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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	TECHNICAL SPECIFICATION FOR AGITATORS FOR SLURRY APPLICATION
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PROJECT	BHUSAWAL THERMAL POWER STATION UNIT-6 : 1 X 660 MW (FGD PACKAGE)
OWNER	MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO)
OWNER CONSULTANT	DEVELOPMENT CONSULTANTS PVT. LTD., CONSULTING ENGINEERS, VASHI, MUMBAI

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
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**DOCUMENTS TO BE SUBMITTED WITH THE BID:**

The bidder must submit the following documents along with their bid to enable BHEL to evaluate their offer.

- a) Duly filled in Agitator datasheet [Annexure: 2] of all Varieties
- b) Preliminary GAD having Complete Details such as Foundation Details, Load Details, Dimensions etc.
- c) Agitator Performance curves (Liquid Height Vs BkW and other relevant Curves)
- d) Un-priced copy of attached BHEL price bid formats [Annexure: 3] indicating quoted/not quoted against each row & column.
- e) Pre-Qualification Criteria/ Equipment qualification criteria / PTR / Reference Lists [Annexure: 6]
- f) Checklist [Annexure: 4]
- g) Deviation list [Annexure: 10] **
- h) Guaranteed Power Consumption Format[Annexure-12]

** Bidder shall submit Annexure: 10 indicating as **NO DEVIATION** along with their offer. Any specific deviations, with respect to specification requirement due to design constraints and OEM limitation, which are impractical to meet, shall be raised in form of pre-bid queries as per Annexure: 11 before submission of Techno Commercial offer.

In case the above-mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.



1. INTENT OF SPECIFICATION

This specification specifies the minimum requirement of Complete Design, Engineering, Manufacturing, Assembling, Inspection & testing at manufacturer's works, Delivery of properly packed & painted, Supervision services at Site for Agitators with all equipment/accessories as specified in the scope of work and are provided in the Flue Gas Desulphurization plant of 1 X 660 MW Bhusawal Thermal Power Station Unit-6 FGD system for the safe and trouble-free operation of equipment to be installed at site.

2. SPECIAL NOTES TO BIDDERS

- 2.1 This specification shall be read in conjunction with all its annexures. In case of any discrepancy arising between this specification & its annexures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its annexures, calls for decision of owner/BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, so as to enable owner/BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by owner/BHEL then, without any cost, delivery, or any other commercial implications.
- 2.2 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.
- 2.3 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment's. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the Agitator unit is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.
- 2.4 Bidder shall quote strictly as per the scope of supply and requirements of this specification.
- 2.5 Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.
- 2.6 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.
- 2.7 In case Bidder is unable to offer due to any specific requirement of specification; Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.
- 2.8 In case of any conflict between this specification and Annexures, stringent of the requirement will govern.



3. PROJECT INFORMATION

Sl. No.	Description	Details
1.	Owner	Maharashtra State Power Generation co. Ltd.
2.	Project	Bhusawal Thermal Power Station 1 x 660 MW unit-6 project(FGD Package)
3.	Owner's consultant	Development Consultants Pvt. Ltd., Mumbai
4.	Location	Site is located in Dipnagar near Bhusawal, Maharashtra, India
5.	Nearest Airport	Aurangabad
6.	Nearest Railway Station	Bhusawal
7.	Logitude/latitude	75°51'10'' East/21°02'30'' North
8.	Lowest temperature recorded (deg. C)	13
9.	Highest temperature recorded (deg. C)	48.7
10.	Elevation above MSL	210 m
11.	Wet bulb temperature (deg. C)	27 (Maximum)
12.	Maximum Ambient temperature for Electrical equipment / system (deg. C)	50
13.	Minimum Ambient temperature for Electrical equipment / system (deg. C)	13
14.	Seismic Zone	Zone III as per IS :1893

Note: Any data required for designing the equipment, bidder may ask prior to the submission of bid.

4. APPLICATION OF SYSTEM

Agitators are envisaged to prevent caking and settlement of particles out of slurry/Sludge installed inside various Tanks. For the present requirement, Agitators are required for various tanks such As Auxiliary Absorbent Tank, Limestone Slurry Storage Tank Agitator, Secondary Hydrocyclone Feed Tank, Filtrate Water Tank Agitator, Waste Water Tank Agitator, Absorber Area Drain Sump Agitator, Gypsum Area Drain Sump Agitator and Limestone Area Drain Sump. Quantity required of Agitators for various tanks are mentioned in subsequent Clauses.

5. TECHNICAL DETAILS/REQUIREMENTS

5.1. **Applicable Codes and Standards:**

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Agitator shall follow the latest applicable Indian/International (AISI/ASME/EN/Japanese) Standards. GB standards are not acceptable.

5.2. Technical Details/Requirement:

Table-A: AGITATOR DETAILS FOR AUXILIARY ABSORBENT TANK		
Sl. No.	Description	Requirement
1	Type	Horizontal Type (Side Entry)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor [Canopy to be provided by bidder for Motor]
5	Operation	Whenever FGD is under Maintenance
6	Capacity of slurry	1545 m ³
7	Dimensions of Tank (in mtrs.)	12.5 Dia X13.4 H
8	Tank Shape	Cylindrical
9	MOC of Agitator	Agitator Shaft and blades shall be made with Alloy 926 or better material.
10	Minimum liquid level in the tank	1.0 mtr.
11	Normal liquid level in the tank	12.4 mtrs.
12	Maximum liquid level in the tank	12.6 mtrs.
13	Quantity of Agitators per Tank	4 Nos. [3 Nos. (To be Installed) +1 No. (Redundant)] Note: Out of the 4 Nos. of Agitator, 3 Nos. of Agitators shall be installed on Tank and 1 No. of Agitator shall be supplied as Warehouse Spare. Bidder shall ensure that the agitator is selected in such a way that the 3 nos. of Agitator installed on Tank shall meet the desired requirement.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	200 mesh (75 μ)
c	Normal solid particle size, d ₅₀	325 mesh (43 μ)
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	30%
h	Sp. Gravity of slurry	1.204
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	10 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design: 70 deg C.
Table-B: AGITATOR DETAILS FOR LIMESONE SLURRY STORAGE TANK		
Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)



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2	Medium to be handled	Limestone slurry
3	Duty	Continuous
4	Location	Outdoor [Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	437 m ³
7	Dimensions of Tank (in mtrs.)	8.0 Dia X9.2 H
8	Tank Shape	Circular
9	MOC of Agitator	Blade :Duplex Stainless steel Shaft : CS + Rubber lining
10	Minimum liquid level in the tank	1.2 mtr.
11	Normal liquid level in the tank	8.5 mtrs.
12	Maximum liquid level in the tank	8.7 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Limestone Slurry
b	Maximum solid particle size	200 mesh (75 μ)
c	Normal solid particle size, d50	325 mesh (43 μ)
d	Solid to be handled	Limestone + impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	30%
h	Sp. Gravity of slurry	1.214
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	30 cP
k	pH	5 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal: 54.2 deg C; Design : 70 deg C.

Table-C: AGITATOR DETAILS FOR SECONDARY HYDROCYCLONE FEED TANK

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor[Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	392 m ³
7	Dimensions of Tank (in mtrs.)	8.0 Dia X 8.3 H
8	Tank Shape	Cylindrical
9	MOC of Agitator	Blade: Duplex Stainless steel Shaft : CS+ Rubber lining
10	Minimum liquid level in the tank	1.4 mtr.
11	Normal liquid level in the tank	7.6 mtrs.
12	Maximum liquid level in the tank	7.8 mtrs.
13	Quantity of Agitators per Tank	1 No.



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14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	200 mesh (75 μ)
c	Normal solid particle size, d50	325 mesh (43 μ)
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	16.6%
h	Sp. Gravity of slurry	1.101
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	4 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design : 70 deg C.

Table-D: AGITATOR DETAILS FOR FILTERATE WATER TANK

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor[Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	47.75 m ³
7	Dimensions of Tank (in mtrs.)	4.0 Dia X 4.3 H
8	Tank Shape	Cylindrical
9	MOC of Agitator	Blade :Duplex Stainless steel Shaft : CS+Rubber lining
10	Minimum liquid level in the tank	1.1 mtr.
11	Normal liquid level in the tank	3.6 mtrs.
12	Maximum liquid level in the tank	3.8 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	200 mesh (75 μ)
c	Normal solid particle size, d50	325 mesh (43 μ)
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	11 %
h	Sp. Gravity of slurry	1.06
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	4 cP
k	pH	4 to 8



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1	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design : 70 deg C.

Table-E: AGITATOR DETAILS FOR WASTE WATER TANK

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor [Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	135 m ³
7	Dimensions of Tank (in mtrs.)	5.5 Dia X 6.2 H
8	Tank Shape	Cylindrical
9	MOC of Agitator	Blade : Duplex Stainless steel Shaft : CS+Rubber lining
10	Minimum liquid level in the tank	1.2 mtr.
11	Normal liquid level in the tank	5.5 mtrs.
12	Maximum liquid level in the tank	5.7 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	200 mesh (75 μ)
c	Normal solid particle size, d50	325 mesh (43 μ)
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	3%
h	Sp. Gravity of slurry	1.013
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	3 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design : 70 deg C.

Table-F: AGITATOR DETAILS FOR ABSORBER AREA DRAIN SUMP

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor [Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	56 m ³
7	Dimensions of Tank (in mtrs.)	4 (W) X4 (L) X4 (H)
8	Tank Shape	Rectangular



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9	MOC of Agitator	Blade :Duplex Stainless steel Shaft : CS+Rubber lining
10	Minimum liquid level in the tank	1.4 mtr.
11	Normal liquid level in the tank	3.3 mtrs.
12	Maximum liquid level in the tank	3.5 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	6-7 mm
c	Normal solid particle size, d50	6-7 mm
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	30%
h	Sp. Gravity of slurry	1.204
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	10 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design : 70 deg C.

Table-G: AGITATOR DETAILS FOR GYPSUM AREA DRAIN SUMP

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor[Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	56 m ³
7	Dimensions of Tank (in mtrs.)	4 (W) X4 (L) X4 (H)
8	Tank Shape	Rectangular
9	MOC of Agitator	Blade: Duplex Stainless steel Shaft : CS +Rubber lining
10	Minimum liquid level in the tank	1.4 mtr.
11	Normal liquid level in the tank	3.3 mtrs.
12	Maximum liquid level in the tank	3.5 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	6-7 mm
c	Normal solid particle size, d50	6-7 mm
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale



g	Slurry concentration	30%
h	Sp. Gravity of slurry	1.204
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	10 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal : 54.2 deg C; Design : 70 deg C.

Table-H: AGITATOR DETAILS FOR LIMSTONE AREA DRAIN SUMP

Sl. No.	Description	Requirement
1	Type	Vertical Type – (Center Mounted)
2	Medium to be handled	Gypsum slurry
3	Duty	Continuous
4	Location	Outdoor[Canopy to be provided by bidder for Motor]
5	Operation	Continuous
6	Capacity of slurry	56 m ³
7	Dimensions of Tank (in mtrs.)	4 (W) X4 (L) X4 (H)
8	Tank Shape	Rectangular
9	MOC of Agitator	Blade: Duplex Stainless steel Shaft : CS + Rubber lining
10	Minimum liquid level in the tank	1.4 mtr.
11	Normal liquid level in the tank	3.3 mtrs.
12	Maximum liquid level in the tank	3.5 mtrs.
13	Quantity of Agitators per Tank	1 No.
14	Slurry Details	
a	Slurry to be handled	Gypsum Slurry
b	Maximum solid particle size	6-7 mm
c	Normal solid particle size, d50	6-7 mm
d	Solid to be handled	Gypsum along with Limestone & other impurities
e	Chloride concentration	Max 20000 ppm
f	Hardness of particle	5-7 mohs scale
g	Slurry concentration	30%
h	Sp. Gravity of slurry	1.204
i	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)
j	Viscosity of Slurry	10 cP
k	pH	4 to 8
l	SiO ₂ Content	4 to 6 g/l
m	Temperature	Normal: 54.2 deg C; Design : 70 deg C.

6. SCOPE OF SUPPLY/SERVICES AND TECHNICAL FEATURES

Scope for the bidders shall include Design, Engineering, Manufacturing, Supply, and Supervision services at site. Please refer below clauses for more details on scope of supply.



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.

6.1. SCOPE OF SUPPLY

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

Supply: Bidder's scope of supply to include all requirements specified in this specification and annexures including testing, painting, documentation, sub vendor list, equipment specifications etc.,

The scope of supply and for this enquiry is as given below:

Quantity of Agitator and Its Associated Accessories: Refer Technical Details of Agitator Details (Annexure-1).

Scope for Each Agitator Assembly is as follows:

1.	Assembly of Agitator Blades and Shaft, Coupling arrangement (Flexible), Gland Packing, Seals, O Rings, Glands, Shaft Sleeve, Lanterns/ Stools (Bearing Housing), Safety Guard, Bearings, Agitator Mounting Flanges with gaskets and fasteners, Drive Motor with gearbox arrangement etc.
2.	Vessel nozzle, Mating Flange for Supporting on Slurry Tank Roof
3.	Bidder shall provide the details of first Fill of Lubricants and Consumables (quantity, type of lubricant, periodicity etc.). First Fill of Lubricants and Consumables is in BHEL Scope.
4.	Complete Civil Loading data to enable purchaser for finalizing Civil Design and BoQ.
5.	Special tools & tackles as applicable- 1 Set for Each Agitator One set (1 Set) of Special tools and tackles [special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance (disassemble, assemble, or maintaining the unit) of the Agitator-Gear box-Motor assembly shall be quoted as per manufacturer's recommendation. 1 Sets stands for requirement for one no. of Agitator. Bidder to furnish the list along with the offer. Prices for Special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.
6.	Start-up and Commissioning Spares as applicable- 1 Set for Each Agitator Commissioning spare shall be as per OEM recommendation. Any leftover (unused) spares after commissioning, out of those included by vendor, shall be handed over to the owner.



	Bidder shall include all the required commissioning spares in their scope of supply and ensure that the erection and commissioning of the plant is not delayed for want of Commissioning spares. Prices for the commissioning spares shall be part of main scope of supply. No separate price shall be offered for the same. <i>Note: Any commissioning spare consumed over and above the recommended commissioning Spares, during commissioning shall be supplied free of cost by the equipment vendor</i>
7.	Necessary Bolts, nuts, shims/grouting pads etc.
8.	Any other items required for completeness of the equipment except the items covered in the exclusions.
9.	Complete Unit Test: All ordered Agitators shall be tested with Job motor, Job coupling, and Job base plate, Job Gear Box etc.
10.	Recommended Spare List (Not in Bidder Scope): Bidders shall also furnish the Recommended spares list along with the offer required for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment.

6.2. SCOPE OF SERVICES :

Bidder shall quote for services which includes supervision of erection & commissioning (including trial operation) and comprehensive training the end customer's Personnel covering the all aspects of Agitators - Operation & Maintenance, Troubleshooting etc.

Bidder to note that the service charges for the above shall consists of the following:

- Per day supervision charges of an Engineer including all other expenses like boarding, lodging, local travel, insurance etc.
- Travel expenses (inclusive of any clearance charges like Visa fee etc, insurance) from / to vendor works to site.

Per diem charges shall be applicable from the day bidder's representative reports to site, up to the day certified by BHEL.

For the purpose of tender evaluation man days and Visits as mentioned in Price bid shall be followed. Please refer to price bid format enclosed as Annexure-3A-I & 3A-II.

Notes:

- However, either or both of the number of man days or number of visits may change on either side based on the actual site requirement.
- All payments towards supervision services shall be made only after BHEL certification.

- iii. Bidder to mobilize concerned competent person for supervision service activities within a period of 7 days of receipt of intimation in this regard by BHEL.
- iv. Bidder to quote supervision service activities strictly as per BHEL's price format.

6.3. TECHNICAL FEATURES :

SL. No.	Technical Requirement
I.	GENERAL REQUIREMENTS
1	All agitators shall be designed for continuous operation unless otherwise specified elsewhere. The design of the agitators shall be of proven type.
2	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-Flushless Type (only for side entry agitators), impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.
3	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.
4	The material for the shaft and agitator blades of the Auxiliary Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades and Shaft shall be made of Duplex Stainless Steel (SS904 L) and CS +Rubber Lining respectively.
5	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.
6	To prevent mechanical blocking load start-up after standstill of pumps, piping and Agitators for slurries shall be applied with C-hose connection.
7	Lifting lugs and eyes as required for Agitator Assembly and its associate components shall be provided to permit easy handling.
8	Static and dynamic balancing of all agitators shall be carried out after assembly.
9	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.
10	All exposed moving parts shall be covered by guards made up of Mild Steel.
11	Side entry agitator shall be flange mounted.
12	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 & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.
13	Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions.
14	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



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	98% of liquid column to virtually “Uniform Solid Concentration”. No chemical reaction will takes place.
15	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 as per OEM standard practice. Bidder's machines that consume less power will be in an advantageous position.
16	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”.
17	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.
18	Agitator and its driver shall perform on the test stand at shop and on the Agitator's permanent location at site within vibration limit the vibration of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the “Acceptance Criteria” of the equipment. Please note vibration at test stand can only be taken for information.
19	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. The Tank water level is indicated as per Annexure-1.
20	Agitator must have low-pitch propeller with low solidity ratio and Power Number of 0.3-0.35. The Maximum Input Power at motor terminal shall be considered as a guaranteed parameter under “Schedule of Guaranteed Parameters” 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.
21	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.
II.	CONSTRUCTIONAL FEATURES
A)	BLADE AND HUB OF PROPELLER
i)	The material for the shaft and agitator blades of the Auxiliary Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades and Shaft shall be made of Duplex Stainless Steel (SS904 L) and CS+Rubber Lining respectively..
ii)	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.



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iii)	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.
iv)	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.
B)	BLADE AND HUB OF PROPELLER
1.	<u>Horizontal / Side Entry Agitators for Auxiliary Absorber Tank</u>
i)	Agitators should be provided with Single Stage mechanical seal. The mechanical seal should be as per ISO-21049 / API 682. However, bidder shall ensure to select most suitable type of seal (single stage or double stage) as suitable for the given application.
ii)	The Mechanical Seals shall be so arranged that repacking or fitting of replacement seals can be carried out with the minimum of disruption to plant operation.
iii)	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.
iv)	Provide requirements for periodical flushing to rinse the seal face for leaked slurry.
v)	All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.
vi)	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.
vii)	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, it should have a provision of collecting / or discharging back to the tank.
viii)	Mechanical seals shall be fitted and installed in the Agitator before shipment and shall be clean. Mechanical seals shall be plugged with screw for shipping.
ix)	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. Agitator manufacturer to decide the same along with seal manufacturer the best seal that is suitable for the offered Agitator
x)	Seal life has to be guaranteed, taking into consideration all its components for 25000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.
2.	<u>Vertical Agitators for Tanks(Other than Auxiliary Absorber Tank) and Sumps</u>
i)	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.
C)	SHAFT
	MOC of Shaft shall be Alloy 926 or better material for Agitator of Absorber Auxiliary Tank and CS + Rubber Lining for Agitator of other Tanks. 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.
D)	BEARING & BEARING HOUSING IN GEAR BOX



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i)	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.
ii)	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).
iii)	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.
iv)	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.
v)	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.
E)	MATERIALS
i)	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.
ii)	A detail quality plan is to be submitted along with offer for all items marked "Full Compliance Material".
F)	Driver (Motor)
i)	Supply Power Parameters: 11 KV: For Motor above 160 kW 415 V: For 0.2 kW to 160 Kw 240 V: Upto 0.2 Kw Frequency Variation: +3% and -5% Voltage variation: (+/-)10% Combined Variation of Voltage and Frequency: 10% Absolute Sum
ii)	Motor Design Standard: IS325 duly taking care of Customer Motor Specification (Annexure-5). Energy Efficient Class: IE3 as per IS12615 Motor Protection: IP 55 System Fault Level Current: 50 KA for 1 Sec Service Factor:1.0 Canopy: To be Provided for all Motors
iii)	Motor Rating shall be selected higher than maximum load demand of the driven Equipment under entire operating range, Including voltage and Frequency variation. Driver shall also meet all specified operating conditions including bearing housing , seal, external gear box and coupling loss(if any).
iv)	The Motor Name Plate rating shall have more than 10% margin over the input power requirement of the HT Driven Equipment and 15% for LT Driven equipment at rated duty point.
v)	For Other Motor Technical Requirement, Please refer Motor Specification (Annexure-5).
G)	GEAR BOX



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	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 at Gear box shall be at least 1.5 times the rated torque of Agitator.
H)	COUPLING & COUPLING GUARD
i)	Coupling and coupling guard should be supplied between driver and driven equipment.
ii)	Coupling should be designed taking into consideration adequate service factor.
iii)	Design rating of the coupling (excluding service factor) should be indicated in data sheet.
iv)	Coupling must be having locking screw so that it does not slide over shaft in due course operation.
v)	Vertical Agitators - Coupling between Motor and Gear Box shall be Spacer-type flexible coupling, made of Cast Iron. Spacer length shall be of sufficient length so than Motor and Gear Box shall be able to run independently at no-load condition by detaching the respective coupling.
vi)	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.
vii)	Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations.
I)	PLATE AND FASTENING BOLTS
i)	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.
ii)	Base plate must have provision of leveling on its intended mounting place. Sole plate is not in the scope of supply of Agitator manufacturer. It should be noted that Sole plate will be rubber lined to prevent any leakage of corrosive gases.
iii)	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.
iv)	Sole plate with desired number of hole, will be machined on one side. Sole 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.
J)	OTHER COMPONENTS
	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.
K)	AUXILIARY ABSORBER TANK AGITATORS:
i)	All Agitators shall be designed for continuous operation.
ii)	The Absorber Agitators shall be of Horizontal / Side Entry type.
iii)	The Material of Construction (MOC) of Agitators shall be Alloy 926 or better material as per Technical Details of Agitator(Annexure-1).
iv)	It should be of Flange mounted type.
v)	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 condition.



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vi)	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from side. Vendor to provide the nozzle along with the agitator.
vii)	The Bidder to consider Gypsum Sedimentation during stoppage of Agitator.
viii)	<u>The following information to be provided along with the bid:</u> a) <u>Impeller Diameter</u> b) <u>Impeller Speed</u> c) <u>Agitator Pumping Capacity (m³/min)</u> d) <u>Volume per Agitator:</u>
L)	Other Tanks Agitators:
i)	All Agitators shall be designed for continuous operation.
ii)	The Material of Construction (MOC) of Agitators: Agitator blades and Agitator shaft shall be Duplex Stainless steel and CS + Rubber lining respectively.
iii)	It should be roof mounted.
iv)	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.
V)	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.
vi)	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Vendor to provide the nozzle along with the agitator.
vii)	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material.
viii)	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.
ix)	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.
x)	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 that the torsional critical speed is well off the operating speed by 20% from the operating speed.

7. OPTIONAL PRICES:

Bidders shall also furnish the **optional Price for 3 years** recommended spares required for normal operation of Agitator along with the offer as per Price Bid Format (Annexure-3). Prices of these spares will not be used for evaluation of the bids and will remain valid up to 6 months after placement of Notification of Award for the main equipment.

8. EQUIPMENT QUALIFICATION CRITERIA (EQC)/ PREQUALIFICATION CRITERIA

Vendor to furnish duly fill in Experience Record Proforma /Prequalification Criteria as per Annexure-6.

9. QUALITY PLAN AND INSPECTION & TESTING



9.1. QUALITY PLAN

Quality plan will be reviewed during detailed Engineering stage with respect to inspection, standard Engineering practices & specification requirements and various tests and stages of inspection and appropriate agencies for Inspection will be Intimated. Bidder to abide by the same.

Pl refer Annexure: 7 for guidelines & QAP format. For details, refer enclosed specifications.

