agitator shaft power in kw- vendor to specify.	
22.	Impeller diameter - vendor to specify.	
23.	Blade Material-Alloy926/1.4529 -vendor to confirm	
24.	Impeller mounting bolt and nut shall be Alloy 926 - vendor to confirm	
25.	Shaft Material (carbon steel) - vendor to	

**TECHNICAL DATA SHEET**

Annexure-12

Sl. No.	Description	Data To be filled by Bidder
	specify the grade.	
26.	Shaft diameter - vendor to specify.	
27.	Shaft to be rubber lined - vendor to confirm.	
28.	Rubber lining material (chlorobutyl rubber)- vendor to specify	
29.	Rubber lining thickness - 6mm -vendor to confirm	
30.	Rubber lining hardness (55-65)	
31.	Life of Rubber Lining (minimum 2 yrs.)	
32.	Selected Motor frame size-	
33.	Selected motor power in kw	
34.	Motor RPM & Agitator shaft RPM	
35.	Motor efficiency class (minimum IE3)	
36.	All bearing are FAG/SKF only vendor to confirm	
37.	Static load- vendor to specify.	
38.	Dynamic load (vertical axial force, torsional moment, bending moment)	
39.	Static & dynamic balancing required- vendor to confirm	
40.	Tip speed vendor to specify (less than 30m/s)	
41.	Critical Speed of agitator	
42.	Ratio of shaft speed to critical speed	
43.	Coupling guards with mounting bolt to be provided	
44.	Name plate shall be in SS 304 - vendor to confirm	
45.	Rotation direction of agitator shaft to be marked through arrow plate at a visible location near coupling- vendor to confirm	
46.	General Arrangement drawings of agitator assembly with sectional view & material of construction, BOM, important	

**TECHNICAL DATA SHEET**

Annexure-12

Sl. No.	Description	Data To be filled by Bidder
	dimensions- to be submitted along with offer by vendor for evaluating the Bid - vendor to confirm.	
47.	Direct Drive flexible coupling with high tensile bolts is to be provided by vendor . Coupling make and model Number Coupling drawing with BOM to be provided after purchase order - Vendor to confirm	
48.	First fill oil /grease other consumable to be sent along with pump - vendor to confirm	