9.2. INSPECTION & TESTING:

Sl. No.	Description
The General inspection requirements to be considered are as below:	
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used on the Agitators for review by BHEL/Customer/Consultant prior to manufacture.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by BHEL/Customer/Consultant.
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 test 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.
6.	Dynamics of Agitator
6.1	Critical Speed
6.1.1	Operation speed of the Agitator motor shall be at least 25% below the first critical speed
6.1.2	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 that the torsional critical speed is well off the operating speed by 20% from the operating speed.
6.2	Vibration Severity



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6.2.1	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.
6.2.2	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, 1.5-2.3mm/sec even if Motor rating falls below 15kw.
6.2.3	Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity.
6.2.4	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.
7.	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.
8.	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.
9.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
10.	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.
11.	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.
12.	All offered agitators will be inspected at the Bidder's works before dispatch or where the test facilities are available. In case the systems / Agitators are being supplied from outside India, the inspection and witnessing of performance test shall be by renowned Third Party Inspection as mentioned below has to be considered and the charges should be included by bidder in the Main offer. For those bidders, who are supplying from India, such third party inspection / witness charges need not be considered in bidder's price and same will be arranged by BHEL/ BHEL nominated inspection agency. i. Lloyds Register of Industrial Services (LRIS), ii. Bureau Veritas (BV), iii. Det Norske Veritas (DNV), iv. Certification Engineers International Ltd. (CEIL), v. TUV



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	The above list is only indicative and the actual approved third party details will be arranged by purchaser after order placement. Bidder to quote the price of Agitators accordingly as per price Bid format (Annexure-3). Customer and BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection. Local conveyance to be arranged by Bidder at their own cost.
13.	Job shaft mechanical seals shall be used during shop tests.
14.	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
15.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment.
16.	Bidder to arrange all calibrated gauges, Instruments during inspection.
17.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.
18.	Performance Guarantee at site
18.1	All performance tests for Agitators shall be carried out in accordance with any latest international codes/standards. Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories.
18.2	Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed.
18.3	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.
18.4	Acceptance tests to be carried out as per the procedure defined by the bidder, which shall be submitted and approved by Customer/Consultant/BHEL.
18.5	In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at their own cost and the performance test shall be repeated. The extension of delivery schedules will not be entertained due to this reason.

10. PAINTING

The VENDOR's scope of work shall include surface preparation, and application of shop painting and final painting to all equipment and accessories, uninsulated piping and structural steel work forming part of this package. The color code shall be based on Indian Standard, IS. The Painting Shall be as follows:

i) Surface Preparation: Blast Cleaning SA 2.5

ii) PRIMER COAT:



- a. Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ± 2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70 μ
- iii) Intermediate : One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80% ± 2) DFT- 100 μ .

iv) FINISH COAT:

Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55% ± 2) DFT- 35 μ / coat Shade: Grey white RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0 Δ E)

v) COLOUR CODE

Base: To be informed during contract stage.

Lettering: To be informed during contract stage

Prior approval of painting shall be taken from BHEL after award of contract.

For More Details on Painting of Agitator Assembly and all other accessories shall be as per Annexure-5. In case of any ambiguity, the painting shall be discussed and mutually agreed after award of contract.

Final shade for Agitator, Motor and Gearbox shall be informed during detail engineering stage

11. PACKING AND FORWARDING:

The equipment shall be protected for a storage of 12 months at site. If any extra precaution is to be taken by the purchaser for storage beyond 12 months, the same shall be explicitly indicated in the Operation & Maintenance manual. For details please refer Annexure-5.

12. SUB-VENDORS

Bidder shall follow approved sub vendors list as per Annexure-8.

In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list [Annexure-8] and to furnish Proven Track record, credentials for the proposed vendors for BHEL approval.

For other items for which sub vendors are not specified, bidder can follow their standard vendors with due intimation to BHEL during detailed engineering stage. Also they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

13. INSTRUCTIONS ON PRICE BID FORMAT AND BID EVALUATION CRITERIA FOR POWER CONSUMPTION:

13.1 INSTRUCTIONS ON PRICE BID FORMAT:



Bidder to indicate his offer as per Price Bid format enclosed as Annexure-3.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per Annexure-11, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be in bidder scope Only.

Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. Prices quoted by the bidder shall remain firm till the successful handing over of the entire package to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

13.2 GUARANTEE & BID EVALUATION CRITERIA FOR POWER CONSUMPTION:

Bidder to specify the total Guaranteed Auxiliary Power Consumption of the following Agitators operating at the rated capacity in their offer and please also refer to Cl.No.6.3.(I.20) & 9.2 etc for Guarantee conditions.

- 1) Filtrate Water Tank Agitator
- 2) Waste Water Tank Agitator
- 3) Limestone Slurry Storage Tank Agitator
- 4) Secondary Hydrocyclone Feed Tank Agitator

The total auxiliary power consumption guarantee for the all the above listed agitators together (Sl.No.(1) to (4)) shall **not** exceed 37kW, failing which the offer of bidder will not be considered for evaluation.

14. PRE-BID CLARIFICATIONS & DEVIATIONS:

Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.

Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.



Bidders may also please note that the data sheets for valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.

All pre-bid clarifications & deviations shall be clear bring as per Annexure: 11 only.

In case bidder doesn't bring any clarification/deviation in prebid stage, the same shall be brought in their offer with following conditions:

- a) Any deviations to Customer specifications, same are acceptable provided these deviations are also regularly accepted by Customer for their direct orders on bidders. In such cases, proof of the same shall be furnished along with the offer.
- b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.
- c) Price implication due to non-acceptance [by BHEL/Customer] of the deviations considered by bidder will not be permitted.
- d) Deviations [if any] shall be clear bring as per Annexure-10 only.

15. DOCUMENTATION:

Please refer to enclosed Master Documentation List [MDL] for the list of DOCUMENTS / DRAWINGS to be submitted by the bidder as part of documentation. Bidder shall ensure submission of all documentation as per the MDL, Annexure: 9.

Bidder to note that the dates of submission of all the documents shall be finalized based on PO date. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.

DEFINITION OF VENDOR DOCUMENT REVIEW STATUS ASSIGNED BY BHEL

The guidelines listed below are followed in assigning the document status code to the vendor documents: Final submittal of vendor documents will not be required as long as the document status code is 1 or 4 and the "AS-BUILT" condition of the component agrees with the current document.

Permission to proceed does not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the vendor and does not relieve the vendor from full compliance with contractual obligations.

Code-1: Approval

The document conforms to procurement document requirements. The document requires no changes or additions. Matters remaining to be resolved do not require document change and will be handled by correspondence. Where it is known that the design information on a vendor



document is not complete and re-submittals will be required, e.g., due to "hold" areas, the document is assigned another status code.

Code-2: Revise and resubmit

Work may proceed subject to resolution of indicated comments. The document is in basic conformance with procurement document requirements. Minor deviations from procurement document requirements have been noted or other minor technical or physical changes in the equipment are required. The vendor shall resolve comments and resubmit documents prior to shipment of commodity.

Code-3: Rejected. Revise and resubmit

The document:

- Does not conform to the procurement requirements,
- Is of a design that is technically unacceptable without significant changes,
- Does not meet project requirements, i.e., orientation of equipment, nozzles, conduit connections, etc.,
- Does not conform to project criteria or with proposal documents or data, or
- Does not meet minimum submittal requirements.

This submittal rejection does not relieve vendor of any schedule commitments.

Code-4: Review not required

The document is not subject to BHEL review. Typical uses for this status are in the review of items that are vendor standard products, small internal parts of major equipment, or vendor standardized data.

DRAWINGS REVIEW & APPROVALS:

Each drawing submitted by the bidder shall be with a title block furnished by BHEL during detailed engg stage.

All drawings / documents shall be thoroughly checked, duly signed, and stamped by the vendor including drawing /documents of sub-vendor, before submission to BHEL. Documents, which are unchecked, unsigned, and without revisions marked clearly, shall be returned without review. Any delay on account of this shall be to the vendor's account. After first review of documents, vendor to submit all the further revisions of documents along with comment resolution sheet. Successive documents submitted without comment resolution sheet shall be returned without review.

The approval and /or review by BHEL /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

Documents once reviewed in Code-1 shall not be submitted (incorporating some changes) again for review, however if some change is really necessary, the same shall be brought to the notice of BHEL separately through design change note for review / information. Finally, As – built drawings, duly updated, shall be submitted.



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During detailed engg. stage, BHEL shall furnish check list regarding minimum contents in GA drawing. Bidder to submit GAD [duly incorporating all requirements as per the check list] along with signed checklist. GAD shall not be reviewed without duly filled in checklist signed by the bidder.

NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED:

All the documents shall be submitted as given below:

SL NO.	DESCRIPTION	NO. OF COPIES / PIECES TO BE SUBMITTED	WHEN TO SUBMIT
1)	Schedule of Documents and Drawings submission (with planned date)	Soft Copy Only	Within 3 days of placement of order
2)	Initial drawings/documents under approval and information category.	Soft copy only	Within 14 days of placement of order
3)	BHEL shall furnish their observation on submitted documents	Soft copy only	Within 14 days of document submission
4)	*Revised drawings/documents along with compliance sheet incorporating all BHEL comments. <i>*Vendor to incorporate all BHEL comments so that further revisions can be minimized.</i>	Soft copy only	Within 7 day of receipt of commented Drawings from BHEL
5)	BHEL shall furnish their observation on revised submitted documents	Soft copy only	Within 14 days of document submission
6)	Final Drawings/documents	12	Within 2 months of placement of order.
7)	Erection Documentation	5	1 month before dispatch of equipment. The list of documents identified under master document list for erection to be furnished in 5 no's of folders
8)	Draft O & M Manuals for BHEL review. <i>Note: Bidder to furnish final hard copy of O&M only after getting concurrence on soft copy.</i>	Soft copy	At least 2 months before the delivery date of equipment
9)	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	12	Within one month before the delivery date of equipment



10)	Final O&M manuals in a CD	4	Within one month after dispatch of equipment after BHEL concurrence on soft
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Notes:

The O&M manuals shall contain the following as minimum:

- The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., full contact address with telephone, fax, & e-mail details.
- Brief description of the system.
- All approved documents [Drawings, documents & test procedures as per MDL]
- Bill of material, BBU, LO schedule, sub vendor list, Mandatory & commissioning spares list etc. Operation, Instruction & maintenance manuals of all equipments / items of the complete package
- System unloading, storage erection, start up, commissioning, shut down requirements.
- Operational & environmental safety instructions.
- Test reports and certificates.
- Catalogues of the equipment & instrumentation.

16. DEFECT LIABILITY/ WARRANTY:

The Bidder warrants that the equipment's/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 Warranty Period shall be twenty four (24) months from the date of delivery or eighteen months (18) months from the date of commissioning, 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.

In case of failure of the equipment to meet the guarantee, BHEL/Customer/Consultant reserves the right to reject the equipment. However, BHEL/Customer/Consultant reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement.

17. LIQUIDATED DAMAGES FOR POWER CONSUMPTION:

If actual Power Consumption during PG Test at the rated operating condition defined above, exceeds the value guaranteed by the bidder, liquidated damages for shortfall in performance shall be deducted from contract price as per the formula given below:

Liquidated damage deductible in INR = (OAPC-OGPC) X P

Where,

OGPC- Overall Guaranteed Power Consumption quoted by bidder in kW, as per Annexure-12



OAPC- Overall Actual Power Consumption in kW, for the list of Agitators in Annexure-12

P- Penalty @ 4,50,000 INR per kW

18. VARIANT TABLE:

Variant	Item	Material Code
01	Auxiliary Absorbent Tank Agitator with commissioning spare and Special tool and Tackles.	PY9751648017
03	Limestone Slurry Storage Tank Agitator with commissioning spare and Special tool and Tackles.	PY9751648033
05	SECONDARY HYDROCYCLONE FEED TANK Agitator with commissioning spare and Special tool and Tackles.	PY9751648050
07	Filtrate Water Tank Agitator with commissioning spare and Special tool and Tackles.	PY9751648076
09	Waste Water Tank Agitator with commissioning spare and Special tool and Tackles.	PY9751648092
11	Absorber Area Drain Sump Agitator with commissioning spare and Special tool and Tackles.	PY9751648114
13	Gypsum Area Drain Sump Agitator with commissioning spare and Special tool and Tackles.	PY9751648130
15	Limestone Area Drain Sump Agitator with commissioning spare and Special tool and Tackles.	PY9751648157
17	Supervision of E&C for Agitator	PY9851648175



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				Annexure-1	
				Rev. No.	00

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Annexure-1

A. TECHNICAL DETAILS OF AGITATOR

B. TANK DRAWINGS

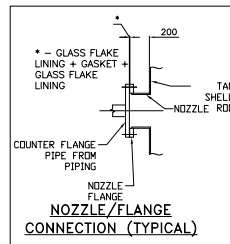
Revisions: Refer to record of revisions				

ANNEXURE-1: Technical Information of Agitators for Mahagenco Bhusawal (1 X 660 MW) FGD system

REF: BHUSAWAL:FGD:AGITATORS									
PROJECT INFORMATION:									
a.	Owner	Mahagenco Bhusawal							
b.	Capacity (MW)	1X660 MW							
c.	Buyer	BHEL							
c.	Process/Application	Flue Gas Desulphurization							
PROJECT LOCATION									
a.	Country	India							
b.	State/Division	Maharashtra							
c.	District	Jalgaon							
TECHNICAL INFORMATION OF									
SLNO	Description	AUXILIARY ABSORBENT TANK AGITATOR	LIMESTONE SLURRY STORAGE TANK AGITATOR	SECONDARY HYDROCYCLONE FEED TANK AGITATOR	FILTRATE WATER TANK AGITATOR	WASTE WATER TANK AGITATOR	ABSORBER AREA DRAIN SUMP AGITATOR	GYPSUM AREA DRAIN SUMP AGITATOR	LIMESTONE AREA DRAIN SUMP AGITATOR
1	Agitator slno	2	3	4	5	6	7	8	9
2	Parameters								
a.	Type	Horizontal Type (Side Entry)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)
b.	Medium to be handled	Gypsum slurry	Limestone slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry
c.	Seal Type	Mechanical Seal (Flushless)	Not required	Not required	Not required	Not required	Not required	Not required	Not required
d.	Emergency Flushing	Applicable	Not required	Not required	Not required	Not required	Not required	Not required	Not required
e.	Duty	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
f.	Agitator location	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
g.	Operation	Whenever FGD is under maintenance	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.
3	Tank Details								
a.	Tank shape	Circular	Circular	Circular	Circular	Circular	Rectangular	Rectangular	Rectangular
b.	Tank Name	AUXILIARY ABSORBENT TANK	LIMESTONE SLURRY STORAGE TANK	SECONDARY HYDROCYCLONE FEED TANK	FILTRATE WATER TANK	WASTE WATER TANK	ABSORBER AREA DRAIN SUMP	GYPSUM AREA DRAIN SUMP	LIMESTONE AREA DRAIN SUMP
c.	Capacity of slurry (in m3)	1545 m ³	437 m ³	392 m ³	47.75 m ³	135.0 m ³	56 m ³	56 m ³	56 m ³
d.	Dimension (m)	12.5 Dia X13.4 H	8.0 Dia X9.2 H	8.0 Dia X8.3 H	4.0 Dia X4.3 H	5.5 Dia X6.2 H	4 W X4 L X4 H	4 W X4 L X4 H	4 W X4 L X4 H
e.	MOC of Agitator	Agitator Shaft and blades shall be made with SS904 L Or Nickel Alloy	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining	Blade :Duplex Stainless steel Shaft : CS+Rubber lining
f.	Minimum liquid level in the tank	1.0	1.2	1.4	1.1	1.2	1.4	1.4	1.4
g	Normal liquid level in the tank	12.4	8.5	7.6	3.6	5.5	3.3	3.3	3.3
h.	Maximum liquid level in the tank	12.6	8.7	7.8	3.8	5.7	3.5	3.5	3.5
i.	Quantity of Agitators per Tank	3 Nos. (To be Installed on Tank) + 1 No.(Warehouse Spare)	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
j.	Total Quantity	4 Nos.	1 No	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
4	Slurry Analysis								

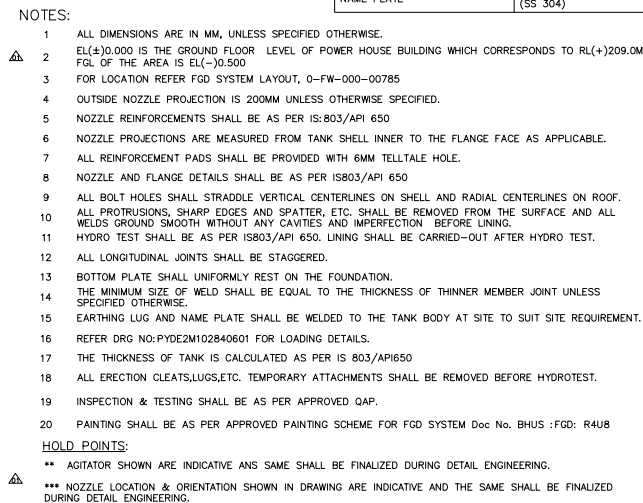
a.	Slurry to be handled	Gypsum slurry	Limestone slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry
b.	Maximum solid particle size	200 mesh (75 μ)	200 mesh (75 μ)	200 mesh (75 μ)	200 mesh (75 μ)	200 mesh (75 μ)	6-7 mm	6-7 mm	6-7 mm
c.	Normal solid particle size, d50	325 mesh (43 μ)	325 mesh (43 μ)	325 mesh (43 μ)	325 mesh (43 μ)	325 mesh (43 μ)	6-7 mm	6-7 mm	6-7 mm
d.	Solid to be handled	Gypsum along with Limestone & other impurities	Limestone + impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Limestone + impurities
e.	Chloride concentration	Max 20000 ppm	Max 1000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 1000 ppm
f.	Hardness of particle	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale
g.	Slurry concentration, wt%	30%	30%	16.60%	11%	3%	30%	30%	30%
h.	Sp. Gravity of slurry	1.204	1.214	1.101	1.060	1.013	1.204	1.204	1.214
i.	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)
j.	Viscosity of Slurry	10 cP	30 cP	4 cP	4 cP	3 cP	10 cP	10 cP	30 cP
k.	pH	4 to 8	5 to 8	4 to 8	4 to 8	4 to 8	4 to 8	4 to 8	5 to 8
l.	SiO ₂ Content	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l
m.	Temperature	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -52.2 deg C; Design-70 deg C	Normal -54.2 deg C; Design-70.0deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.
5	PRICE loading for auxiliary power consumption (Refer Bid specification for the details)	Not applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Not applicable	Not applicable

INVENTORY NO.	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME XXXXXXXXXXXX-SXX-RXX.DWG
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MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, ROOF, BASE AND BOTTOM PLATE	IS:2062 E250 GRADE BR
STRUCTURES	IS:2062 E250 GRADE A/ B
STAIRWAYS & PLATFORMS	IS:2062 E250 GRADE A/ B
MANHOLE	IS:2062 E250 GRADE BR
NOZZLE	A106 G B
NOZZLE FLANGES	IS:2062 E250 GRADE BR
NOZZLE REINFORCEMENT	IS:2062 E250 GRADE BR
NOZZLE NECKS	IS:1239
HAND RAILING	IS:1239 PART(II) MED. GRAD PIPE
GASKETS	BUTYL RUBBER
BOLT	IS:1367 CLASS 4.4
FITTINGS	UP TO 50NB ASTM A105, ABOVE 50NB & UP TO 350NB ASTM A234 G.C.WPB. 350NB & ABOVE FABRICATE FROM PARENT PIPES
EARTHING LUG	AUSTENITIC STAINLESS STEEL (SS 304)
ANCHOR CHAIR	IS:2062 E250 GRADE BR
FOUNDATION BOLTS	IS:1367 CLASS 4.4
NAME PLATE	AUSTENITIC STAINLESS STEEL (SS 304)

DESIGN DATA		
DESIGN CODE	—	IS: 803/API 650
STORAGE PRODUCT	—	LIMESTONE SLURRY
TANK CAPACITY(HOLD VOLUME)	M3	1546
TANK CAPACITY(EFFECTIVE)	M3	1497
TYPE OF TANK	—	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	—	5'
DESIGN PRESSURE	—	HYDROSTATIC HEAD
OPERATING PRESSURE	—	ATMOSPHERIC
DESIGN TEMPERATURE	°C	60
OPERATING TEMPERATURE	°C	54.2
SPECIFIC GRAVITY	—	1.214
HYDRO TESTING	—	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	—	0.7
RADIOGRAPHY	—	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
BASIC WIND SPEED	M/S	39
SEISMIC ZONE	—	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	12500
HEIGHT	MM	13400
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	10,10,8,8,6,6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	—	NOT APPLICABLE
EMPTY WEIGHT	TON	77
WATER FILLED WEIGHT	TON	2280
INSIDE LINING	—	3MM THICK VINYL ESTER BASED 3MM THICK GLASS FLAKE LINING

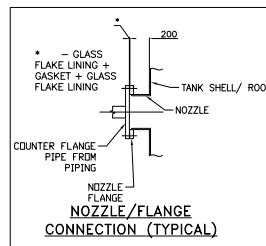


REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC NO.
1	PROCESS P&ID AUXILIARY ABSORBENT TANK	B240-00710
2	DESIGN CALCULATIONS OF AUXILIARY ABSORBENT TANK	PY-CD-4-M102-8406-01
3	FGD- SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000-00742
4	FGD DESIGN BASIS-PROCESS	4-FW-000-00773
5	FOUNDATION INPUT DETAIL DRAWING OF AUXILIARY ABSORBENT STORAGE TANK	PYDE2M102840601
6	PLOT PLAN FOR FGD SYSTEM	0-FW-000-00785
7	FGD MATERIAL SELECTION	F-FW-000-00779
8	PAINTING SYSTEM FOR FGD SYSTEM	BHUS:FGD:RAU8

PROJECT:		1x660 MW BHUSAWAL TPS UNIT-6 (FGD PACKAGE)															
CUSTOMER:		MAHARASHTRA STATE POWER GENERATION CO.LTD.															
PWC CONSULTANT		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI, NAVI MUMBAI															
																	
		BHARAT HEAVY ELECTRICALS LTD. HYDERABAD															
DEPT. PEASO CODE 450		UNTOL. DIMS. GR. S/M/F				SCALE NTS		WEIGHT (KG) -N-A-		REF. TO ASSY. DRG. -N-A-		ITEM NO. -N-A-		NO. OF ITEMS -N-A-			
TITLE GENERAL ARRANGEMENT OF AUXILIARY ASSEMBLY STORAGE TANK (CAP: 1497M3)																	
CARD CODE								DRAWING NO. PYDGM102840601						REV. 01			
SHT. NO.								NO. OF SHT.									

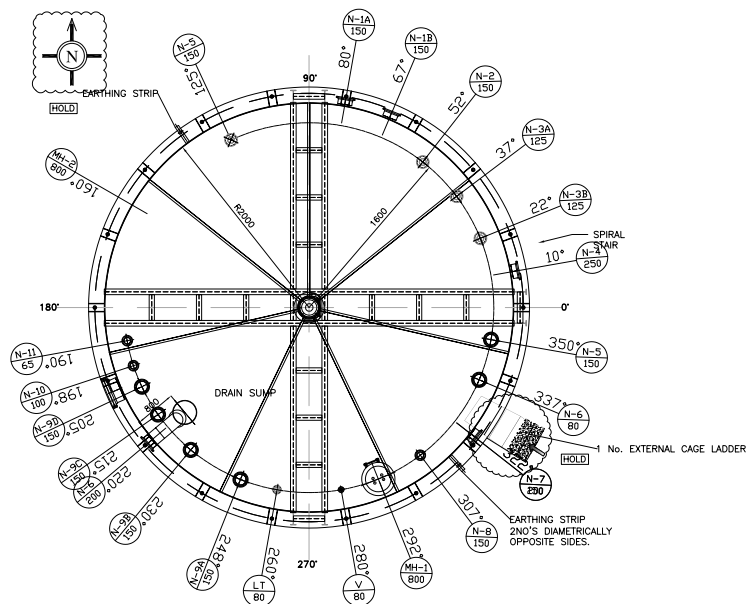
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INVENTORY NO.	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME
			XXXXXXXXXX-SXX-RXX.DWG



MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, ROOF, BASE AND BOTTOM PLATE	IS:2062 E250 GRADE BR
STRUCTURES	IS:2062 E250 GRADE A / B
STAIRWAYS & PLATFORMS	IS:2062 E250 GRADE A / B
MANHOLE	IS:2062 E250 GRADE BR
NOZZLE	A106 Gr B
NOZZLE FLANGES	IS:2062 E250 GRADE BR
NOZZLE REINFORCEMENT	IS:2062 E250 GRADE BR
NOZZLE NECKS	IS:1239
HAND RAILING	IS:1239 PART(II) MED. GRADE PIPE
GASKETS	BUTYL RUBBER
BOLT	IS:1367 CLASS 4.4
FITTINGS	UP TO 50NB ASTM A105, ABOVE 50NB & UP TO 350NB ASTM A234 Gr.WB. 350NB & ABOVE FABRICATE FROM PARENT PIPES
EARTHING LUG	AUSTENITIC STAINLESS STEEL (SS 304)
ANCHOR CHAIR	IS:2062 E250 GRADE BR
FOUNDATION BOLTS	IS:1367 CLASS 4.4
NAME PLATE	AUSTENITIC STAINLESS STEEL (SS 304)

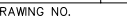
DESIGN DATA		
DESIGN CODE	—	IS: 803/API 650
STORAGE PRODUCT	—	ABSORBER BLEED
TANK CAPACITY(HOLD VOLUME)	M3	48
TANK CAPACITY(EFFECTIVE)	M3	29
TYPE OF TANK	—	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	—	5'
DESIGN PRESSURE	—	HYDROSTATIC HEAD
OPERATING PRESSURE	—	ATMOSPHERIC
DESIGN TEMPERATURE	°C	60
OPERATING TEMPERATURE	°C	58
SPECIFIC GRAVITY	—	1.06
HYDRO TESTING	—	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	—	0.7
RADIOGRAPHY	—	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
WIND CODE	—	39
SEISMIC CODE	—	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	4000
HEIGHT	MM	4300
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	—	NOT APPLICABLE
EMPTY WEIGHT	TON	14
WATER FILLED WEIGHT	TON	78
INSIDE LINING	—	3MM THICK VINYL ESTER BASED 3MM THICK GLASS FLAKE LINING

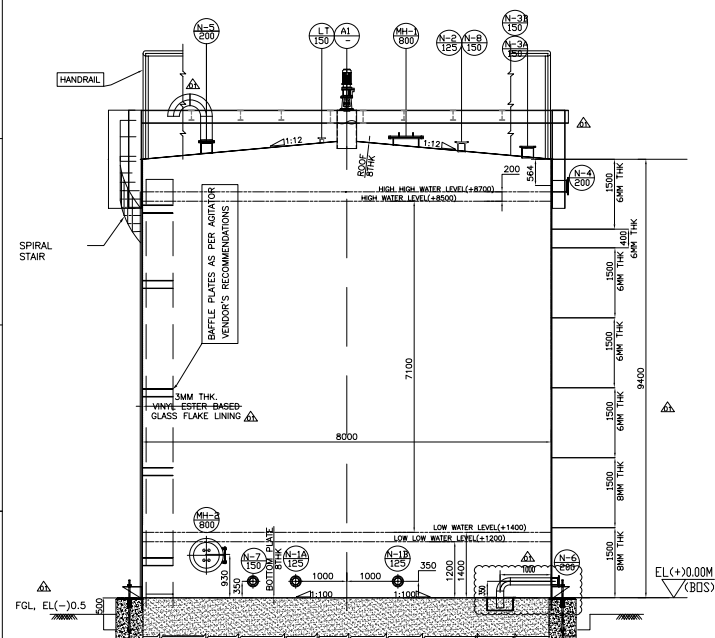


1 ALL DIMENSIONS ARE IN MM, UNLESS SPECIFIED OTHERWISE.
2 EL(+0.00) IS THE GROUND FLOOR LEVEL OF POWER HOUSE BUILDING WHICH CORRESPONDS TO
3 RL(+209.0M). FGL OF THE AREA IS EL(-0.500)
4 FOR LOCATION REFER FGD SYSTEM LAYOUT, 0-FW-000-00785
5 OUTSIDE NOZZLE PROJECTION IS 200MM UNLESS OTHERWISE SPECIFIED.
6 NOZZLE REINFORCEMENTS SHALL BE AS PER IS: 803/API 650
7 NOZZLE PROJECTIONS ARE MEASURED FROM TANK SHELL INNER TO THE FLANGE FACE AS APPLICABLE.
8 ALL REINFORCEMENT PADS SHALL BE PROVIDED WITH 6MM TELLTALE HOLE.
9 NOZZLE AND FLANGE DETAILS SHALL BE AS PER IS803/API 650
10 ALL BOLT HOLES SHALL STRADDLE VERTICAL CENTERLINES ON SHELL AND RADIAL CENTERLINES ON ROOF.
11 ALL PROTRUSIONS, SHARP EDGES AND SPATTER, ETC. SHALL BE REMOVED FROM THE SURFACE AND ALL
12 WELDS GROUND SMOOTH WITHOUT ANY CAVITIES AND IMPERFECTION BEFORE LINING.
13 HYDRO TEST SHALL BE AS PER IS803/API 650. LINING SHALL BE CARRIED-OUT AFTER HYDRO TEST.
14 ALL LONGITUDINAL JOINTS SHALL BE STAGGERED.
15 BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION.
16 THE MINIMUM SIZE OF WELD SHALL BE EQUAL TO THE THICKNESS OF THINNER MEMBER JOINT UNLESS
17 SPECIFIED OTHERWISE.
18 EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK BODY AT SITE TO SUIT SITE
19 REQUIREMENT.
20 REFER DRG NO:PYDE2M102840606 FOR LOADING DETAILS.
21 THE THICKNESS OF TANK IS CALCULATED AS PER IS 803/API650
22 ALL ERECTION CLEATS,LUGS,ETC. TEMPORARY ATTACHMENTS SHALL BE REMOVED BEFORE HYDROTEST.
23 INSPECTION & TESTING SHALL BE AS PER APPROVED QAEP.
24 PAINTING SHALL BE AS PER APPROVED PAINTING SCHEME FOR FGD SYSTEM Doc No. BHUS :FGD: RAUB

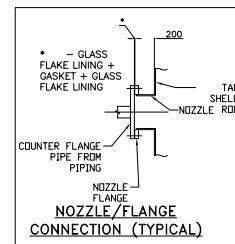
*** NOZZLE LOCATION & ORIENTATION SHOWN IN DRAWING ARE INDICATIVE AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.

REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC. NO.
1.	PROCESS P&ID GYPSUM DEWATERING SYSTEM(FILTRATE WATER TANK)	B240-00431
2.	FOUNDATION INPUT DETAIL DRAWING OF FILTRATE WATER STORAGE TANK	PLYE2M102840603
3.	DESIGN CALCULATIONS FOR FILTRATE WATER STORAGE TANK	PLYCD4M102840606
4.	FGD - SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000-00742
5.	FGD DESIGN BASIS-PROCESS	4-FW-000-00773
6.	PLOT PLAN FOR FGD SYSTEM	0-FW-000-00785
7.	FGD MATERIAL SELECTION	F-FW-000-00779
8.	PAINTING SYSTEM FOR FGD SYSTEM	BHUS.FGD.R4U8

PROJECT:		1x660 MW BHUSAWAL TPS UNIT-6 (FGD PACKAGE)			
CUSTOMER:		MAHARASHTRA STATE POWER GENERATION CO.LTD.			
					
PMC CONSULTANT		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI, NAVI MUMBAI			
					
		BHARAT HEAVY ELECTRICALS LTD. HYDERABAD			
					
TITLE GENERAL ARRANGEMENT OF FILTRATE WATER STORAGE TANK(CAP:29M3)		CARD CODE			
		REV. 01			
		REV. 01			

DRG. NO. PYDGM102840602
SHT. 1 OF 1

NOZZLE SCHEDULE							
NOZZLE			QTY	FLANGE			REMARKS
MARK	SIZE	Sch.No.		RATING	FACING	STANDARD	
A-1	LATER	-	1	-	-	-	AGITATOR VERTICAL MOUNTED
M-2	NB800	10	1	PLATE	SOFF	AWWA	MANHOLE
M-1	NB800	10	1	PLATE	SOFF	AWWA	MANHOLE
L-1	NB150	10	1	150	SOFF	ANSI B 16.5	LEVEL TRANSMITTER
N-8	NB150	10	1	150	SOFF	ANSI B 16.5	SPARE INLET
N-7	NB150	10	1	150	SOFF	ANSI B 16.5	SPARE OUTLET
N-6	NB200	10	1	150	SOFF	ANSI B 16.5	BOTTOM DRAIN
N-5A/B	NB200	10	2	150	SOFF	ANSI B 16.5	VENT
N-4	NB200	10	1	150	SOFF	ANSI B 16.5	OVERFLOW
N-3A/B	N150	10	2	150	SOFF	ANSI B 16.5	LIQUID INLET
N-2	NB125	10	1	150	SOFF	ANSI B 16.5	MINIMUM FLOW
N-1A/B	NB125	10	2	150	SOFF	ANSI B 16.5	PUMP SUCTION



MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, ROOF, BASE AND BOTTOM PLATE	IS:2062 E250 GRADE BR
STRUCTURES	IS:2062 E250 GRADE A/ BR
STAIRWAYS & PLATFORMS	IS:2062 E250 GRADE A/ BR
MANHOLE	IS:2062 E250 GRADE BR
NOZZLE	A106 Gr B
NOZZLE FLANGES	IS:2062 E250 GRADE BR
NOZZLE REINFORCEMENT	IS:2062 E250 GRADE BR
NOZZLE NECKS	IS:1239
HAND RAILING	IS:1239 PART(I) MED. GRADE PIPE
GASKETS	BUTYL RUBBER
BOLT	IS:1367 CLASS 4.4
FITTINGS	UP TO 50NB ASTM A105, ABOVE 50NB & UPTO 300NB ASTM A234 Gr WPB, 350NB & ABOVE FABRICATED FROM PARENT PIPES
EARTHING LUG	AUSTENITIC STAINLESS STEEL (SS 304)
ANCHOR CHAIR	IS:2062 E250 GRADE BR
FOUNDATION BOLTS	IS:1367 CLASS 4.4
NAME PLATE	AUSTENITIC STAINLESS STEEL (SS 304)

NOTES:

- ALL DIMENSIONS ARE IN MM, UNLESS SPECIFIED OTHERWISE.
- EL(+0.000) IS THE GROUND FLOOR LEVEL OF POWER HOUSE BUILDING WHICH CORRESPONDS TO RL(+209.0M). FGL OF THE AREA IS EL(-)0.500
- FOR LOCATION REFER FGD SYSTEM LAYOUT, 0-FW-000-00785
- OUTSIDE NOZZLE PROJECTION IS 200MM UNLESS OTHERWISE SPECIFIED.
- NOZZLE REINFORCEMENTS SHALL BE AS PER IS:803/API 650
- NOZZLE PROJECTIONS ARE MEASURED FROM TANK SHELL INNER TO THE FLANGE FACE AS APPLICABLE.
- ALL REINFORCEMENT PADS SHALL BE PROVIDED WITH 6MM TELLTALE HOLE.
- NOZZLE AND FLANGE DETAILS SHALL BE AS PER IS803/API 650
- ALL BOLT HOLES SHALL STRADDLE VERTICAL CENTERLINES ON SHELL AND RADIAL CENTERLINES ON ROOF.
- ALL PROTRUSIONS, SHARP EDGES AND SPATTER, ETC. SHALL BE REMOVED FROM THE SURFACE AND ALL WELDS GROUND SMOOTH WITHOUT ANY CAVITIES AND IMPERFECTION BEFORE LINING.
- HYDRO TEST SHALL BE AS PER IS803/API 650. LINING SHALL BE CARRIED-OUT AFTER HYDRO TEST.
- ALL LONGITUDINAL JOINTS SHALL BE STAGGERED.
- BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION.
- THE MINIMUM SIZE OF WELD SHALL BE EQUAL TO THE THICKNESS OF THINNER MEMBER JOINT UNLESS SPECIFIED OTHERWISE.
- EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK BODY AT SITE TO SUIT SITE REQUIREMENT.
- REFER DRG NO:PYDGM102840602 FOR LOADING DETAILS.
- THE THICKNESS OF TANK IS CALCULATED AS PER IS 803/API650
- ALL ERECTION CLEATS,LUGS,ETC. TEMPORARY ATTACHMENTS SHALL BE REMOVED BEFORE HYDROTEST.
- INSPECTION & TESTING SHALL BE AS PER APPROVED QAP.
- PAINTING SHALL BE AS PER APPROVED PAINTING SCHEME FOR FGD SYSTEM Doc No. BHUS :FGD: R4U8

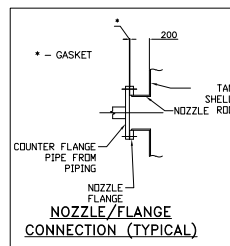
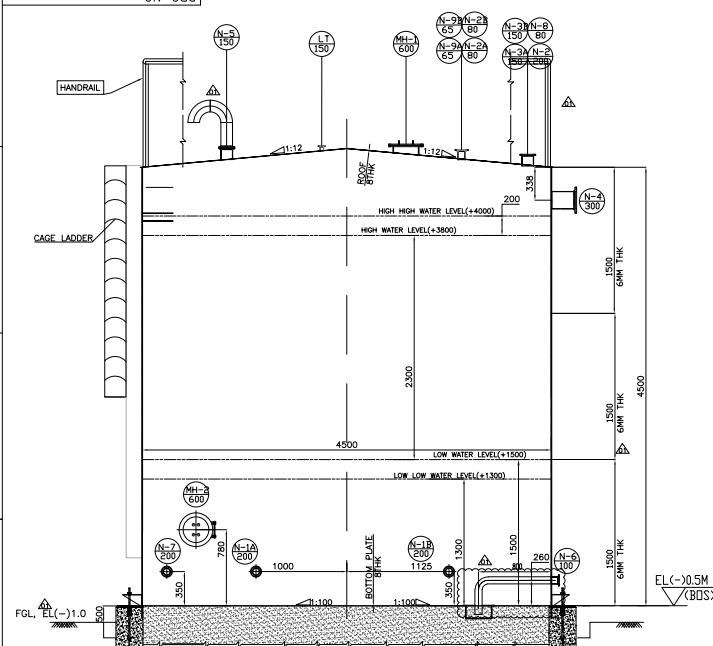
HOLD POINTS:

- ** AGITATOR SHOWN ARE INDICATIVE AND SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.
- *** NOZZLE LOCATION & ORIENTATION SHOWN IN DRAWING ARE INDICATIVE AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.

DESIGN DATA		
DESIGN CODE	-	IS:803/API 650
STORAGE PRODUCT	-	LIMESTONE SLURRY
TANK CAPACITY(HOLD VOLUME)	M3	437
TANK CAPACITY(EFFECTIVE)	M3	357
TYPE OF TANK	-	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	-	5'
DESIGN PRESSURE	-	HYDROSTATIC HEAD
OPERATING PRESSURE	-	ATMOSPHERIC
DESIGN TEMPERATURE	°C	60
OPERATING TEMPERATURE	°C	54.2
SPECIFIC GRAVITY	-	1.215
HYDRO TESTING	-	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	-	0.7
RADIOGRAPHY	-	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
BASIC WIND SPEED	M/S	39
SEISMIC ZONE	-	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	8000
HEIGHT	MM	9400
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	8,8,6,6,6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	-	NOT APPLICABLE
EMPTY WEIGHT	TON	42
WATER FILLED WEIGHT	TON	677
INSIDE LINING	-	3MM THICK VINYL ESTER BASED 3MM THICK GLASS FLAKE LINING

REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC NO.
1.	PROCESS P&ID BALL MILL SYSTEM LIMESTONE SLURRY FEED PUMP	B240-00521
2.	FOUNDATION INPUT DETAIL LIMESTONE SLURRY STORAGE TANK	PYDGM102840602
3.	DESIGN CALCULATIONS FOR LIMESTONE SLURRY STORAGE TANK	PYDGM102840602
4.	FGD - SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000-00742
5.	FGD DESIGN BASIS-PROCESS	4-FW-000-00773
6.	PLOT PLAN FOR FGD SYSTEM	0-FW-000-00785
7.	FGD MATERIAL SELECTION	F-FW-000-00779
8.	PAINTING SYSTEM FOR FGD SYSTEM	BHUS:FGD:R4U8

PROJECT:	1x660 MW BHUSAWAL TPS UNIT-6 (FGD PACKAGE)		
CUSTOMER:	MAHARASHTRA STATE POWER GENERATION CO.LTD.		
PMC CONSULTANT:	DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI, NAVI MUMBAI		
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD			
NAME	SIGN.	DATE	NO. OF VAR.
R.MURALIDHAR		26.04.20	-N.A.-
CHD. JITHKAR		26.04.20	-N.A.-
APPD. M.S.S. NAGESH		26.04.20	-N.A.-
DEPT. PE&SD	UNTL. DMS. GR. E/N/P	SCALE	WEIGHT (KG)
450		NTS	-N.A.-
TITLE GENERAL ARRANGEMENT OF LIMESTONE SLURRY STORAGE TANK(CAP: 357M3)		DRAWING NO. PYDGM102840602	REV. 01
SHT. No 1		NO. OF SHT. 1	

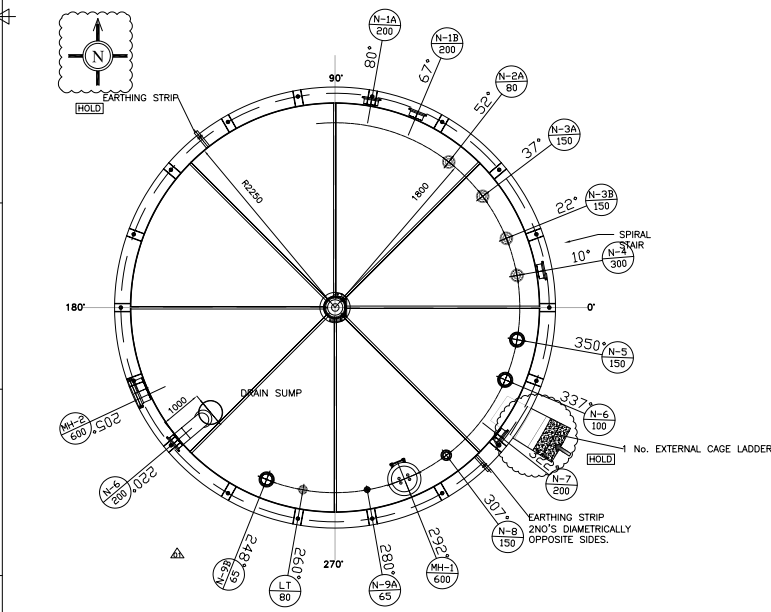
DRG. NO. PYDGM102840605
SHT. 1 OF 1

NOTES:

- ALL DIMENSIONS ARE IN MM, UNLESS SPECIFIED OTHERWISE.
- EL(+30.000) IS THE GROUND FLOOR LEVEL OF POWER HOUSE BUILDING WHICH CORRESPONDS TO EL(+209.0M). FGL OF THE AREA IS EL(-30.500)
- FOR LOCATION REFER FGD SYSTEM LAYOUT, 0-FW-000-00785
- OUTSIDE NOZZLE PROJECTION IS 200MM UNLESS OTHERWISE SPECIFIED.
- NOZZLE REINFORCEMENTS SHALL BE AS PER IS:803/API 650
- NOZZLE PROJECTIONS ARE MEASURED FROM TANK SHELL INNER TO THE FLANGE FACE AS APPLICABLE.
- ALL REINFORCEMENT PADS SHALL BE PROVIDED WITH 6MM TELLTALE HOLE.
- NOZZLE AND FLANGE DETAILS SHALL BE AS PER IS803/API 650
- ALL BOLT HOLES SHALL STRADDLE VERTICAL CENTERLINES ON SHELL AND RADIAL CENTERLINES ON ROOF.
- ALL PROTRUSIONS, SHARP EDGES AND SPATTER, ETC. SHALL BE REMOVED FROM THE SURFACE AND ALL WELDS GROUND SMOOTH WITHOUT ANY CAVITIES AND IMPERFECTION BEFORE LINING.
- HYDRO TEST SHALL BE AS PER IS803/API 650. LINING SHALL BE CARRIED-OUT AFTER HYDRO TEST.
- ALL LONGITUDINAL JOINTS SHALL BE STAGGERED.
- BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION.
- THE MINIMUM SIZE OF WELD SHALL BE EQUAL TO THE THICKNESS OF THINNER MEMBER JOINT UNLESS SPECIFIED OTHERWISE.
- EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK BODY AT SITE TO SUIT SITE REQUIREMENT.
- REFER DRG NO:PYDE2M102840606 FOR LOADING DETAILS.
- THE THICKNESS OF TANK IS CALCULATED AS PER IS 803/API650
- ALL ERECTION CLEATS,LUGS,ETC. TEMPORARY ATTACHMENTS SHALL BE REMOVED BEFORE HYDROTEST.
- INSPECTION & TESTING SHALL BE AS PER APPROVED QAP.

HOLD POINTS:

- *** NOZZLE LOCATION & ORIENTATION SHOWN IN DRAWING ARE INDICATIVE AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.



REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD	REV.	DATE	ALTERED	CHD/APPD
ZONE				ZONE				ZONE				ZONE				ZONE				ZONE				ZONE				ZONE				ZONE			

NOZZLE SCHEDULE									
NOZZLE			QTY	FLANGE			SERVICE	REMARKS	
MARK	SIZE	Sch.No.		RATING	FACING	STANDARD			
M-2	NB600	10	1	-	SOFF	API-650	MANHOLE		
M-1	NB600	10	1	PLATE	SOFF	API-650	MANHOLE		
L-1	NB150	10	1	150	SOFF	ANSI B 16.5	LEVEL TRANSMITTER		
N-9A/B	NB65	10	2	150	SOFF	ANSI B 16.5	MINIMUM FLOW		
N-8	NB150	10	1	150	SOFF	ANSI B 16.5	SPARE INLET		
N-7	NB200	10	1	150	SOFF	ANSI B 16.5	SPARE OUTLET		
N-6	NB100	10	1	150	SOFF	ANSI B 16.5	BOTTOM DRAIN		
N-5	NB150	10	1	150	SOFF	ANSI B 16.5	VENT		
N-4	NB300	10	1	150	SOFF	ANSI B 16.5	OVERFLOW		
N-3A/B	NB150	10	2	150	SOFF	ANSI B 16.5	LIQUID INLET		
N-2A/B	NB80	10	1	150	SOFF	ANSI B 16.5	MINIMUM FLOW		

MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, ROOF, BASE AND BOTTOM PLATE	IS:2062 E250 GRADE BR
STRUCTURES	IS:2062 E250 GRADE A/ BR
STAIRWAYS & PLATFORMS	IS:2062 E250 GRADE A/ BR
MANHOLE	IS:2062 E250 GRADE BR
NOZZLE	A106 Gr B
NOZZLE FLANGES	IS:2062 E250 GRADE BR
NOZZLE REINFORCEMENT	IS:2062 E250 GRADE BR
NOZZLE NECKS	IS:1239
HAND RAILING	IS:1239 PART(I) MED. GRADE PIPE
GASKETS	BUTYL RUBBER
BOLT	IS:1367 CLASS 4.4
FITTINGS	UP TO 50NB ASTM A105, ABOVE 50NB & UPTO 300NB ASTM A234 Gr WPB, 350NB & ABOVE FABRICATED FROM PARENT PIPES
EARTHING LUG	AUSTENITIC STAINLESS STEEL (SS 304)
ANCHOR CHAIR	IS:2062 E250 GRADE BR
FOUNDATION BOLTS	IS:1367 CLASS 4.4
NAME PLATE	AUSTENITIC STAINLESS STEEL (SS 304)

DESIGN DATA		
DESIGN CODE	-	IS:803/API 650
STORAGE PRODUCT	-	CLARIFIED WATER
TANK CAPACITY(HOLD VOLUME)	M3	64
TANK CAPACITY(EFFECTIVE)	M3	37
TYPE OF TANK	-	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	-	5'
DESIGN PRESSURE	-	HYDROSTATIC HEAD
OPERATING PRESSURE	-	ATMOSPHERIC
DESIGN TEMPERATURE	°C	60
OPERATING TEMPERATURE	°C	58
SPECIFIC GRAVITY	-	0.99
HYDRO TESTING	-	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	-	0.7
RADIOGRAPHY	-	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
WIND CODE	-	39
SEISMIC CODE	-	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	4500
HEIGHT	MM	4500
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	-	NOT APPLICABLE
EMPTY WEIGHT	TON	10
WATER FILLED WEIGHT	TON	89
INSIDE LINING	-	NOT APPLICABLE

REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC NO.
1.	UTILITY P&ID PROCESS WATER TANK	B270-10401
2.	FOUNDATION INPUT DETAIL DRAWING OF PROCESS WATER STORAGE TANK	PYDE2M102840606
3.	DESIGN CALCULATIONS FOR PROCESS WATER STORAGE TANK	PYCD4M102840605
4.	FGD - SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000-00742
5.	FGD DESIGN BASIS-PROCESS	4-FW-000-00773
6.	PLOT PLAN FOR FGD SYSTEM	0-FW-000-00785
7.	FGD MATERIAL SELECTION	F-FW-000-00779
8.	PAINTING SYSTEM FOR FGD SYSTEM	BHUS:FGD:R4U8

PROJECT:		1x660 MW BHUSAWAL TPS UNIT-6 (FGD PACKAGE)			
CUSTOMER:		MAHARASHTRA STATE POWER GENERATION CO.LTD.			
MAHAGENCO					
PMC CONSULTANT		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI, NAVI MUMBAI			
					
		BHARAT HEAVY ELECTRICALS LTD. HYDERABAD			
		NAME	SIGN.	DATE	NO. OF VAR.
		DR. R.MURALIDHAR		26.04.20	
		CHD. IFTKHAR		26.04.20	-N.A.-
		APPD. M.S.S. NAGESH		26.04.20	-N.A.-
CANCL	DEPT. PE/ASD	UNTO. DMS. GR.	DWS. E/N/P	SCALE	WEIGHT (KG)
	CODE 450			NTS	-N.A.-
					
TITLE GENERAL ARRANGEMENT OF PROCESS WATER STORAGE TANK(CAP:29M3)					
		CARD CODE	DRAWING NO. PYDGM102840605		REV. 01
		SHT. NO. 1	NO. OF SHT. 1		

INVENTORY NO.	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME
			XXXXXXXXXX-SXX-ROLDWG



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MATERIAL SPECIFICATION4

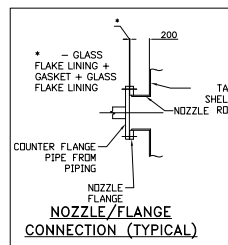
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DESIGN DATA		
DESIGN CODE	—	IS: 803/API 650
STORAGE PRODUCT	—	GYPSUM SLURRY
TANK CAPACITY(HOLD VOLUME)	M3	392
TANK CAPACITY(EFFECTIVE)	M3	302
TYPE OF TANK	—	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	—	5'
DESIGN PRESSURE	—	HYDROSTATIC HEAD
OPERATING PRESSURE	—	ATMOSPHERIC
DESIGN TEMPERATURE	°C	60
OPERATING TEMPERATURE	°C	58
SPECIFIC GRAVITY	—	1.345
HYDRO TESTING	—	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	—	0.7
RADIOGRAPHY	—	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
WIND CODE	—	39
SEISMIC CODE	—	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	8000
HEIGHT	MM	8300
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	8,6,6,6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	—	NOT APPLICABLE
EMPTY WEIGHT	TON	35
WATER FILLED WEIGHT	TON	656
INSIDE LINING	—	3MM THICK VINYL ESTER BASED 3MM THICK GLASS FLAKE LINING

REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC NO.
1.	PROCESS P&ID GYPSUM DEWATERING SYSTEM(SHTT)	B240--00441
2.	FOUNDATION INPUT DETAIL DRAWING OF SECONDARY HYDROCYCLONE FEED STORAGE TANK	PyD2M102840604
3.	DESIGN CALCULATIONS FOR SECONDARY HYDROCYCLONE FEED STORAGE TANK	PyCD4M102840603
4.	FGD-- SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000--00742
5.	FGD DESIGN BASIS--PROCESS	4-FW-000--00773
6.	PLOT PLAN FOR FGD SYSTEM	0-FW-000--00785
7.	FGD MATERIAL SELECTION	F-FW-000--00779
8.	PAINTING SYSTEM FOR FGD SYSTEM	BHUS-FGD-RAU8

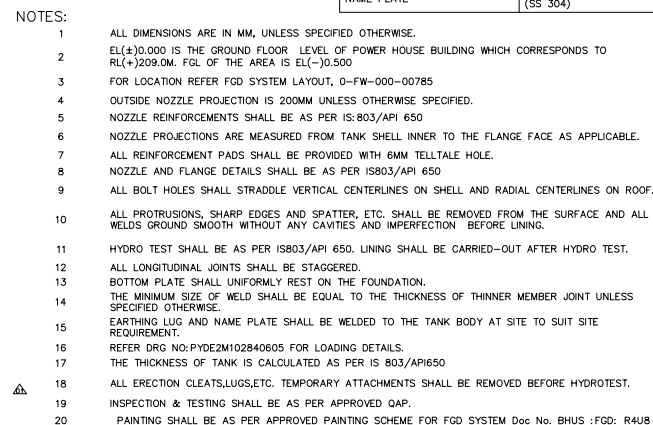
PROJECT:		1x660 MW BHUSAWAL TPS UNIT-6 (PGD PACKAGE)					
CUSTOMER:		MAHARASHTRA STATE POWER GENERATION CO.LTD.					
							
PMC CONSULTANT		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASIH, NAVI MUMBAI					
							
		BHARAT HEAVY ELECTRICALS LTD.		NAME	SIGN.	DATE	NO. OF VAR.
		HYDERABAD		DRN. R.MURALIDHAR		26.04.20	
				CHD. J.FTEKHAR		26.04.20	-N.A.-
DEPT. PEASO		UNTLT. DIMS. GR.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
C450		S/M/F	NTS	N--A--	N--A--	N--A--	N--A--
							
TITLE GENERAL ARRANGEMENT OF SECOND. HYDROCYCLONE FED STORAGE TANK(CAP. 302M3)				CARD CODE	DRAWING NO. PYDGM102840603		REV. 01
				SHT. NO. 1. NO. OF SHT. 1			

INVENTORY NO.	SIGN. AND DATE	REF. DRG. NO.	COMPUTER FILE NAME
			XXXXXXXXXX-SXX-RXX.DWG



MATERIAL SPECIFICATION	
ITEM	MATERIAL
SHELL, ROOF, BASE AND BOTTOM PLATE	IS:2062 E250 GRADE BR
STRUCTURES	IS:2062 E250 GRADE A/ B
STAIRWAYS & PLATFORMS	IS:2062 E250 GRADE A/ B
MANHOLE	IS:2062 E250 GRADE BR
NOZZLE	A106 Gr B
NOZZLE FLANGES	IS:2062 E250 GRADE BR
NOZZLE REINFORCEMENT	IS:2062 E250 GRADE BR
NOZZLE NECKS	IS:1239
HAND RAILING	IS:1239 PART(II) MED. GRADE PIPE
GASKETS	BUTYL RUBBER
BOLT	IS:1367 CLASS 4.4
FITTINGS	UP TO 50NB ASTM A105, ABOVE: 50NB & UP TO 350NB ASTM A234 Gr WPL 350NB & ABOVE: FABRICATED FROM PARENT PIPES
EARTHING LUG	AUSTENITIC STAINLESS STEEL (SS 304)
ANCHOR CHAIR	IS:2062 E250 GRADE BR
FOUNDATION BOLTS	IS:1367 CLASS 4.4
NAME PLATE	AUSTENITIC STAINLESS STEEL (SS 304)

DESIGN DATA		
DESIGN CODE	—	IS: 803/API 650
STORAGE PRODUCT	—	WATER
TANK CAPACITY(HOLD VOLUME)	M3	135
TANK CAPACITY(EFFECTIVE)	M3	97
TYPE OF TANK	—	VERTICAL CYLINDRICAL FIXED CONE ROOF
ROOF SLOPE	—	5'
DESIGN PRESSURE	—	HYDROSTATIC HEAD
OPERATING PRESSURE	—	ATMOSPHERIC
DESIGN TEMPERATURE	'C	60
OPERATING TEMPERATURE	'C	58
SPECIFIC GRAVITY	—	1.012
HYDRO TESTING	—	WATER FILLED HEAD UPTO OVERFLOW NOZZLE
JOINT EFFICIENCY	—	0.7
RADIOGRAPHY	—	NO APPLICABLE
CORROSION ALLOWANCE	MM	2.0 MM FOR SHELL AND BOTTOM PLATE
WIND CODE	—	39
SEISMIC CODE	—	III
NO. OF TANK	NO.	1
DIAMETER (ID)	MM	5500
HEIGHT	MM	6200
ROOF PLATE THICKNESS	MM	8
SHELL PLATE THICKNESS	MM	6,6,6,6
BOTTOM PLATE THICKNESS	MM	8
INSULATION	—	NOT APPLICABLE
EMPTY WEIGHT	TON	22
WATER FILLED WEIGHT	TON	187
INSIDE LINING	—	3MM THICK VINYL ESTER BASED 3MM THICK GLASS FLAKE LINING



HOLD POINTS:

- ** AGITATOR SHOWN ARE INDICATIVE AND SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.**
- *** NOZZLE LOCATION & ORIENTATION SHOWN IN DRAWING ARE INDICATIVE AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.**

REFERENCE DRAWINGS		
S.NO.	DRAWING/DOCUMENT	DRG.DOC NO.
1.	PROCESS P&ID GYPSUM DEWATERING SYSTEM(WASTE WATER TANK)	B240-00451
2.	FOUNDATION INPUT DETAIL DRAWING OF WASTE WATER STORAGE TANK	PYDE2M102840605
3.	DESIGN CALCULATIONS FOR WASTE WATER STORAGE TANK	PYCD4M102840604
4.	FGD- SIZING CALCULATION & SELECTION PARAMETER FOR SLURRY TANK	4-FW-000-00742
5.	FGD DESIGN BASIS-PROCESS	4-FW-000-00773
6.	PLOT PLAN FOR FGD SYSTEM	0-FW-000-00785
7.	FGD MATERIAL SELECTION	F-FW-000-00779
8.	PAINTING SYSTEM FOR FGD SYSTEM	BHUS-FGD-R4U8

PROJECT:		1x660 MW BHUSAWAL TPS UNIT-6 (PGD PACKAGE)			
CUSTOMER:		MAHARASHTRA STATE POWER GENERATION CO.LTD.			
					
PMC CONSULTANT		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASIH, NAVI MUMBAI			
					
		NAME		SIGN.	DATE
		DR. R.MURALIDHAR			26.04.20
		CHD. F.TEKHAR			26.04.20
		APPD. M.S.S. NAGESH			26.04.20
DEPT. PEASO C/O 450		UNTLT. DIMS. GR. S/M/F		SCALE	WEIGHT (KG)
			NTS	-N.-A.-	-N.-A.-
TITLE GENERAL ARRANGEMENT OF WASTE WATER STORAGE TANK(CAP: 97M3)		CARD CODE		DRAWING NO. PYDGM102840604	
				REV. 01	
				SHT. NO. 1. NO. OF SHT. 1	

ESP-001- 2A Rev.00		BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032		Std. / Doc. Number
				Annexure-2
				Rev. No. 00

COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-2 (AGITATOR DATASHEET)
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Revisions: Refer to record of revisions				

ANNEXURE-2:Data Sheet for Agitators for Mahagenco Bhusawal (1 X 660 MW) FGD system

	REF: BHUSAWAL:FGD:AGITATORS	
PROJECT INFORMATION:		
a.	Owner	Mahagenco Bhusawal
b.	Capacity (MW)	1X660 MW
c.	Buyer	BHEL
c.	Process/Application	Flue Gas Desulphurization
PROJECT LOCATION		
a.	Country	India
b.	State/Division	Maharashtra
c.	District	Jalgaon

[illegible]

b.	Maximum solid particle size	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	200 mesh (75 µ)	6-7 mm	6-7 mm	6-7 mm
c.	Normal solid particle size, d50	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	325 mesh (43 µ)	6-7 mm	6-7 mm	6-7 mm
d.	Solid to be handled	Gypsum along with Limestone & other impurities	Limestone + impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Gypsum along with Limestone & other impurities	Limestone + impurities
e.	Chloride concentration	Max 20000 ppm	Max 1000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 20000 ppm	Max 1000 ppm
f.	Hardness of particle	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale
g.	Slurry concentration, wt%	30%	30 wt%	16.60%	11%	3%	30%	30%	30
h.	Sp. Gravity of slurry	1.204	1.214	1.101	1.060	1.013	1.204	1.204	1.214
i.	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)
j.	Viscosity of Slurry	10 cP	30 cP	4 cP	4 cP	3 cP	10 cP	10 cP	30 cP
k.	pH	4 to 8	5 to 8	4 to 8	4 to 8	4 to 8	4 to 8	4 to 8	5 to 8
l.	SiO ₂ Content	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l
m.	Temperature	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -52.2 deg C; Design-70 deg C	Normal -54.2 deg C; Design-70.0deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.	Normal -54.2 deg C; Design-70 deg C.
5	Motor Details								
a.	Total Power consumed(KW)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
b.	Motor Rating(KW)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
c.	Motor Explosion Proof Class	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof
d.	Motor Protection Class	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor
e.	Motor Efficiency Class	IE3	IE3	IE3	IE3	IE3	IE3	IE3	IE3
6	Impeller								
a.	Type of impeller	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
b.	No. of impeller per agitator (stage)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
c.	Impeller diameter (mm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
d.	Impeller tip speed (m/s)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
e.	Operating speed (rpm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
f.	Agitator Pumping Capacity (m ³ /min)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
g.	Volume/Agitator (m ³)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
7	Baffle Plates (not in bidder's scope)								
a.	No. & size of baffle plates	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
b.	Thickness of baffle plates (mm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
c.	Distance from Bottom of the tank(mm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
8	Nozzle (not in bidder's scope)								
a.	Size of the nozzle on which agitator frame is mounted	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
9	Loads								
a.	Static Load (N)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
b.	Dynamic load (N)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
c.	Torsional Moment (Nm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
d.	Bending Moment (Nm)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
10	Power loading for auxiliary power consumption (KW)	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
11	Agitator Model No.	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish
12	PQC Meeting[Yes/No]	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish	Bidder to furnish

Note: Bidder to submit this data sheet along with offer for Review.Post order stage Standard data sheet format shall be shared and vendor need to furnish the data sheet as per format only.

ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032		Std. / Doc. Number	
				Annexure-3	
				Rev. No.	00

COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-3 (PRICE BID FORMAT)
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Revisions: Refer to record of revisions				

Annexure-3A-I							
 BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032							
PRICE FORMAT (R00) FOR AGITATOR ASSEMBLY PROJECT: BHUSAWAL THERMAL POWER STATION UNIT-6 : 1 X 660 MW (FGD PACKAGE) CUSTOMER: MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO) CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD., CONSULTING ENGINEERS,VASHI,MUMBAI							
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	Bidder confirmation (Quoted/ Not Quoted)	HSN/SAC Code	GST (%)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Eng. No. & date : <Bidder to indicate>							
I MAIN OFFER							
A MATERIAL SUPPLY: AUXILIARY ABSORBENT TANK AGITATOR [Material code:PY9751648017]							
	Auxiliary Absorbent Tank Agitator with all accessories including commissioning spares, special tools & tackles as per specification. Note: Out of the 4 Nos. of Agitator, 3 Nos. of Agitators shall be installed on Tank and 1 No. of Agitator shall be Supplied as Warehouse Spare. Bidder shall ensure that the agitator is selected in such a way that the 3 nos. of Agitator installed on Tank shall meet the desired requirement.	4	Sets	89.96			
B Supervision charges for erection & commissioning at site [Material code:PY9851484032]							
	Supervision of erection & commissioning (including trial operation), comprehensive training the end customer's Personnel covering the all aspects of Agitators - Operation & Maintenance, Troubleshooting etc, it shall include the following: 1. Per diem charge of for the above towards offered Agitator Assembly and its associated accessories. 2. Charges for 1 visit Note: The above shall also include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 11]	10 Day and 1 Visit		10.04			
Grand total price for sl no A to B (Inclusive of Packing & Forwarding, Freight and Insurance)				100			
Packing & Forwarding, Freight, Insurance and GST :							
(I) For Supply:							
(i) Packing & Forwarding	In bidder scope			Included in basic price			
(ii) Freight:	In bidder scope			Included in basic price			
(iii) Insurance:	In BHEL scope			-			
(iv) GST	Extra at actuals			Extra at actuals			
(v) Any other:	shall be included in basic price			Included in basic price			
(II) For supervision of E&C:							
(i) GST:	Extra at actuals			Extra at actuals			
(ii) Any other:	Included in basic price			Included in basic price			
Notes:							
1) Bidders should quote the Total Bid Value in both in figures & words in the specified place.							
2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items.							
3) Bidders shall NOT fill/edit/modify anything else in the Price Bid Format.							
4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) Indian paise.							
5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight & Insurance Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates.							
6) Evaluation shall be done on the basis of total bid value (Grand Total Price as above) i.e. the total landed cost to BHEL for this enquiry.							
7) The bidders will also provide UN-PRICED PRICE FORMAT strictly in the BHEL price format given above, in the techno commercial part of their offers. BID WILL BE REJECTED IF ANY OTHER PRICE FORMAT IS USED. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies.							
8) Bidder to quote strictly as per BHEL's NIT requirements.							
9) Bidder to note that this is a LUMP SUM Turn-Key Order. However (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably. (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.							
10) Main offer (Annexure-3A-I) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-3A-III) consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.							

SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	Bidder confirmation (Quoted/ Not Quoted)	HSN/SAC Code	GST (%)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>						
	11) Prices quoted by bidders for items under main offer : Sl. No.I(A+B) will be considered for evaluation of lowest bidder. For the purpose of tender evaluation (L1 bidder evaluation) following shall be noted: Referring to Sl.No.I(B)- Supervision charges for Agitators Assembly and its associated Items, For the purpose of Quotation, total no of 10 man days for Agitator Assembly and Its associate items and 1-visit have been considered and payment against Sl.No. I (B) above shall be made as per the actual number of visits and man days required for the supervision of the complete identified activities as per these diem rates. Purchase Order for supply of main items, (ie., I(A)) shall be placed by BHEL- PE&SD Hyderabad. For Supervision of E&C (ie. I(B)), LOI shall be placed by PE&SD and PO by BHEL-Power sector region / PE&SD. However, BHEL reserves the right (a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evaluation will be intimated to vendor during technical evaluation(before price bid opening). (b) To place PO for any of the Optional items within the contract period. Hence bidders need to MANDATORILY QUOTE reasonable prices for all OPTIONAL ITEMS considering such requirement and keep the validity of the prices till the end of contract period. 12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against Sl.No. A to B shall be Weighed w.r.t Overall Price as mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12 b) Bidder must NOT change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price. 12 c) Bidder to quote for ALL the items as per price bid format. Incomplete/partial offer may be liable for rejection. 13 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended (as per bidder's experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum. 13.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor. 14)With respect to Mandatory Spares; A) If any of above items indicated by the specified name are not applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced- B) If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed enge- stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL. 15) Reference document: PY51648, R00 & annexures. 16) Unpriced price bid format indicating as "Quoted" against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format. 17) In case the systems are being supplied from outside India, reputed Third Party Inspection as mentioned in BHEL Tender Specification has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need <u>not</u> be considered and same will be arranged by BHEL/BHEL nominated inspection agency.						

Annexure-3A-II

	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032						
PRICE FORMAT (R00) FOR AGITATOR ASSEMBLY PROJECT: BHUSAWAL THERMAL POWER STATION UNIT-6 : 1 X 660 MW (FGD PACKAGE) CUSTOMER: MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO) CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD., CONSULTING ENGINEERS,VASHI,MUMBAI							
SL NO	ITEM DESCRIPTION	QTY	UNIT	Weightage w.r.t Overall Price (In %)	Bidder confirmation (Quoted/ Not Quoted)	HSN/SAC Code	GST (%)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>							
I MAIN OFFER							
A MATERIAL SUPPLY:LIMESTONE SLURRY STORAGE TANK AGITATOR [Material code:PY9751648033]							
	Limestone Slurry Tank Agitator with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	27.83			
B MATERIAL SUPPLY:SECONDARY HYDROCYCLONE FEED TANK AGITATOR [Material code:PY9751648050]							
	Secondary Hydrocyclone Feed Tank Agitator with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	26.62			
C MATERIAL SUPPLY:FILTERATE WATER TANK AGITATOR [Material code:PY9751648076]							
	Filterate Water Tank Agitator with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	7.55			
D MATERIAL SUPPLY:WASTE WATER TANK AGITATOR [Material code:PY9751648092]							
	Waste Water Tank Agitator with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	11.69			
E MATERIAL SUPPLY:ABSORBER AREA DRAIN SUMP AGITATOR [Material code:PY9751648114]							
	Absorber Area Drain Sump with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	6.31			
F MATERIAL SUPPLY:GYPSUM AREA DRAIN SUMP AGITATOR [Material code:PY9751648130]							
	Gypsum Area Drain Sump with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	6.31			
G MATERIAL SUPPLY:LIMESTONE AREA DRAIN SUMP AGITATOR [Material code:PY9751648157]							
	Limestone Area Drain Sump with all accessories including commissioning spares, special tools & tackles as per specification.	1	Set	6.31			
H Supervision charges for erection & commissioning at site [Material code:PY9851484032]							
	Supervision of erection & commissioning (including trial operation), comprehensive training the end customer's Personnel covering the all aspects of Agitators - Operation & Maintenance, Troubleshooting etc, it shall include the following: 1. Per diem charge of for the above towards offered Agitator Assembly and its associated accessories. 2. Charges for 1 visit Note: The above shall also include all other expenses like boarding, lodging, local travel, insurance, travel expenses (inclusive of all other charges like visa fee (if applicable), insurance etc) from / to vendor works to site for Engineer. [Refer Note 11]	10 Day and 1 Visit		7.38			
Grand total price for sl no A to H (Inclusive of Packing & Forwarding, Freight and Insurance)				100			
Packing & Forwarding, Freight, Insurance and GST :							
(I) For Supply:							
(i) Packing & Forwarding	In bidder scope			Included in basic price			
(ii) Freight:	In bidder scope			Included in basic price			
(iii) Insurance:	In BHEL scope			--			
(iv) GST	Extra at actuals			Extra at actuals			
(v) Any other:	shall be included in basic price			Included in basic price			
(II) For supervision of E&C:							
(i) GST:	Extra at actuals			Extra at actuals			
(ii) Any other:	Included in basic price			Included in basic price			
Notes:							
1) Bidders should quote the Total Bid Value in both in figures & words in the specified place.							
2) Bidders should mention the applicable HSN/SAC code along with GST% against respective line items.							

3) Bidders shall NOT fill/edit/modify anything else in the Price Bid Format.
4) The rates of line items mentioned in the Price Format shall be derived by BHEL by multiplying the Total Bid Value quoted by the Bidder with the Weightage Factor assigned against respective line items. The rate of each item shall be rounded off to the next 1 (one) Indian paise.
5) The Total Bid Value quoted by the Bidder shall represent the total landed cost for this enquiry and shall include Packing & Forwarding Charges, Freight & Insurance Charges, and all applicable taxes and duties, other than GST. GST shall be paid extra by BHEL at applicable rates.
6) Evaluation shall be done on the basis of total bid value (Grand Total Price as above) i.e. the total landed cost to BHEL for this enquiry.
7) The bidders will also provide UN-PRICED PRICE FORMAT strictly in the BHEL price format given above, in the techno commercial part of their offers. BID WILL BE REJECTED IF ANY OTHER PRICE FORMAT IS USED. Both priced and un-priced price formats to be provided by the bidders shall be signed and stamped copies.
8) Bidder to quote strictly as per BHEL's NIT requirements.
9) Bidder to note that this is a LUMP SUM Turn-Key Order. However (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably. (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.
10) Main offer (Annexure-3A-II) consists of those items which will be part of main order after successful bidder is identified. Optional Items (Annexure-3A-III) consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.
11) Prices quoted by bidders for items under main offer : Sl. No.I(A to H) will be considered for evaluation of lowest bidder. For the purpose of tender evaluation (L1 bidder evaluation) following shall be noted: Referring to Sl.No.I(H)- Supervision charges for Agitators Assembly and its associated Items, For the purpose of Quotation, total no of 10 man days for Agitator Assembly and Its associate items and 1 visit have been considered and payment against Sl.No. I (H) above shall be made as per the actual number of visits and man days required for the supervision of the complete identified activities as per these diem rates. Purchase Order for supply of main items, (ie., I(A to G)) shall be placed by BHEL- PE&SD Hyderabad. For Supervision of E&C (ie. I(H)), LOI shall be placed by PE&SD and PO by BHEL-Power sector region / PE&SD. However, BHEL reserves the right (a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evaluation will be intimated to vendor during technical evaluation(before price bid opening). (b) To place PO for any of the Optional items within the contract period. Hence bidders need to MANDATORILY QUOTE reasonable prices for all OPTIONAL ITEMS considering such requirement and keep the validity of the prices till the end of contract period.
12.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against Sl.No. A to H shall be Weighed w.r.t Overall Price as mentioned above. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 12 b) Bidder must NOT change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price. 12 c) Bidder to quote for ALL the items as per price bid format. Incomplete/partial offer may be liable for rejection.
13 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended (as per bidder's experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum. 13.b) Commissioning spare consumed over and above the recommended commissioning spares, during commissioning shall be supplied free of cost by the equipment vendor.
14)With respect to Mandatory Spares, A) If any of above items indicated by the specified name are <u>not</u> applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced. B) If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed engg. stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL.
15) Reference document: PY51648, R00 & annexures.
16) Unpriced price bid format indicating as "Quoted" against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.
17) In case the systems are being supplied from outside India , reputed Third Party Inspection as mentioned in BHEL Tender Specification has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need <u>not</u> be considered and same will be arranged by BHEL/BHEL nominated inspection agency.

Annexure-3A-III						
	BHARAT HEAVY ELECTRICALS LIMITED					
	PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032					
	PRICE FORMAT (R00) FOR AGITATOR ASSEMBLY PROJECT: BHUSAWAL THERMAL POWER STATION UNIT-6 : 1 X 660 MW (FGD PACKAGE) CUSTOMER: MAHARASHTRA STATE POWER GENERATION CO. LTD. (MAHAGENCO) CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD., CONSULTING ENGINEERS,VASHI,MUMBAI					
SL NO	ITEM DESCRIPTION	QTY.	UNIT	Bidder confirmation (Quoted/ Not Quoted)	HSN/SAC Code	GST (%)
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>					
I	OPTIONAL ITEMS	--	--			
A	3 Years Recommended Spares					
	Recommended spares list for three years normal operation along with unit price breakup for Agitator Assembly and other accessories. (List with price break up to be enclosed) (1 set stands for quantity required for the replacement required for 1 No. of each type of offered Agitator Assembly (and) accessories)	1	Set			
B	SPARES FOR AUXILIARY ABSORBENT TANK AGITATOR :					
B.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
B.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
C	SPARES FOR LIMESTONE SLURRY STORAGE TANK AGITATOR					
C.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
C.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
D	SPARES FOR SECONDARY HYDROCYCLONE FEED TANK AGITATOR					
D.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				

vi)	Coupling	1 No. of Each type				
D.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
E	SPARES FOR FILTERATE WATER TANK AGITATOR					
E.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
E.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
F	SPARES FOR WASTE WATER TANK AGITATOR[Material code: PY9751648106]					
F.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
F.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
G	SPARES FOR ABSORBER AREA DRAIN SUMP AGITATOR					
G.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
G.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				

v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
H	SPARES FOR GYPSUM AREA DRAIN SUMP AGITATOR[Material code: PY9751648149]					
H.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
H.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				
I	SPARES FOR LIMESTONE AREA DRAIN SUMP AGITATOR[Material code: PY9751648165]					
I.1	For Agitator					
i)	Impeller Assembly	1 No. of Each type				
ii)	Bearing Assembly	1 No. of Each type				
iii)	Motor	1 No. of Each type				
iv)	Belt and Pulley(If applicable)-	1 No. of Each type				
v)	Gear Box Assembly(If Applicable)-	1 No. of Each type				
vi)	Coupling	1 No. of Each type				
I.2	For Motor					
i)	415 V Motor -1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
ii)	End Shield Cover Driving and Non Driving -1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iii)	Driving & Non Driving End Bearing-1 Set for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
iv)	Cooling Fan-1 No. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
v)	Motor Terminal Block-2 Nos. for Each Type & Rating of Motor	1 No. for Each Type & Rating of Motor				
vi)	Complete Set of Coupling-1 Set of Each Application	1 set of each application				

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				Rev. No.	00

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Revisions: Refer to record of revisions				

ANNEXURE- 4 to BHEL TENDER SPECIFICATION

CHECKLIST FOR OFFER FOR AGITATOR

S.No.	Description	Bidder's Confirmation
1.	Bidder to confirm that the following documents are submitted along with their offer to enable BHEL to evaluate the offer. i) Duly filled in Agitator datasheet [Annexure: 2] of all Varieties ii) Preliminary GAD having Complete Details such as Foundation Details, Civil Load Details, Weight and Dimensions etc. iii) Agitator Performance curves (Liquid Level vs. BKW and other relevant curves) iv) Un-priced copy of attached BHEL price formats [Annexure:3A & 3A-I] indicating quoted/not quoted against each row & column. v) Pre-Qualification Criteria/ Equipment qualification criteria / PTR / Reference Lists [Annexure: 6] vi) Checklist [Annexure: 4] vii) No Deviation Certificate as per (Annexure-10) viii) Guaranteed Power Consumption Format (Annexure-12) Datasheets in formats other than Annexure-2 shall NOT be reviewed.	
2.	Scope of supply as per Tender Specification. Bidder to Confirm. <u>Further, any document indicating scope of supply submitted by bidders shall not be reviewed.</u>	
3.	Bidder to confirm that the scope of supply and Services shall be as per Cl. No. 6.0 and Technical Details of Agitator (Annexure-1) of BHEL tender Specification.	
4.	Bidder to confirm that Performance requirement, Design and construction of the offered Agitator is as BHEL tender Specification.	
5.	Bidder to confirm that for Auxiliary Absorber Tank Agitator, Shaft and blades shall be made with Alloy 926 or better material.	
6.	Bidder to confirm that for other Tanks/ Sumps (Other Than Auxiliary Absorber Tank) Agitator, Blade & Shaft shall be made of duplex stainless steel and CS+rubber lining respectively.	
7.	Bidder to confirm that the Motor rating/Gearbox Rating is selected is duly taking care of all the margins as specified in BHEL tender specification.	
8.	Bidder to confirm that for Auxiliary Absorber tank the Agitator is considered for Side Mounted or Horizontal Mounted Entry.	
9.	Bidder to confirm that Agitators for all other Tanks (Except Auxiliary Absorber Tank) is considered for Vertical Mounted Entry.	
10.	Bidder to confirm that the Mechanical seal (Flushless Type) is considered for all agitators meant for Side/ Horizontal Entry.	

11.	Bidder to confirm that as part of Supervision of E&C, bidder has quoted for 10 Man days and 1 No. Visit in their scope of service (in Price bid format).	
12.	Bidder to provide suitable Power cable gland and lugs for motor. Cable details shall be furnished during detail engineering stage. Bidder to confirm.	
13.	Bidder to confirm that suitable canopy for each motor is considered in Bidders scope.	
14.	Bidder to furnish list of commissioning spares as per OEM recommendation. Any commissioning spare required over and above the recommended commissioning spares during commissioning shall be supplied free of cost by the equipment vendor. Deviation in this is not acceptable. Bidder to Confirm.	
15.	Bidder to furnish list of special tools & tackles required for the offered Agitators. All these special tools and tackles are included in bidder's scope of supply. Deviation in this point is not acceptable. Bidder to Confirm.	
16.	Bidder to furnish list of 3 year recommended spares as per OEM recommendation. Bidder to quote for the same in the price bid as Optional price. Bidder to Confirm.	
17.	Painting schedule shall be as per Annexure-5 of Tender Specification, Bidder to Confirm.	
18.	Inspection, Testing requirements for Agitator Assembly: Inspection, Testing requirements shall be as per BHEL QAP & specification requirement only. Bidder to note that QAP shall be as per Annexure-7 & the same shall be discussed during detail engineering. However, in case of practical difficulties in meeting the quality requirement, same shall be mutually discussed & agreed during detail engineering stage. Bidder to note & confirm.	
19.	Bidder to appoint TPI agency from the following on behalf of BHEL for inspection of Agitators sourced from outside India: i. Lloyds Register of Industrial Services (LRIS), ii. Bureau Veritas (BV), iii. Det Norske Veritas (DNV), iv. Certification Engineers International Ltd. (CEIL), v. TUV. Bidder to Confirm. Cost incurred in Appointment of TPI shall be borne by bidder only. Accordingly, the price of Each Agitator to be quoted as per Price bid format. For those bidders, who are supplying from India, such third party inspection / witness charges need not be considered in bidder's price and same will be arranged by BHEL/ BHEL nominated inspection agency	
20.	Bidder to confirm that the Agitator shall meet all the testing and Inspection requirement as mentioned in Cl. 9.0 of BHEL tender Specification.	
21.	Bidder to confirm that the offered Agitator shall meet Performance guarantee criteria as mentioned in BHEL Tender Specification. Failing to which shall be liable for rejection of Material at Inspection and Testing stage.	
22.	Bidder to submit Auxiliary Power Guarantee for the Agitators as listed in the BHEL tender specification and also to confirm to meet the Maximum Power consumption criteria mentioned in Cl. No. 13.0 of BHEL Tender Specification.	
23.	Make of all the items shall be as per Annexure-8 (Sub-Vendor List). Bidder to confirm.	
24.	Bidder to confirm compliance with Annexure-9, Master Document List enclosed with Tender Specification, w.r.t list of documents, schedule of submission.	
25.	Any specific deviations, which are impractical, shall be raised in form of pre-bid queries as per Annexure-11 before submission of Techno Commercial offer. Any deviation/ queries raised during technical bid submission shall not be entertained. Bidder to Confirm.	

26.	Bidder to quote Price Bid as per Annexure-3, Price Bid Format only, clearly indicating all the applicable items and highlighting not applicable items clearly. Un priced copy of the same is enclosed with bidder's technical offer. Bidder to check and confirm.	
27.	Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to check and confirm.	
28.	Bidder to confirm that the Liquidated damage for Power consumption is understood by them and accordingly they have quoted for the enquiry.	
29.	Bidder to confirm that the defect liability/ warranty requirement as per Cl. No. 16.0 of BHEL tender Specification shall be met by bidder.	
30.	Bidder to confirm that the training shall be provided to Customer's personnel after supply of Material at site, as per tender specification.	

SIGNATURE:

NAME:

DESIGNATION:

COMPANY:

DATE:

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Annexure-5

(Customer/Consultant specification)

Revisions: Refer to record of revisions				

- Frequency variation : (+) 3% and (-) 5%
- Voltage variation for LT motors : ($\pm$) 10%
- Voltage variation for HT motors : ($\pm$) 10%
- Combined variation of voltage and frequency : 10% (absolute sum)

All the motors shall be so designed that maximum inrush currents, locked rotor torque and pullout torque developed at extreme voltage and frequency variations do not endanger the motor and the driven equipment.

3.3.0 System Parameters

Sl. No.	Description	HT System	LT System
1.	Voltage level	11 kV Above 160 kW	240 V : up to 0.2 kW 415 V : >0.2 kW and up to 160 kW.
2.	System earthing	Earthed through resistance. Earth fault current : 300 Amps	415V: Solidly grounded.
3.	System fault level	44 kA for 3 sec	50 kA for 1 second
4.	Fault withstand rating of motor terminal box (Breaker operated)	44 kA for 0.25 sec	50 kA for 0.25 second

3.4.0 Type

- AC Motors shall be squirrel cage induction type unless otherwise it is specified. All the motor shall be bi-directional.

3.5.0 Duty

- All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation.
- Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash.

3.6.0 Design margin

- Motor rating shall be selected higher than the maximum load demand of the driven equipment, as per the criteria stated in mechanical section of this specification, under entire operating range, including voltage and frequency variation.
- The motor name plate rating shall have more than 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipment at rated duty point.
- The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating; pull up, breakdown and full load torques are available for the intended service.
- Service shall be considered as 1.0 only.

3.7.0 Method of Starting

- All the motors shall be suitable for direct on-line starting on full load.
- HT Motors will be controlled through vacuum circuit breaker.
- LT motors rated up to 90kW will be controlled through MPCB/MCCB and contactor. LT motors rated more than 90 kW will be controlled through air circuit breaker

3.8.0 Efficiency

All the continuous duty motors shall be energy efficient type. For LT motors, it shall be IE2 class as per IS 12615. For HT motors, efficiency shall be more than 95%.

3.9.0 Temperature rise

- Winding Insulation shall be Class F.
- Temperature rise of motors shall not exceed 70°C over air temperature of 50°C by resistance method, while delivering its maximum rated output.

3.10.0 Starting voltage

- a) Motors shall be capable of starting and accelerating the load at following starting voltage, with direct on line starting, without exceeding specified winding temperatures.
 - HT Motors : 85% of rated voltage
 - LT motors : 80% of rated voltage
- b) During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage will be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.
- c) The motor shall be capable of operating at full load at a supply voltage of 80% of the rated voltage for 5 minutes.
- d) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.
- e) Motor shall not stall if the supply voltage drops to 70% of the rated voltage two (2) second duration

3.11.0 No. of Starts

Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia.

- No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level).
- No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).
- For conveyor motors, no. of consecutive hot starts shall be 3 (with initial temperature of the motor at full load operating level).

3.12.0 Starting current

- Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries. No further tolerances are applicable on starting current specified above for HT motors.
- For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

3.13.0 Locked rotor withstand time

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater.
- For the LT motors having starting time upto 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time.
- For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
- For motors having starting time more than 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

3.14.0 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque.
- Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
- The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.15.0 Enclosure

- a) All motor enclosures shall conform to the degree of protection IPW 55 unless otherwise specified. Motor for outdoor or semi outdoor service shall be of weather proof construction.
- b) For hazardous location, the enclosure of motors shall have flame proof construction conforming to applicable standard.

3.16.0 Cooling

- LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self driven bi-directional centrifugal fan protected by fan cover.

- HT motors can be totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA) type.
- Motors rated >3000kW can be closed air circuit water cooled (CACW).
- Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
 - Hot and cold air temperatures of the closed air circuit for CACA motors.
 - Hot and cold, air and water temperatures for CACW motors.
- The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 5A at 240 V AC.

3.17.0 Winding

- Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
- For the VFD operated drives, insulation shall be designed to take care of stresses due to high dV/dt. Motors shall be wound with dual coated winding wires and impregnated with VPI process. Further for such application, insulated bearings shall be provided to avoid circulating current caused by shaft induced voltages.
- Space heaters rated for 240V AC, 50 Hz supply shall be provided for motors rated 30kW and above to maintain windings in dry condition when motor is standstill.
- For HT motors, insulation shall be Vacuum Impregnated (VPI).
- HT motors shall withstand 1.2/50 microsec impulse Voltage wave of 4U+5 kV (U=Line voltage in kV). The coil inter-turn insulation shall be as per IEC-60034 – Part 15 followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.

Temperature Detectors

- All 11000V motors shall be provided with six (6) nos. duplex, or twelve (12) nos. simplex type winding temperature detectors, i.e. two (2) nos. duplex or four (4) nos. Simplex per phase.
- 11000V motor bearing shall be provided with duplex type temperature detectors.
- The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.
- Five number of Temperature detectors / thermistors shall be provided for L.T. motors above 90 KW (3 numbers winding temperatures & 2 numbers bearing temperatures)

3.18.0 Bearings

- Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

- Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes.
- Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required.
- Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30kW and above re-lubrication facility shall be provided.
- For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads.
- Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10A at 230 V AC.
- For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired upto the terminal box.
- Each bearing shall be provided with dial type thermometer.
- For all VFD operated motors and motors rated above 1000KW having shaft length more than 1.5M shall have insulated bearings to prevent flow of shaft currents.

3.19.0 Terminal Boxes

- Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box shall be capable of being turned 360° in steps of 90°, unless otherwise approved. The terminal boxes shall be split type with removable cover with access to connections.
- Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- The terminal box shall be capable of withstanding maximum system fault current for 0.25 sec for all breaker operated motors and shall be provided with explosion vent.
- For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB.
- Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes.
- Cable spreader box shall be provided for larger cable sizes.
- Cable boxes of HT motors shall be phase segregated type. The terminals of three phases shall be segregated by barriers of metal or fibre glass. For HT motors, cable box design shall be suitable for accommodating cable termination kits.
- Separate terminal box for space heaters shall be provided.

- A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors.
- Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 numbers CT for mounting on switchgear side shall be in bidder's scope. The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later to the successful bidder. The CT details shall be finalized during detail engineering. Neutral terminal box shall have IP 55 degree of protection.
- The secondary leads of CT shall be wired to separate auxiliary terminal box of IP 55 degree of protection
- All the accessory terminal boxes shall be located on the same side of the main (power) terminal box.
- For LT motors, terminal box shall be located on top, unless otherwise specified.

3.20.0 Earthing Terminals

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

The grounding connection shall be suitable for accommodation of ground conductors as follows :

- Motor above 90 KW : 75 x 10 mm GS Flat
- Motor above 30 KW up to 90 KW : 50 x 6 mm GS Flat
- Motor above 5 KW up to 30 KW : 25 x 3 mm GS Flat
- Motor up to 5 KW : 8 SWG GI Wire

3.21.0 Noise and Vibration

- Motors shall be selected with low noise levels in accordance with IS 12065.
- The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
- All HT motors shall be provided with vibration pads for mounting vibration detectors.

3.22.0 Name Plates

Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking.

In addition to the minimum information required by IEC/IS, the following information shall be shown on motor rating plate:

- Temperature rise in °C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

3.23.0 Drain plug

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

3.24.0 Lifting provision

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

3.25.0 Dowel pins

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment

4.0.0 INSTALLATION

Installation shall be carried out as per IS: 900.

5.0.0 PAINTING

Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Paint Shade for the Motor shall be RAL 7032 (Siemens Grey). Sufficient quantity of touch-up paint shall be furnished for application at site.

6.0.0 TESTING AND INSPECTION

5.0.0 Tests shall be performed in presence of Owner's representatives. Successful Bidder shall give atleast fifteen (15) days advance notice for witnessing the tests. Copies of certified reports of all tests carried out at the works shall be furnished. The equipment shall be dispatched from works, only after receipt of Owner's written approval of the test reports.

5.1.0 Routine and Type Tests are to be conducted for all HT motors and for LT motors above 60 KW rating in presence of customer's representative as per IS:325 and required copies of test certificates are to be furnished for approval.

5.2.0 Test certificates for Routine tests conducted as per IS-325 for motors of rating 60 KW and below shall be submitted for Mahagenco review, approval and dispatch clearance.

ANNEX - 1.7

CLEANING, PROTECTIVE COATING AND PAINTING

1.0 General

This specification covers the general requirements related to the cleaning protective coating and painting of equipment, components and systems that are covered under main equipment / system specifications. The components and/or equipment shall be mechanically and /or chemically cleaned during the following stages of the Contract.

- Cleaning in workshop
- Cleaning before painting and/or corrosion protection (application of prime coat)
- Cleaning before erection and during installation.

Cleaning of fabricated component items shall be carried out after fabrication and final heat treatment or welding at manufacturer's works or at site, as appropriate. No paint shall be applied surfaces within 75 mm of field welded connections. These surfaces shall be coated with a consumable preservative and marked.

For cleaning in workshop and before painting, mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, hand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the Owner / Engineer.

Machined surfaces shall be protected during the cleaning operations.

In the event of the surfaces not being cleaned to the Owner's satisfaction, such parts of the cleaning procedures or agreed alternatives as are deemed necessary to overcome the deficiencies shall be carried out at the supplier's sole expense.

For reclining small areas, hand cleaning by wire brushing may be permitted.

1.1 Codes and Standards

Painting of equipment shall be carried out as per the Codes indicated below and shall conform to the relevant IS Code for the material and workmanship.

The following codes and standards shall be followed for the surface preparation, surface protection and painting works.

IS: 5	Colors for ready mixed paints and enamels.
IS: 101	Methods of test for ready mixed paints and enamels.
IS: 104	Ready mixed paint, brushing, Zinc Chrome, priming.
IS: 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS: 161	Heat resistant paints
IS: 1303	Glossary of terms relating to paints.
IS: 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II).
IS: 2074	Specifications for ready mixed paint, Air drying, red oxide zinc chrome priming.
IS: 2338	Code of practice for finishing of wood and wood based materials: Parts 2 schedules.
IS: 2339	Aluminum paint for general purposes, in dual container.
IS: 2395	Code of practice for painting of concrete, masonry and plaster

	surfaces: Part 2 schedules.
IS: 2524	Code of practice for painting of non-ferrous metals in buildings (Parts I & II).
IS: 2932	Specification for enamel, synthetic, exterior (a) undercoating, (b) Finishing
IS: 3140	Code of practice for painting asbestos cement building products.
IS: 6158	Recommended practice for design safeguarding against Embrittlement of hot dip Galvanized Iron & steel products.
IS: 6159	Recommended practice for design & fabrication of Iron & steel products prior to Galvanizing & metal spraying.
IS: 6278	Code of practice for white washing and Color - Washing.
IS: 10221	Code of practice for coating & wrapping of underground mild steel pipelines.
IS: 33	Inorganic pigments and extenders for paints –Methods of sampling & test.
IS: 13183	Aluminum paint, Heat resistant - specifications.
IS: 144	Specification for ready mixed paint brushing, petrol resisting, Air drying for Interior paints of tanks and containers, Red oxide.
IS: 9954	Pictorial surface preparation standards for painting of steel surfaces.
IS: 11883	Specification for Ready Mixed Paint, Air Drying, Red Oxide Priming for metals.
IS: 9404	Color code for identification of pipelines used in the Thermal Power Plants.
IS: 12744	Specification for Ready Mixed Paint, Air Drying, Red Oxide-Zinc Phosphate Priming.
BS: 2015	Glossary of paint selected terms.
BS: 5252	Final coat color.
BS: 7079A1/S1	Specification for rust grades and preparation grades of uncoated substrates after overall removal of previous coating.
BS: 7079A2	Preparations grades of previously coated steel substrates.
BS: 7079GrC	Surface roughness characteristics of blast cleaned steel substrates.
BS: 7079GrD	Methods for surface preparation.
BS-4232	Surface Finish of Blast cleaned steel for painting.
ASTM	American Standard for Testing Material.
ASTM A 780	Standard practice for repair of damaged galvanized coatings.
AWWA	American Water Works Association.
ASA-A-13.1-1981	Scheme for identification of piping system (American National Standard Institution).
DIN	Deutsehes Institute for Normung
S1S-055900-1967	Surface preparation standards for painting steel surfaces. (Swedish standard Institution)
SSPC-SP	Preparation Specifications (Steel structures painting council, U.S.A.).
	National Association of Corrosion Engineers, U.S.A. (NACE).

1.2 Scope of Work and General Requirements

This specification covers the surface preparation, method of application and material to be used for all coating of equipment, steel structures and piping. Steel material subjected to surface preparation on shop/site shall have minimum requirements in accordance with Rust Grade B (SSPC/SSPM Volume-2).

Coating materials according to SSPC, EN ISO, ASTM, BIS or DIN standards, shall be used. The paint shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work. The materials shall be matched with each other so that they are compatible. Coatings deviating this specification shall be subject to approval.

Standards of surface preparation and painting shall give a time to first maintenance of minimum 10 years.

The paint to be applied shall be approved by Owner.

All paints & paint material used shall be procured from approved manufacturers. Paint shall be supplied in manufacturers original containers with the description of content, specification No., colour, ref no, date of manufacture, shelf life expiry date & pot life.

The paint manufacturers shall provide coating system data sheet for each coating system to be used containing the following information

- a. Surface preparations
- b. Film thickness (min and max)
- c. Min and max recoating intervals at relevant temperatures
- d. Mixing ratio, thinner details and coating repair systems

The sample for testing the paint being used may be taken by the Owner at any time.

In general Shop fabricated equipment will be delivered to the site coated with a shop applied system or the manufacturer's standard finish in accordance with the requirements of this specification.

For equipment that has received shop prime coat, all touch-up prime coat and additional coats shall be applied in accordance with the coating schedule. It is responsibility of the vendor to ensure compatibility between shop and field applied paint systems.

Necessary precautions shall be provided to all equipment, structures to protect other surfaces from abrasive blasting, coating over spray and spatter. Damage to other surfaces or equipment shall be repaired by the vendor.

The Contractor shall submit the following for review and approval by the Owner:

- a. Manufacturer's recommended paint scheme for the project
- b. Latest published product & instructions for application data,
- c. Procedures for surface preparation and application.
- d. Pre qualification for equipments and blasting materials, product, procedure and personnel qualifications for the paint and painting systems.
- e. Painting repair procedures

Painting records shall contain:

- Equipment/components/location painted
- Date of painting
- Paint details such as specification No, colour, date of manufacture, shelf life, expiry date
- Application equipments
- Ambient conditions at the time of painting
- Surface temperature
- Drying time between coating, DFT and number of coatings
- Appropriate work plan for painting.

The supply of all necessary equipments, weather protection, and scaffolding for painting to ensure work is carried out in accordance with the specification and agreed programme.

Maintenance of the paint work until completion of the contract, this shall include repair of any damaged areas caused by third party.

Disposal of painting waste resulting from painting, shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work and coating materials.

It is a mandatory requirement that all operatives working to this procedure take full cognizance and implement necessary safety precautions.

2.0 Cleaning at manufacturer's works

Mechanical cleaning shall preferably be carried out by abrasive blasting. The Owner is prepared to consider alternative methods such as chemical cleaning provided they achieve the necessary surface condition.

In case of chemical cleaning, the detailed procedure for chemical cleaning as well as the system for which chemical cleaning is required shall be submitted by the contractor for Owner's approval. The procedure shall comprise of pre-treatment and acid treatment to achieve cleanliness equivalent to that specified for mechanical cleaning.

Surface condition:

The Metal surfaces shall be clean and free of mil scale, rust, dirt, grease and any other deleterious matter.

Where metal surfaces are to be painted the surface profiles shall conform to the painting specification requirements.

Where this does not apply, surfaces shall have a surface texture not coarser than Grade 80 abrasive paper.

Abrasives:

Abrasives containing silica, silicates or slag residues shall not be used for water/steam side surfaces of plant except for cleaning sand castings, where hydro blasting may be employed.

For austenitic materials only, abrasives containing 98% or more of alumina, Al_2O_3 , shall be used.

Removal of abrasive and debris:

After cleaning, abrasive and debris shall be thoroughly removed for components.

3.0 Protection at manufacturer's works

As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

All water, air and steam side surfaces shall be protected by the application of approved water soluble corrosion inhibitors, or vapor phase inhibitors that can be subsequently removed by site water washing or steam blowing.

The gas side of steam generating plant items shall be protected by the application of temporary protective that do not require to be removed before commissioning, but which are removed during initial firing.

The rate of application of volatile corrosion inhibitors shall be at least 10 grams per square meter or 35 grams per cubic metre, whichever is the greater, except for pipes up to 300 mm diameter for which the minimum application rates shall be 5 grams per square metre.

Immediately after the protective treatment has been applied all vessels and pipes shall be suitably sealed off by discs or caps or approved alternatives to prevent ingress from the surroundings. Cylindrical plugs shall not be driven into the ends of pipes. These protective

covers shall not be removed until immediately before final connection is made to the associated equipment.

4.0 Weather conditions

Painting shall be done only when the surface temperature is above 5°C. Surface temperature must be at least 3°C above dew point to ensure that condensation does not occur on the surface.

Reasonable protection against precipitation and seawater spray shall be exercised for the painting of outdoor parts.

Precautions shall also be taken against solar radiation to ensure that the specified dry film thickness of priming or finish coats is obtained.

Any prime coat exposed to excess humidity, rain, dust etc., before drying, shall be permitted to dry and the damaged area of primer shall be removed and the surface prepared and primed again.

Sheltered or unventilated horizontal surfaces on which dew may collect require more protection, and to achieve this additional top coat of paint shall be applied.

The temperature quoted as "normal" in the "Paint System Tables" refers to the average local climatic conditions.

5.0 Surface preparation

In preparing any surface to be coated, all loose paint, dirt, grease, rust, scale, weld slag or spatter or any other extraneous material shall be removed and defects repaired, so as to obtain a clean, dry, even surface to receive the priming or finishing coat (s) as called for in the painting schedules. Sharp edges should be rounded, especially when tank linings have to be applied.

All machined surfaces, including flange faces, shall be suitably covered to prevent damage during surface preparation.

All surfaces should be blast cleaned whenever possible.

Surface preparation methods:

Bare steel surfaces should be prepared by one of the methods described below in order of preference and in accordance with Swedish Standard SIS 05 59 00 or Steel Structures Painting Council, SSPC, Vis 1, or DIN 55928, section 4.

The relative humidity level should not be more than 60% & the steel surface temperature at least 3° C above the dew point during dry blast cleaning operations.

a. White metal blast cleaning Sa 3 or SSPC - SP 5

Sa 3 Blast cleaning to bare metal. Mill scale, rust and foreign matter must be removed completely. Subsequently, the surface is cleaned with vacuum cleaner, clean dry compressed air or a clean brush. It must then have a uniform metallic color and correspond in appearance to the prints designated Sa 3.

b. Near white metal blast cleaning Sa 2 1/2 or SSPC - SP 10

Sa 2 1/2. very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight imperfections in the form of spots or stripes. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry

compressed air or a clean brush. It must then correspond in appearance to the prints designated Sa 2 1/2.

Mechanical cleaning should only be used when procedures (a) and (b) are not practicable.

c. Near white metal blast cleaning P Sa 2 1/2 DIN 55928

Very thorough blast cleaning. Very adhesive coatings remain. From all other surface mill scale and rust are to be removed to such an extent that the only traces remaining are slight imperfections in the form of spots or stripes. Further treatments see Sub b).

The adhesivity of residual coatings in the transition zone has to be tested even after the application of the primer.

d. Very thorough mechanical scraping and wire brushing St 3

St 3 very thorough scraping and wire-brushing - machine brushing - grinding - etc. are to be preferred. Surface preparation as for St 2. But much more thoroughly. After the removal of dust, the surface must have a pronounced metallic sheen and correspond to the prints designated St. 3.

e. Thorough scraping and wire brushing St 2

St 2 Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should then have a faint metallic sheen. The appearance must correspond to the prints designated St 2.

f. Air Blasting with Non-Metallic Abrasives Powder

Whenever the "Duplex"-process is to be applied (hot dip galvanising followed by painting), prepare the hot dip galvanised surface by water washing to remove flux residues and careful air blasting with non-metallic abrasive powder. Use an abrasive with grain size from 0.1 to 0.5 mm, at a greatly reduced air pressure, max. 2 bar (g) (28 psig).

This procedure also applies to stainless steel and aluminium surfaces to be coated.

Surface preparation methods	SIS 055900	DIN 55928 Part-4	BS 4232 only for blasting	SSPC-Vis
Blasting acc to item (a),(b),(c),	Sa 3		First quality	White metal SP 5
Blasting acc to item (b)	Sa 2 1/2		Second quality	near White SP 10
Blasting acc to item (c)	Sa 2		Third quality	Commercial blast SP 6
Hand/or power tool derusting acc to item (e)	St 2		--	Hand tool cleaning SP 2
acc to items (d) and (e)	St 3		--	Power tool cleaning SP 3
Flame jet cleaning		F1	--	Flame cleaning SP 4
Pickling		Be	--	Pickling

Steel structures to be blast cleaned have to be free of pitting and other severely corroded places in accordance with B.S. 4232 and SIS 055900.

The abrasives used for blast-cleaning shall be graded flint, grit, shot or silica sand and shall be such that they will produce an average keying profile on the blast-cleaned surface of not more than 40 microns.

An air pressure of 7 bar g at the nozzle shall be used.

After blast-cleaning, all accumulated grit, dust, etc., must be removed leaving the surface clean, dry and free of mill scale, rust grease and other foreign matter.

In the event of rusting after completion of the surface preparation, the surface must be cleaned again in the manner specified.

Oil, grease, soil, cement, salts, acids or other corrosive chemicals shall be cleaned from steel surfaces, by the use of solvents, emulsions or cleaning compounds. The final wiping shall be with clean solvent and clean rags or brushes. There shall be no detrimental residue left on the surface.

Primed areas which suffer damage must be spot blasted on site to a degree of cleanliness Sa 2 1/2 before, touching up.

Protective coating must be applied as quickly as possible after the completion of surface preparation no matter what cleaning method has been used.

No blast-cleaned surface shall be allowed to remain uncoated overnight.

Steel work protected by shop primer after arrival on site must be cleaned of salt, sand, oil etc. Before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming.

Concrete: If a protective coating is required, concrete shall be allowed to cure before painting.

6.0 Preparation of coating materials

All containers shall remain un-opened until required for use.

Primers and paints which have livered, gelled or otherwise deteriorated shall not be used.

The oldest primer or paint of each kind shall be used first.

All ingredients in any container shall be thoroughly mixed before use, and shall be agitated frequently during application to keep the primer in suspension.

Primer or paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the body of liquid.

Mixing in open containers shall be done in a well ventilated area.

Primer or paint shall be mixed in a manner ensuring the breakdown of all lumps, complete dispersion of pigment and uniform composition.

Two-component primers shall be mixed in accordance with the manufacturer's instructions.

Thinners shall not be added to primers or paints unless necessary for proper application according to the manufacturer's instructions.

When use of thinners is permitted, it must be added to the primer or paint during mixing.

6.1 Primer Paint

After the surface is prepared, one coat of suitable primer shall be applied. After this first coat is dried up completely, second coat of primer shall be applied.

Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be as specified in Paint System of this specification.

The primer should be worked by brush application to cover the crevices, corners, sharp edges etc. in the presence of inspector.

The shades of successive coats should be slightly different in color in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per specification approved by Engineer before application of successive coats.

The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.

Elko meter for measuring the Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detectors for checking the painted surface discontinuities should be provided by the contractor.

The contractor shall make arrangements for paint manufacturer to provide expert technical service at site as and when required free of cost and without any obligation to the Owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations.

Final inspection shall include measurement of paint dry film thickness, check of finish and workmanship.

6.2 Rub down and Touch Up of Primer

The shop coated surfaces shall be rubbed down thoroughly with emery paper to remove all dust, rust and other foreign matters, washed, degreased, then cleaned with warm fresh water and air dried.

The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry before applying a coat of primer.

The compatibility between shop coat and field primer shall be ascertained from the paint manufacturer. In case degreasing with white spirit is not effective, the surface shall be finally wiped clean with aromatic solvent like xylol or light naphtha.

6.3 Non Compatible Shop Coat Primer

- a) The compatibility of finishing coat shall be confirmed from the paint manufacturer. In the event of use of primer such as zinc rich epoxy, inorganic zinc silicate etc., the paint system shall depend on condition of shop coat. If the shop coat is in satisfactory condition showing no major defect, the shop coat shall not be removed. The touch up primer and finishing coat(s) shall be identified for application by Engineer. Shop coated (coated with primer & finishing coat) equipment shall not be repainted unless paint is damaged.
- b) Shop primed equipment and surfaces shall only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer unless otherwise specified. If shop primer is not compatible with field primer then shop coated primer shall be completely removed before application of selected paint system for particular environment. For package units/equipment, shop primer shall be as per the paint system given for particular environment.

- c) In case of existing paint, compatibility between finishing coat and new selected finish coat shall be ascertained before application of finish coat. In case, the coat is selected for upgrading existing alkyd coating to high performance coating then, surface preparation shall be by manual/mechanical means to remove loose rust, peeled off/damaged paint, but sound old coating need not be removed. It shall be touched with suitable primer wherever it has peeled off before application of tie coat. The tie coat shall be applied after 7 days of curing of the primer. If, new paint system is not suitable to upgrade existing coating then complete paint shall be removed by mechanical or blast cleaning before application of new coating system.

6.4 Finish Paint

Suitable Finish paints as per the schedule shall be applied for the jobs. The color/shade shall be as approved by the Owner. After cleaning the dust on the dried up primer, first coat of finished paint shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After applying second coat, allowing the water to get evaporated completely, third finish coat of finish paint may be applied(if applicable).

7.0 Steel Structures Painting

Generally, all steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied (if required) after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.

Steel surface which is to painted shall be cleaned off dust and grease and the heavier layers of rust shall be removed by chipping to grade ST-2 as per SIS05-5900 or as per IS: 1477 (part -I) prior to actual surface preparation. Suitable primer of required DFT shall be applied as specified in the Paint system of this document- Annex-1.

Suitable finish paint of required DFT shall be applied as specified in the Paint system of this document- Annex-1. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. All paints shall be of approved brand and shade as per the Owner's requirement.

Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

8.0 Paint Materials

The paints shall conform to the specifications given in this Annex and class - 1 quality in the products range of any of the following manufacturers:

- a. Asian Paints (India) Ltd.
- b. Bombay Paints
- c. Berger Paints India Ltd.,
- d. Good lass Nerolac Paints Ltd.,
- e. Garware Paints
- f. Jenson & Nicholson
- g. Shalimar Paints
- h. Equivalent other country manufacturer after prior approval of Owner.

9.0 Storage

All paints and painting material shall be stored only in rooms to Engineer's approval. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separated from adjacent buildings. A signboard bearing the words "PAINT STORAGE - NO NAKED LIGHT - HIGHLY INFLAMMABLE - DANGER - NO SMOKING" shall be clearly displayed outside. All paints shall be stored in the safest manner so that no container rolls down and causes accidents. The shelf life of the paints shall be ensured so that the paint materials are not in storage and use after the date of expiry.

10.0 Application

Health and safety of work

The supplier has to check all painting work to be carried out according to the specification of the paint supplier further to all relevant prescriptions and regulations concerning the health and safety of work.

The paint supplier has to present a written specification including at least the flash point of the paints, ventilation requirements, handling precautions such as inhalation, eye and skin protection, and first aid procedure, storage requirements, spill or leak procedure, fire precaution, waste disposal.

Methods

Quality of the surface to be painted or coated has to be tested acc. to DIN 55928 and DIN 8202.

Temporary corrosion protections are to be completely removed prior to applying the definite one, in acc. with DIN 55928.

All prime coatings shall be applied by brush or airless spray or a combination of these methods, as approved by the coating manufacturer.

All doors, windows, stairways, handrails (if painted), bolts, flanges and equipment supports shall be finish painted by brush.

Spray guns should not be used outside in windy weather or near surfaces of a contrasting colour unless the latter is properly protected.

All cold-spray painting shall be done using standard equipment in accordance with accepted standards and methods.

Care has to be taken not to connect spraying devices for nitro and backelite paints simultaneously to oil based paints.

Paint applied to items that are not being painted shall be removed at the supplier's expense, leaving the surface clean, unstained and undamaged.

Dry film thickness (DFT)

To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats shall not be of the same colour.

For a composite paint or coating system consisting of several coats, the total DFT must be at least equal to the sum of the minimal DFT's for the individual coats. If, the paint system does not have the required minimum DFT those areas should be marked & repainted. If the occurrence of those areas is high, the complete surface must be repainted. It is also critically important to check the DFT of primers and intermediate coats and to correct them where necessary.

For paintings based on Zinc silicate the DFT is limited as well on minimum DFT as on maximum (150µm) because of the risk of mud cracking.

Consumption of paints

Has to be evaluated according to DIN 53220. The paints shall be tested as per IS - 101.

Each coat of paint shall be allowed to harden before the next is applied. For epoxy paint the hardening time normally is 12-14 hours. Suppliers' recommendations regarding hardening time of epoxy paints must be followed.

Particular attention must be paid to full film thickness at edges.

The minimum total dry film thickness of the paint systems shall be as recommended in the following tables below. The DFT is given in microns (millionths of a metre).

11.0 Protective coatings and paint systems

The colour coding for identification of pipelines should comply with IS-2379 & IS -9404.

The type and number of protective coats for any item requiring painting are to be in accordance with DIN 55928 and are to be at least of a quality as shown in the attached Annex-1- Paint System.

Alternative to the Annex-1- Paint System specified, are to be presented on the schedule Departure from Specification, as indicated elsewhere.

Generally, all parts shall receive the specified prime coat (s) at the supplier's works to ensure that no corrosion occurs during transport to the site and storage at the site.

Parts which cannot be damaged during transport shall receive the full number of coats.

Types of Substrate, Base metal:

- Ferrous (Surface Temperature during operation < 120° C, EN ISO 12944:1998)

To this group belongs carbon steel, low alloyed steel & high alloyed steel. All paint systems are inevitable for corrosion protection.

- Hot dip galvanized surfaces.

Hot dip galvanized surfaces do require painting in a wet, industrial, chemicals and/or marine environment

- SS (EN ISO 12944:1998 conditionally applicable)

In general, SS surfaces do not require painting unless in a chemical and/or marine environment. In case of chemical and/or marine environments determination of whether or not the surface requires painting depends on the chemical content of the base metal.

The following formula applies

$$W = Cr + 3.3 \times Mo + 22.45 N_2$$

If $W < 23$, then the surface has to be painted.

If $W < 28$ & $W > 23$, then the surface to be painted if splash contact with the media (i.e. sea) is possible. This may also occur if there is a strong wind carrying drops to the surface.

If $W > 28$, then the surface need not be painted.

- Aluminium

By default such surfaces/components will not be painted. Exceptions are architectural/aesthetic reasons and high corrosive conditions, which shall be evaluated separately depending on aluminum alloys.

12.0 Galvanizing

Galvanizing works shall conform in all respect to B.S. 729, B.S. 3083 and B.S.C.P. 2008 and to DIN 50976 whatever requires the higher quality and shall be performed by the hot dip process, unless otherwise specified.

It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed in accordance with B.S 4479.

Vent-holes and drain-holes should be provided to avoid high internal pressures and air-locks during immersion, which may cause explosions, and to ensure that molten zinc is not retained in pockets during withdrawal.

Careful cleaning of welds is necessary before welded assemblies are dipped. The welds and the surrounding metal should be cleaned separately, preferably be blast-cleaning, because the usual preliminary pickling cannot be relied on to remove the welding slag.

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with B.S. 4360. All drilling, cutting, welding, forming and final fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants in accordance with DIN 55928, part 4 and DIN 50976. The weight of zinc coating per unit area has to be noted in the manufacturing documents in accordance with DIN 50976.

The minimum average coating weight shall be as specified in Table 1 of B.S. 729 or Table 2, DIN 50976, whatever requires higher quality.

Structural steel items shall be initially grit-blasted to B.S. 4232, second quality, (Sa 21/2) or by pickling in a bath and the minimum average coating weight on steel sections 5 mm thick and over shall be 900 g/m².

On removal from the galvanizing bath, the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor (defined in B.S. 3294, part 1 and B.S. 4604, part 1) is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

Bolts, nuts and washers, including general grade high-tensile friction grip bolts (referred to in B.S. 3139, and B.S.4395 part 1) shall be hot dip galvanized and subsequently centrifuged (according to B.S. 729). Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut. No lubricant, applied to the projecting threads of galvanized high-tensile friction-grip bolt after the bolt has been inserted through the steelwork, must be allowed to come into contact with the mating faces of the steelwork,. A local remelting of the galvanized parts to achieve the nuts to be finger turned on the bolt is possible in accordance with DIN 50976.

Protected slings must be used for offloading and erection. Galvanized work which is to be stored at the works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be restored in accordance with DIN 55928, part A and DIN 50976 by:

- Cleaning the area of any weld slag rust and other impurities and by thorough wire brushing to give a metallic clean surface.
- Application of suitable number of coats of zinc-rich paint containing more than 90 % w/w of zinc in dried film. The dry film thickness shall exceed at least 50 % the thickness of the desired galvanization. In case of application of a low melting point zinc alloy repair rod, the rods shall be in accordance with DIN1707, the thickness of the alloy shall be at least as of the desired galvanization.

The restored area is not to exceed 1 % of the galvanized surface.

Surface restoration of parts in contact with drinking water is not allowed and the quality of the galvanization is to be in accordance with DIN 2444.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc-rich paint. Connections between galvanized surfaces and copper, copper alloy or aluminum surfaces shall be protected by suitable preferably hydrophobe tape wrappings to the owner's approval.

13.0 Sprayed Metal Coatings

Corrosion protection may be also achieved by spraying of suitable metals as zinc and/or aluminum on the surfaces of structures. For special cases tin, copper, lead can be used as well. Methods of surface preparation have to conform to B.S. 2569 or to DIN 8567. A proper treatment of the surface followed by an immediate spraying is to apply to ensure adhesion of the sprayed metal. The surface has to be clean, free of impurities, rust, mill scale and rough enough to have binding properties to ensure good enticulation with the sprayed layer. Suitable roughness can be achieved by blast cleaning acc. to BS 4232 or DIN 8567. Welds are to be cleaned and prepared with special care. All surfaces to be treated have to be dry and accessible.

Application of coatings, requirements for thickness, adhesion, composition of coating metals, and subsequent treatment have to conform to BS 2569, DIN 8565 and 8567.

Testing of the spray coated layers are to be carried out in accordance with DIN 8565.

The contractor has to specify the type, composition and thickness of the sprayed metal and of the sealing coating according to DIN 8565 including the corresponding warranties and tests if, sprayed metal coating will be applied.

Safety of work:

All precautions connected with this type of application of corrosion protection have to be in accordance with German regulation DVS 2307, page 1. 2.

Sprayed, unfused coating of metals and metallic compounds applied by combustion gas flame, plasma arc, detonation and similar processes, and the preparation of components, spraying techniques, sealing, finishing and inspection shall be according to B.S. 4761.

The hot galvanized surface has to be cleaned before the application of the coats to remove corrosion products, dirt, dust, grease.

The cleaning can be achieved by

- brush off
- washing with 1 - 1.5 % ammonia water with up to 0.1 % detergent added and followed by wet grinding to turn the foam to grey color,
- steam blasting.

14.0 Warning Notes / Signals

This Instruction serves the identification of the coated surfaces that are received from shop in assembled condition / module wise.

The warning note shall prevent any possible damage to the coated surfaces during transportation / assembly at site.

Eg.: Welding work OR Heat treatment work on the outside of coated or lined surfaces is prohibited.

15.0 Colour Code for Piping

- a. The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it. The colour coding for the identification of pipelines shall comply with **Annex – 1** of this specification.

Ground Colour shall be applied throughout the entire length for un insulated pipes. For insulated pipes, on the metal cladding or on the pipes of material such as non-ferrous metals, austenitic stainless steel etc., ground colour coating of minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied at the following location.

- i. At battery limit points
 - ii. Intersection points & change of direction points in piping ways.
 - iii. Other points, such as midway of each piping way, near valves, junction joints of service appliances, walls, on either side of pipe culverts.
 - iv. For long stretch/yard piping at 50 M interval.
 - v. At start and terminating points.
- b. Flow direction shall be indicated by an arrow in the location stated above and as directed by Engineer. Colors of arrows shall be black or white and in contrast to the color on which they are superimposed. The size of the arrows shall confirm to IS:2379. Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Engineer. As a rule minimum width of color band shall conform to 75 mm up to 300 NB and to 100 mm over 350 NB. Whenever it is required by the Engineer to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of red and golden yellow as per IS:2379 shall be painted on the ground color.
 - c. All uninsulated piping systems, hangers and supports shall have two coats of suitable primer coats and with suitable finish paints as per Annexure-3 Painting system. Shades shall be as per IS 5 or as indicated by Owner /Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations.

16.0 Identification of Vessels, Piping etc.

Equipment number shall be stenciled in black or white on each vessel, column, equipment and machinery after painting.

Line number in black or white shall be stenciled on all the pipelines of more than one location as directed by Engineer; size of letters printed shall be 150 mm (high) for column & vessels. 50 mm (high) for pump compressor and other machinery and shall be as per IS: 9404 for piping. The storage tanks shall be marked as detailed in the respective drawing.

17.0 Inspection and Testing

- a) All painting materials including primers and thinners brought to site for application shall be procured directly from manufacturer as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable. Engineer at his discretion, may call for tests for paint formulations. Contractor shall arrange to have such tests performed including batch wise test of wet paints for physical & chemical analysis. All costs thereof shall be borne by the contractor. The paints shall be tested as per IS: 101 / equivalent international standard and approved by the Owner.
- b) The painting work shall be subject to inspection by Engineer at all times. In particular, following stage wise inspection shall be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection shall be surface preparation, primer application and each coat of paint. In addition to above, record shall include type of shop primer already applied on equipment e.g. red oxide zinc chromate or zinc phosphate or Silicate primer etc.
- c) Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good of any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint shall be applied to make-up the DFT specified without any extra coat to the Owner.

18.0 Guarantee

The contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/to be provided during execution of work. The contractor shall produce test reports from the manufacturer regarding the quality of the particular batch of paint supplied. The Engineer shall have the right to test wet samples of paint at random for quality of the same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

19.0 Standard Final Colour of Equipment and Piping

19.1 Standard Colour Code for Mechanical Equipment

Sl. No.	Description	Ground Colour
A	Closed Cooling Water System	Sea Green
B	Crane & Hoist	
1	Power house EOT crane	Canary Yellow
2	CW pump house EOT crane	Canary Yellow
C	Compressed Air Plant	
1	Air compressor	Sky Blue
2	Compressed air dryer	Sky Blue
3	Air receiver	Sky Blue
D	Chemical Dosing	Dark Admiralty Grey

Sl. No.	Description	Ground Colour
E	Fire Protection System	
1	Diesel engine driven pump	Fire Red
2	Fuel tank for diesel engine driven pump	Fire Red
3	Main hydrant pump (Electrical)	Fire Red
4	Jockey pump	Fire Red
5	Fire Water Storage tank	Fire Red
6	CO2 cylinder	Fire Red
F	Air Conditioning and Ventilation System	
1	Refrigerant compressor	Sky Blue
2	Chilled / condenser pumps	Sea Green
3	Condenser water pipe	Sea Green
4	Fans	Grey

Notes:

This color code basically refers to IS:2379 for piping with necessary modifications
For any item left out, color coding will be decided after Owner's approval.

19.2 Standard Colour Code for Electrical Equipment

1	Transformers	Olive grey for power transformers and pebble grey for service transformer	RAL 7002 for power transformers and RAL 7032 for service transformers
2	Bus ducts	pastel turquoise for indoor and olive grey for outdoor	indoor 6034 and outdoor 7002
3	Junction boxes.	Pebble grey	RAL 7032
4	HT/LT Switchboards, Distribution boards, Control & Relay panels		
	a) Indoor	Pebble grey	RAL 7032
	b) Outdoor	Pebble grey	RAL 7032
5	UPS Panel, charger panels	Light grey	Exterior RAL 7032 Interior Brilliant white
7	LT Motor	Olive grey	RAL 7002
8	HT Motor	Grass green	RAL 6010
9	Lighting fittings	As per manufacturer's standard	As per manufacturer's standard
10	Cable trays	Galvanized	

1. For interior coating, manufacturer's standard can be adopted subject to Owner's approval.
2. All panels that are to be erected at control room shall be painted using RAL 7032 (exterior colour). All Electrical, C&I, Fire alarm or any other panel shall have this colour.

19.3 Colour Coding for Identification of Pipelines used in Thermal Power Plants

Sl.No	Medium	Ground Shade		Band Shade		Remarks
		Color	Color No. as per IS:5	Color	Color No. as per IS:5	
1	Water system					White is not included in IS - 5-2007
a)	Untreated or raw / service	Sea green	217	White	-	
b)	Treated/dematerialized	Sea green	217	Light orange	557	
c)	Potable water	Sea green	217	French blue	166	
d)	Service & clarified water	Sea green	217	French blue	166	
2	Steam system					with aluminum
a)	Auxiliary steam	Aluminum	-	Signal red	537	
3	Air system					
a)	Instrument	Sky Blue	101	White	-	
b)	Service/Plant	Sky Blue	101	White	-	
c)	Vacuum pipes	Sky Blue	101	Black	-	Black not included in
4	Transformer oil	Light brown	410	Light orange	557	
5	Fire services	Fire red	536	-	-	-
6	Effluent pipes	Black	-	-	-	-

19.4 Colour Code for Structural Steel

SL. NO	ITEM/SERVICE	COLOR	COLOR No. as per IS:5
1	Gantry girder & monorail	Brilliant green	221
2	Gantry girder & monorail stopper	Signal red	537
3	Building structural steel columns brackets, beams bracings, roof truss, purloin, side grit, louvers, stringers	Dark admiralty grey	632
4	Pipe rack structure & trestle	Dark admiralty grey	632
5	Chequered plate (Plain Face)	Black	-
6	Grating	Black	-

SL. NO	ITEM/SERVICE	COLOR	COLOR No. as per IS:5
7	Ladder	Dark admiralty grey	632
8	Hand railing Hand rail	Signal red	537
9	Middle rail	Signal red	537
10	Toe Plate	Signal red	537
11	Vertical post	Black	-
12	Structural steel for Silo	Smoke grey	692

Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above is theoretical. Allowing the losses during application, min specified DFT shall be maintained.
2. All primers and finish coats shall be cold cured and air dried unless otherwise specified.
3. All paints shall conform to relevant Indian Standard and shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship shall be ensured.
4. Technical data sheets for all paints shall be supplied at the time of submission of quotations.
5. In case of use of epoxy tie coat, manufacturer shall demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat, alternate system may be used taking into consideration the service requirement of the system.
6. Contractor will submit the final colour shade for all equipments & piping under his scope for final approval by client / consultant.

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Structural Steel work, piping (Oil + Water), tanks outside surface, transmission towers cranes, steel floors, galleries, stairways, Outdoor.	< 130 Deg	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	1	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	200
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	350
Surface/ Location	Temp					
Structural Steelwork, piping, indoor and outdoor	130 to 200 Deg	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Sealer	1	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
			Finish	2	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
					Total	150
Alternative -2		SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
				1	Single pack Moisture Cured, Inorganic Silicate based heat resisting finish up to 400 Deg - Grey shade./ white/ Aluminium.	50
			Finish	1		50
					Total	175

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Alternative-3			Finish	1	Single pack Heat Resistant Silicon Acrylic Finish paint. - either Aviation White/ Aviation Orange.	80
					Total	155
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Structural Steel work Piping, Un-insulated Carbon Steel Indoor and Outdoor	200 to 400 mmm mDeg C.	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	(75)
			Finish	2	Heat Resisting Silicon Aluminium Paint. VS to be min 28%.	20
					Total	115
Structural Steel work, Piping (Oil + water) , Tanks Indoor.	<130 Deg.C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	100
			Finish	2	Two component Polyamide Cured Epoxy Coating.	25
					Total	325
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Structural Steel work in the battery rooms, chlorination plant and water treatment plant, (extremely aggressive atmosphere)	Ambient	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
			Mid coat	1	Two component, high build rust encapsulating, aluminium pigmented modified epoxy coating.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	150
					Total	350
Steel Tanks inside Surface (Total) for Oil Storage	Normal	SA 2.5	Primer	1	Two component high build amine cured epoxy Primer with zinc phosphate pigment.	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating.	125
					Total	325
Alternative-1			Finish	3	Two component Self priming High Build Polyamine adduct cured epoxy coating. (No primer required. Self priming coating post blasting)	125
					Total	375
Alternative-2			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage. (Primer same as above)	150
					Total	300
Surface/ Location	Temp					
Steel Tanks inside Surface (Total) for Water Storage (Potable and Distilled Water)	Ambient	SA 3	Primer	1	Two component high build polyamide cured zinc phosphate Primer	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating - certified by CFTRI for Potable water usage.	125
Alternative 1						325
			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage. (No primer required. Self priming coating post blasting)	200
						400

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Surface/ Location	Temp		Coat	No. of coats	Generic Type	Dft/Coat
Steelwork immersed in water such as inlet/ outlet structures, dolphins, sheet piling	< 60 Deg C	SA 3	Primer	1	Two component High Build High Solid Rapid Curing Epoxy Zinc Phosphate Primer.	75
			Finish	1	Two component High build High Solid Modified Epoxy coating.	500
					Total	575
					Wherever TAR based product is not to be recommended.	
			Finish	1	Two component High build High Solid Modified Epoxy coating	500
Alternative 1 Cast Iron Water pipelines - Outside surface, buried in Soil					Total	500
			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake.	500
					Total	500
Alternative 1 Cast Iron Water pipelines - Outside surface, buried in Soil	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg. - Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Finish	2	Polyamide Cured Coal Tar Epoxy, Vs min 65% black.	200
					Total	475
			Finish	1	Two component High build High Solid Modified Epoxy coating	500
			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake	500
Surface/ Location Steel Pipes - Inside surfaces such as cooling water lines.	Temp < 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg. - Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
			Finish	2	Coal Tar Epoxy, Vs min 65% black.	225
					Total	525
Water Pipelines - Outside Surface, Indoor	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20, Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	275
Oil pipelines - Outside surface, above ground	< 100 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20, Level 1.	75
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	350
Surface/ Location	Temp					
Pumps, Motors, Turbine, Claddings, Steam Turbine Condenser, Indoor	Up to 90 Deg	SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	75
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	275

Painting Systems					
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.					
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type
Alternative 1		SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.
			Finish	2	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.
					Total
Heat Exchangers - Inside Surface.	Up to 60 Deg	SA 2.5	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg - Paint to meet compositional & performance specifications for SSPC Paint 20, Level 1.
			Finish	2	Coal Tar Epoxy, Vs min 65% black.
					Total
Instrument panels, Electrical cubicles and similar steel sheet – indoor (Can be used on Aluminium, steel, stainless steel and galvanized substrates.)	Ambient	Oil grease and contaminants must be removed	Primer	1	Two pack, high build siloxane modified epoxy primer with zinc phosphate pigment.
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide.
			Top coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%
					Total
Surface/ Location	Temp				
Instrument panels, Electrical cubicles and similar steel sheet – outdoor (Can be used on Aluminium, steel, stainless steel and	Ambient	Oil grease and contaminants must be removed	Primer	1	Two pack, high build siloxane modified epoxy primer with zinc phosphate pigment.
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide.
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum
					Total

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
galvanized substrates.)					1000 hrs.	
					Total	325
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated. - Outdoor	<120 Deg	Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	50
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide	150
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	275
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated.- Indoor	<120 Deg	Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	75
			Primer	1	Two pack, high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	225
					For Outdoor Application	
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated.- Indoor		Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	200

Painting Systems					
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.					
Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type
Substrate, Stainless Steel - Non insulated.	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	For Indoor Application Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%
					Total
			Primer	1	For Outdoor Application Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.
					Total
Applicable for Water - Water Cooled heat Exchangers like Condensers, Flash box, Water - Water coolers etc.	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	For Indoor Application Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.
			Top coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.
					Total
			Primer	1	For Outdoor Application Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.
					Total



CORPORATE STANDARD

AA0490004

Rev. No. 01

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SEAWORTHY PACKING (PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)

1 GENERAL

This standard lays down packing instructions for seaworthy packing of Components /Assemblies/ Equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.

2 SCOPE

This procedure gives minimum guidelines for seaworthy packing to be complied with for packing of Components /Assemblies / Equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.

3 CROSS REFERED SPECIFICATION

- | | |
|---|----------------|
| – Multi-layered cross laminated plastic film | : AA51420 |
| – Packing Wood | : AA51401 |
| – Silica gel | : AA55619 |
| – Thermocole | : AA51416 |
| – Packing slip holders | : AA7240901 |
| – Corrugated Fibre Board | : AA51414 |
| – Rubber sheet | : AA59001 |
| – VCI paper | : AA51406 |
| – High quality full glossy out door finishing paint | : AA56126 |
| – Polyethylene air bubble film | : IS 12787 |
| – Structural steel - standard quality (plates, sections, strips flats & bars) | : AA10108 |
| – International Standards For Phytosanitary Measures No. 15 | : ISPM-15:2009 |

4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

5 TYPE OF PACKING

The following 5 types of packings have been standardized for packing of General Components /Assemblies.

- 'OP' - Open Type
- 'PP' - Partially Packed
- 'CP' - Crate Packing - Components/Equipment requiring physical protection

Revisions: Committee changed from MRC-M&CD to PGC-Packing

APPROVED:
PROCEDURAL GUIDELINES COMMITTEE –
PGC (Packing)

Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 st Issue
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- 'CQ' - Case Packing - Small medium Components/ Assemblies/ Equipment which require corrosion & physical protection
- 'CR' - Case Packing - Electrical Components/Assemblies which require special packing viz. Water Proof, Shock Proof, etc.

6 DESCRIPTION OF TYPES OF PACKING

The various types of packing, as standardized above, are described below.

6.1 'OP' - Open Type

In case, of components which are not affected by water & dust & do not require special protection &, are generally not machined, shall be sent as open packages. However these components may be sent in crates, wherever necessary.

6.2 'PP' - Partially Packed

Components which need special protection, at selected portions only, shall be dispatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces after application of TRP should be protected with Multi-layered cross laminated plastic film to AA51420.

6.3 'CP' - Crate Packing – General

Assemblies/Components which need only physical protection from the point of view of handling shall be dispatched duly packed in crates.

6.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

- a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.
- b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.
- c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.
- d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

6.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons.

- a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.
- b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.
- c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.
- d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

6.6 Volatile Corrosion Inhibitor (VCI) Paper

- a) Un-protected surfaces of steel and cast iron components, tools bearing, 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.
- b) 7 m³ VCI paper is necessary for 1 m³ of packed item approximately as per AA51406.



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Application Limitation:

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

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

6.7 Moisture Absorber

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel should not be less than 1.0 kg per cubic metre volume of the packing box

7 TYPE OF CASES

For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

8 PREPARATION OF PACKING CASE

1) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size, ft weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.

2) In case of 'CR1 - Packing Viz. Electrical ft Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethylene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.

3) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.

Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 - 250mm on all sides.

It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.

4) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.

5) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.

6) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.

7) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.

8) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.

9) The inner side of the top cover shall be lined with polyethylene sheet, of at least

10) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates ft tacked, to, prevent ingress of water from the top.



9 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies.

The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

Following precautions are to be taken during packing:

- Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.
- Put cover on steel, container and Bolt Properly.

10 SEALED PACKING

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

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. Top surface of the case shall be free from dents to prevent rain water pockets.

11 SLING PLATE

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

12 PACKING SLIP HOLDERS

Two nos. steel packing slip holders, specification no. AA7240901 containing the packing list, sealed in thick polyethylene film, shall be fixed one inside and the other outside the packing box.

13 GENERAL PRECAUTIONS

- a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.
- b) Sling protection brackets to be provided on cases wherever required.
- c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.
- d) The various caution signs shall be marked with stencil on both sides of the packing box.
- e) Do not pack any other Mechanical items with this case.

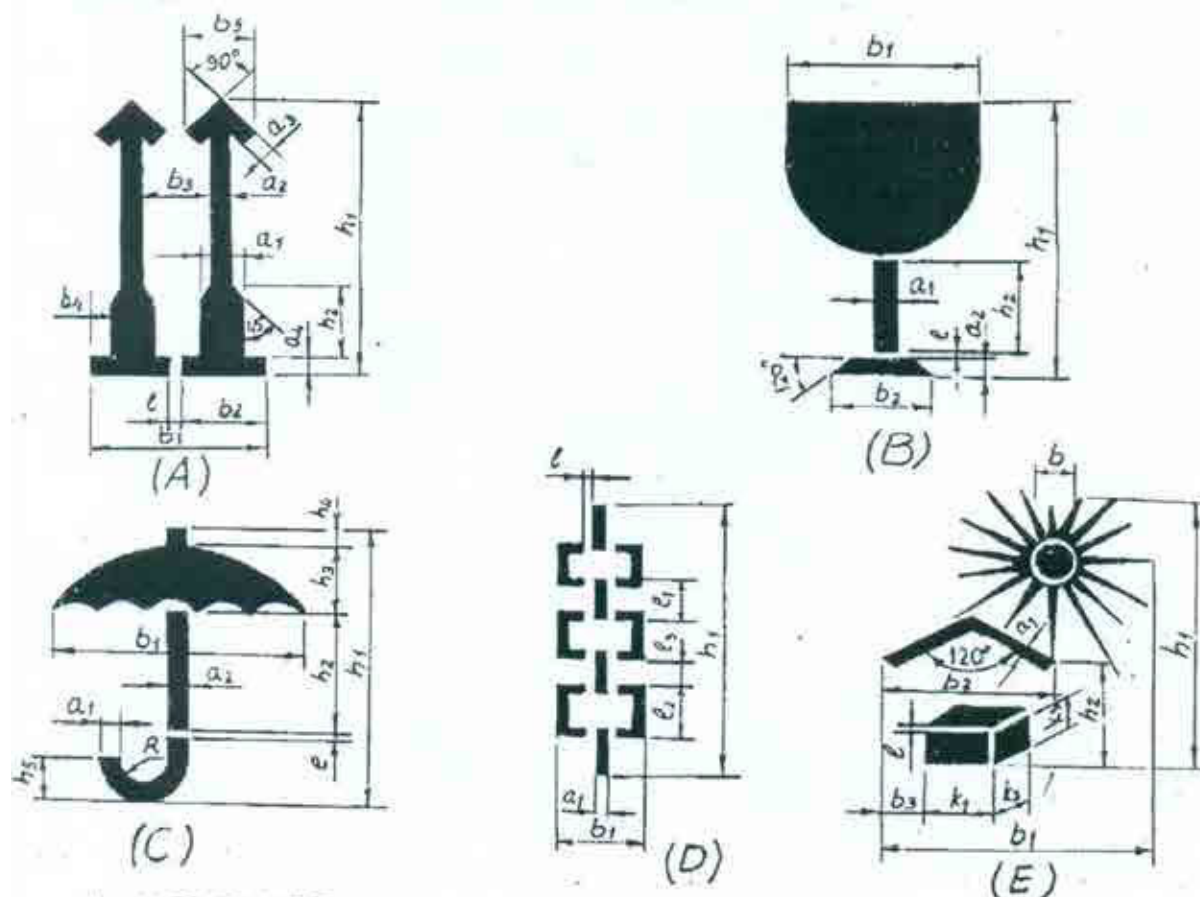
THE FOLLOWING DETAILS ARE TO BE MARKED ON THE PACKING CASES.

- a) Address of consignee.
- b) Purchase Order No./ SO No/WO No.
- c) Description of item or title of packing list.
- d) Case identification Number/ Packing List No.
- e) Net Weight.
- f) Gross Weight.
- g) Dimensions of box
- h) Marking showing upright position.
- i) Marking showing sling position.
- j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.

k) Loading and unloading precautions

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.

Figure 1

CENTER OF GRAVITY



Figure 2

CORPORATE STANDARD



Table 1

DESIGN- ATION		DIMENSIONS IN mm.																							
		a ₁	a ₂	a ₃	a ₄	b ₁	b ₂	b ₃	b ₄	b ₅	b	ℓ	h ₁	h ₂	h ₃	h ₄	h ₅	K ₁	K ₂	K ₃	ℓ ₁	ℓ ₂	ℓ ₃	R	
A	1	12	5	5	4	52	25	19	8	21	-	2	84	23	-	-	-	-	-	-	-	-	-	-	-
	2	17	7	7	6	75	36	29	11	30	-	3	119	33	-	-	-	-	-	-	-	-	-	-	-
	3	24	10	10	8	104	50	38	16	42	-	4	168	46	-	-	-	-	-	-	-	-	-	-	-
	4	34	14	14	11	147	71	59	23	60	-	5	239	65	-	-	-	-	-	-	-	-	-	-	-
B	1	5	5	-	-	50	33	-	-	-	-	2	84	25	-	-	-	-	-	-	-	-	-	-	-
	2	7	7	-	-	71	47	-	-	-	-	3	119	36	-	-	-	-	-	-	-	-	-	-	-
	3	10	10	-	-	100	66	-	-	-	-	4	168	50	-	-	-	-	-	-	-	-	-	-	-
	4	14	14	-	-	142	94	-	-	-	-	5	239	71	-	-	-	-	-	-	-	-	-	-	-
C	1	4	3	-	-	66	-	-	-	-	-	2	80	39	19	5	11	-	-	-	-	-	-	-	6
	2	6	4	-	-	85	-	-	-	-	-	3	114	55	27	7	16	-	-	-	-	-	-	-	9
	3	8	6	-	-	120	-	-	-	-	-	4	160	78	38	10	22	-	-	-	-	-	-	-	12
	4	11	9	-	-	170	-	-	-	-	-	5	227	110	54	14	31	-	-	-	-	-	-	-	17
D	1	6	-	-	-	30	-	-	-	-	-	4	148	-	-	-	-	-	-	-	30	30	10	-	-
	2	9	-	-	-	42	-	-	-	-	-	5	209	-	-	-	-	-	-	-	42	42	14	-	-
E	1	3	-	-	-	69	47	10	-	-	16	2	91	26	-	-	-	17	8	11	-	-	-	-	-
	2	4	-	-	-	98	67	15	-	-	23	3	128	35	-	-	-	24	11	16	-	-	-	-	-
	3	6	-	-	-	138	94	20	-	-	32	4	187	62	-	-	-	34	16	22	-	-	-	-	-

Black and Red Marking Ink to IS: 1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink.

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its Package No. as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.



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14 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 14.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 14.2 Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.
- 14.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.
- 14.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 14.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 14.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 14.7 Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

14.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

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

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per Clause No. 13

- 14.8.1 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°.
- 14.8.2 Handling and lifting should be done without jerks or impacts.
- 14.8.3 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.
- 14.8.4 On receipt of the equipment it 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.
- 14.8.5 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.
- 14.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

15 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3.

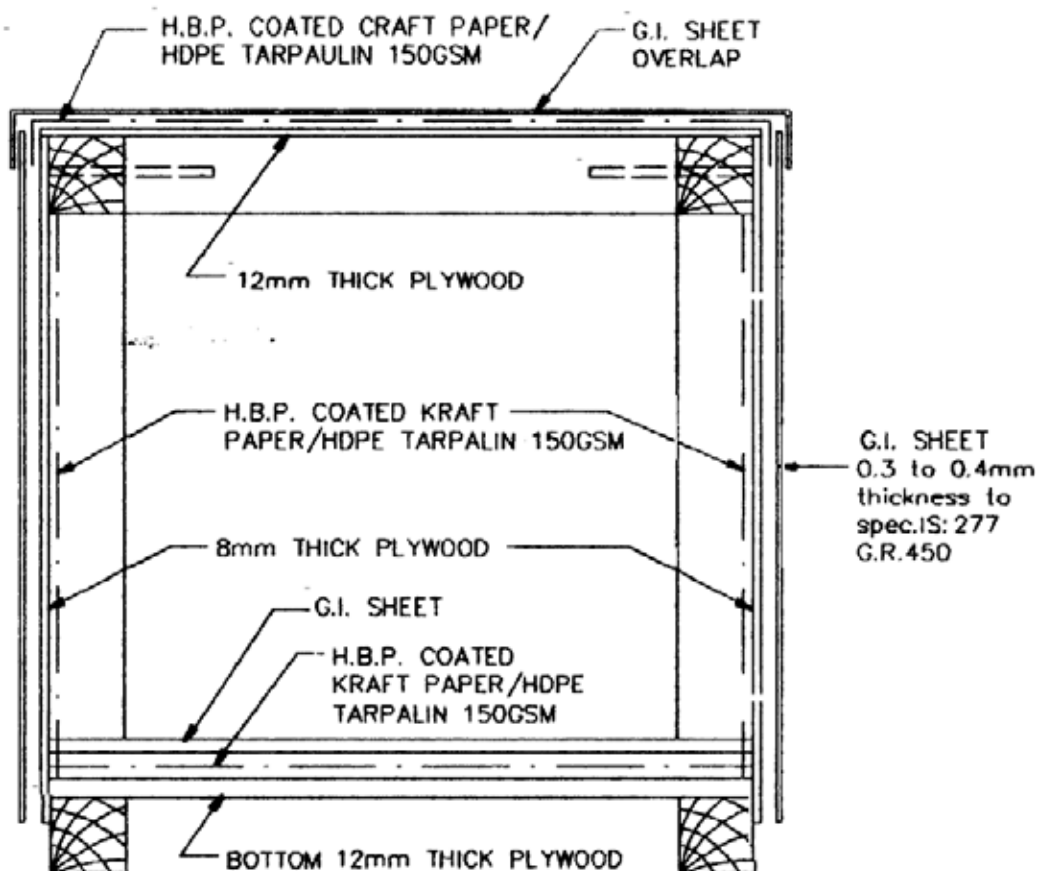
16 TREATMENT of Wood

Treatment of wood is as per ISPM 15: 2009

17 PROVISION FOR INSPECTION

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched till destination. This inspection may require opening of the package and subsequently closing it again. For this purpose suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment the size of the opening shall be suitable to facilitate entry of personnel.



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

Figure 3

	CORPORATE STANDARD	AA0490005 Rev. No. 01 PAGE 1 of 5																		
VACUUM PACKING FOR STAMPINGS																				
1 GENERAL This standard lays down the packing instructions for packing of Stamping to be dispatched against Customer contracts. 2 SCOPE This procedure covers method of packing stamping in a wooden packing boxes with vacuum packing. 3 OBJECTIVE To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%. 4 PACKING BOX Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC. 5 PACKING PROCEDURE a) Only QC cleared packing wooden Boxes shall be used for Packing of stampings. b) Stampings marked by QC with "OK" stickers only need to be packed. Varnished stampings are to be brought down to room temperature before labelling them "OK" for packing. Do not pack hot/warm stampings that have just received after varnishing. c) Stampings are to be stacked in proper alignment and to be kept in packing wooden boxes of specific size. 6 Vacuum Packing a) Turbo generator stamping of HEEP-Haridwar and Hydro stator and Hydro rims stamping of HEP-Bhopal will be packed in Vacuum Bag. b) The stack of stampings shall be placed over porous plastic sheets (for Cushioning) with total thickness of at least 5mm and shall be wrapped with first layer of aluminium barrier bag (vacuum bag), second layer of VCI Paper (Vacuum Corrosion Inhibitor as per BHEL Standard AA51406). The VCI paper must contact stacked stampings. (Refer Figure-1). c) Silica gel packets are to be placed inside the vacuum bag (between stamping and VCI paper) uniformly distributed around the stampings to remove/ prevent moisture. Total quantity per box should be a minimum 1.5 kg for packing box with a single stack and minimum of 2 kg for a double stack box. In order to cover the maximum space inside the box, small quantity packets 25 gm, 50 gm and 100 gm uniformly distributed all-round the box. d) After final clearance from QC by putting green stickers on stack stampings, Vacuum bag should be secured in position and properly sealed using heat sealing machine and air to be drained using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata. e) The top covers of boxes shall be sealed only after final clearance from QC for confirmation of above.																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 5px;">Revisions:</td> <td colspan="3" style="text-align: center; padding: 5px;"> APPROVED: PROCEDURAL GUIDELINES COMMITTEE – PGC (Packing) </td> </tr> <tr> <td style="width: 20%; padding: 5px;">Rev. No. 01</td> <td style="width: 20%; padding: 5px;">Amd. No.</td> <td style="width: 20%; padding: 5px;">Reaffirmed</td> <td style="width: 20%; padding: 5px;">Prepared</td> <td style="width: 20%; padding: 5px;">Issued</td> <td style="width: 20%; padding: 5px;">Dt. of 1st Issue</td> </tr> <tr> <td style="padding: 5px;">Dt: 12-06-2018</td> <td style="padding: 5px;">Dt:</td> <td style="padding: 5px;">Year:</td> <td style="padding: 5px;">EDN, Bangalore</td> <td style="padding: 5px;">Corp. R&D</td> <td style="padding: 5px;">31-05-2018</td> </tr> </table>			Revisions:			APPROVED: PROCEDURAL GUIDELINES COMMITTEE – PGC (Packing)			Rev. No. 01	Amd. No.	Reaffirmed	Prepared	Issued	Dt. of 1 st Issue	Dt: 12-06-2018	Dt:	Year:	EDN, Bangalore	Corp. R&D	31-05-2018
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- f) All boxes should be covered by water proof tarpaulin over top and on all sides.
- g) The packing boxes shall be covered with GI sheets (0.25-0.40mm thick) on all the sides for Export/ Seaworthy packing.
- h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:
Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

7 Aluminium Barrier Laminated Bags

Material must be a first ply of a relatively tough, bi-axially oriented film of organic polymer adhered to second ply of metallic foil/coating and a third ply of a tough polymer such as polyethylene with proper flexibility.

Bags are to be supplied with five sides' sealed and top cover in loose form. Sealing width should be 8 mm minimum.

Properties	Units	Value
Weight	g/m ²	150+ 5 GSM
Tensile Strength	N/mm ² MD	40 (min)
	N/mm ² TD	41 (min)
Water vapour Transmission	g/m ²	0.01 in 24 hrs. at 38 degree C & 90% RH (max)
Oxygen Transmission	cm ³ /m ²	0.02 in 24 hrs at 38 degree C & 90 % RH (max)
Sealing Temp.	Degree C	180 - 220 degree C

8 MARKING OF PACKING BOX

- a) Box No.
- b) P.O. No.
- c) Product Name
- d) Project / Customer Name
- e) Consignee
- f) Water proofing (Umbrella Stencilling)
- g) Upside direction

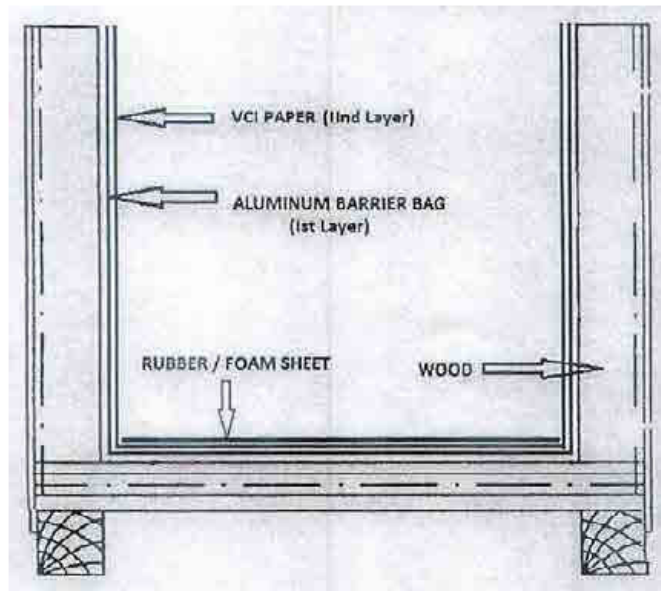


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



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Figure 12

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VACUUM PACKING FOR ELECTRONIC COMPONENTS		
1 GENERAL This standard lays down the packing instructions for packing of components / Electronic module / Assemblies to be dispatched against Customer contracts.		
2 SCOPE This procedure covers method of packing electronic components using vacuum packing in a wooden packing boxes.		
3 OBJECTIVE To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.		
4 PACKING BOX Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC.		
5 PACKING PROCEDURE a) Cleaning parts shall be thoroughly cleaned just before VCI (Volatile Corrosion Inhibitor) Vacuum packing. Finger prints on cleaned items are to be avoided as the same are very corrosive. b) VCI Rust preventive oil (Ferrous grade oil base) shall be applied to all the components to withstand any corrosion.		
6 VCI VACUUM PACKING a) Bubble wrapping the items VCI vacuum packing. b) Appropriate vapour corrosive packets one pouch (1 gm. /pouch) of VCI Anticorrosive Powder and one pouch (10gm./ pouch) of VCI Desiccant per 1000 cub. meter packing space shall be placed inside the VCI vacuum packing. c) All the components shall be separately packed using VCI laminated Aluminium foils from which air/moisture are removed by the air vacuum device and sealed thoroughly using heat sealing machine. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata. d) One identification slip containing component information such as description of item, Material No. Customer PO, Item No. Quantity etc. shall be put inside the VCI vacuum packing. e) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above. f) All boxes should be covered by water proof tarpaulin over top and on all sides. g) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing. h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below: Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.		
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Dt: 12-06-2018	Dt:	Year:
Prepared EDN, Bangalore		Issued Corp. R&D Dt. of 1 st Issue 31-05-2018



7 COMPONENTS REQUIRED

7.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil and VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

7.2 Composition construction of VCI laminated Aluminium foil

- a) PET Film : 12 Microns
- b) Bonding layer : 2 Microns
- c) Aluminium Foil : 9 Microns
- d) Bonding layer : 2 Microns
- e) VCI Poly film : 100 Microns
- f) Total thickness : 125 Microns + or – 5%

7.3 Properties of VC Laminated Aluminium foil

- a) Basic Weight : 138 gsm +/- 8%
- b) Sealing condition : 180 C/ 2 sec
- c) Tensile strength
MD: 20 kgf
CD: 18 kgf
- d) Tear Strength
MD 4.8 kg
CD:3.4 kg
- e) Heat Seal Strength : 30.380 N/cm
- f) WVTR Value : 0.05gms/m /24 hrs.
- g) OTR Value : 0.1 cc/m/24 hrs

8 MARKING OF PACKING BOX

Mark the following information on the two adjacent sides of the each package

- a) Material No.
- b) Customer PO
- c) Item No.
- d) Quantity
- e) Storage Requirement : Indoor
- f) Content Description : Electronic Module
- g) Net weight (in kg)
- h) Dimension (L x W x H in centimetres)
- i) Project Name
- j) Consignee
- k) Water proofing (Umbrella Stencilling)
- l) Upside direction

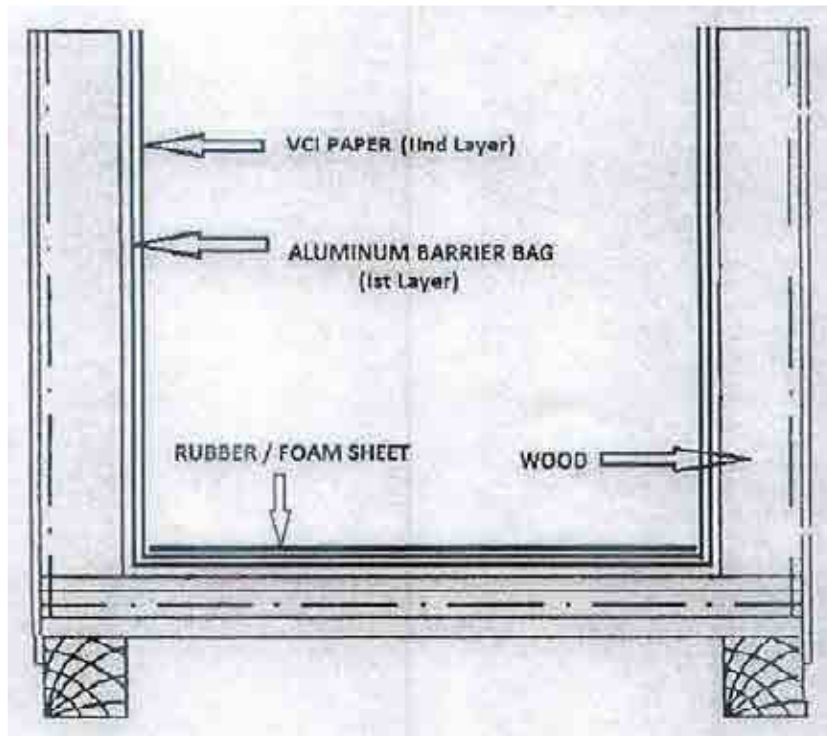


Figure 1



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VACUUM PACKING FOR ELECTRICAL COMPONENT

1 GENERAL

This standard lays down the packing instructions for packing of components / Electrical components Stator/ Rim punching, Wound Pole/ Field Coils and Stator coils / bars to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing component in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/AA0490009 for Export/AA0490004 for Seaworthy packing. Size of the box as per the contract requirement, which has to be checked by QC.

5 PACKING PROCEDURE

- All items packed are to be marked by QC with "OK" stickers. Varnished stator punchings are to be brought down to room temperature before labelling them "OK" for packing. Do not pack hot/warm stator punchings that have is just received from the varnishing.
- Packing of stator punchings, wound pole/ field coils and stator coils / bars should be done in a covered shed.
- Packed materials are to be stacked in proper alignment and to be kept in wooden packing.

6 Additional Packing Methodology for Stator / Rim Punchings (Double stacking) only

In order to eliminate the use of studs avoid double stack packaging per box. Where double stacked packing boxes are unavoidable, the stator /rim punchings are to be securely tightened using GI studs, nuts and soft material washers (rubber/plastic). GI studs, nuts and soft material only to be used in case of double stacking of rim / stator punchings (with holes). Use soft rubber washers to seal the punctured opening at the bottom from where the studs pass in each layer of VCI (Volatile Corrosion Inhibitor) paper, polythene and tarpaulin sheet in case of rim /stator punchings (with holes).

- GI studs with rubber washer to be placed initially inside the wooden packing box.
- Over the wooden base, place water proof tarpaulin sheet.
- Rubber washer shall be placed after the layer of tarpaulin sheet.
- Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to punchings).
- Place the Aluminium Barrier laminated Bags over this porous sheet, place the rubber washer over it.
- Place VCI papers on the Aluminium barrier bag and fix with rubber washer.

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- g) PVC Pipes shall be inserted over the GI studs. These pipes are to be used to cover each stud, to protect its direct contact and hence rubbing with punchings.
- h) Now place the stack of punchings over the VCI paper and securely tighten the punchings using nuts and soft material, washers.
- i) Each layer should be secured in position. Wrap the punchings with VCI paper and properly sealed separately using an adhesive tape.
- j) Silica Gel packets are to be placed over the VCI paper and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.
- k) Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5ata.

Use two separate VCI papers for doubled stacked boxes independently covering each stack. Similarly two Aluminium barrier laminated bag are to be used to wrap the two stacks independently, as explained above.

7 Additional Packing Methodology for Wound Pole/ Field Coils and Stator Coils/Bars only

- a) Over the wooden base, place the waterproof tarpaulin sheet.
- b) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to Wound pole/field coils and stator coils/ bars.
- c) Place the Aluminium barrier laminated bag over this porous sheet.
- d) Place the VCI paper (Volatile Corrosion Inhibitor as per BHEL Standard AA51406) on the Aluminium barrier laminated bag along with rubber washer.
- e) Bare copper portion of field coils and stator coils / bars to be covered by VCI paper pouch and fasten with VCI tape.
- f) Now place the wound pole, stack of field coil and stator coil / bars over the VCI paper.
- g) Each layer should be secured in position. Wrap wound pole / field coils and stator coils / bars with VCI paper and properly sealed separately using an adhesive tape.
- h) Silica Gel packets are to be placed and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.
- i) Then Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of evacuation the vacuum inside the pack should be less than 0.5ata.
- j) The VCI paper must contact the stator / rim punchings, wound pole / field coils and stator coils/bars. It has to ensure that the VCI paper, Aluminium barrier bag should not get damage / puncture during the packing process.
- k) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.
- l) All boxes should be covered by water proof tarpaulin over top and on all sides.
- m) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.
- n) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:
Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.



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8 COMPONENT REQUIRED

8.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil & VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

8.2 Composition construction of VCI laminated Aluminium foil

- a) PET Film : 12 Microns
- b) Bonding layer : 2 Microns
- c) Aluminium Foil : 9 Microns
- d) Bonding layer : 2 Microns
- e) VCI Poly film : 100 Microns
- f) Total thickness : 125 Microns + or – 5%

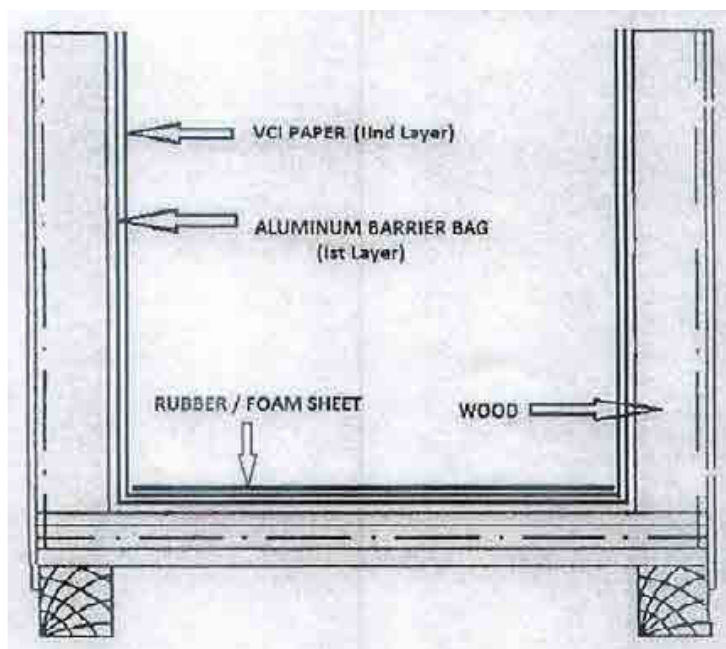
8.3 Properties of Aluminium Barrier laminated Bag

- a) Basic Weight : Unit: g/sq. m 150 +/- 5
- b) Tensile strength : Unit: N/sq. mm MD: 40 (min.)
Unit: N/sq. mm TD: 41 (min.)
- c) Water Vapour Transmission : Unit: g/m² 0.01 in 24 hrs. at 38 deg C & 90% RH(max)
- d) Oxygen Transmission : Unit: cm³/m² 0.02 in 24 hrs. at 38 deg C & 90% RH (max)
- e) Sealing Temp. : Unit : Degree C 180-220 deg C

9 MARKING ON PACKING BOX

Mark the following information on the two adjacent sides of the each package.

- a) Box No.
- b) Customer PO
- c) Product Name.
- d) Project Name
- e) Quantity
- f) Storage Requirement : Indoor
- g) Net weight (in kg)
- h) Dimension (L x W x H in centimetres)
- i) Consignee
- j) Water proofing (Umbrella Stencilling)
- k) Upside direction
- l) Sling position indicator

CORPORATE STANDARD**Figure 1****Figure 2****Figure 3****Figure 4****Figure 5**

	CORPORATE STANDARD	AA0490009 Rev. No. 01 PAGE 1 of 7
EXPORT PACKING (PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)		
1 GENERAL This standard lays down packing instructions for export packing of components/assemblies/equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. The components/assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications, the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.		
2 SCOPE This procedure gives minimum guidelines for export packing to be complied with for packing of components/assemblies/equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.		
3 WOOD SPECIFICATION FOR PACKING: a) The wood shall conform to specification AA51401. b) Ply Wood planks as per specification IS:303 Gr. "MR" Type A,B are used for the sides, top & bottom of the packing cases. c) Ply Wood of marine grade as per IS:710 for packing of control equipment and for support batten pinewood to be used as per specification AA51401.		
4 TYPE OF PACKING: The following types of packings have been standardized for packing of general components/assemblies. 4.1 Open Type: Packing subjected to BHEL approval. 4.2 Closed packing cases: a) Export packing of the specific items requiring additional protection shall be covered with G.I. sheet covering as per customer/contractual/engineering requirements. G.I. shall conform to specification AA10166. b) Any other special or export seaworthy packing (improvement or equivalent to the above) shall be subjected to BHEL Engg & QC approval). 4.3 Special Packing Components requiring special packing (as per customer/contractual/ engineering requirements) not included in this specification shall be covered by product standards.		
5 TREATMENT OF WOOD AS PER ISPM-15 As per customer requirement for export packing, wood to be treated as per International Standards for Phytosanitary Measures ISPM:15.		
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**6 PREPARATION OF PACKING CASE:**

- 1) Export items are to be packed in sea worthy wooden/Ply board cases.
- 2) The base of the case shall be made of wooden battens for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40mm from the ground level.
- 3) The four sides & top cover shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.
Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 - 250mm on all sides.
It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
- 4) Put the job on the base and wherever necessary may be screwed / fastened.
- 5) In case of delicate component Packing Viz. Electrical & Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet as per AA51423, preferably 10mm thick, shall be fixed on to the base to act as cushioning to the equipment.
- 6) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
- 7) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
- 8) Whole Equipment shall be covered and sealed with Multi-layered cross-laminated Polyethylene sheet to AA51420.
- 9) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
- 10) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
- 11) The inner side of the top cover shall be lined with M.L.C. laminated polyethylene sheet of at least 90GSM, which shall project approximately 25 to 150mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
- 12) For specific applications requiring additional protection the packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per specification AA10166, thickness of G.I. sheet shall be 0.25mm.
- 13) For specific applications requiring inspection, additional inspection window has to be provided for custom clearance for export jobs.

7 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

The components sub-assemblies and assemblies are completely covered with 2 layers of M.L.C. laminated poly film. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

Certain special precautions are required for seal tight packing of specific item have to be covered by product standard.



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8 OTHER PACKING MATERIAL

8.1 Volatile Corrosion Inhibitor (VCI) Paper as per AA51406:

- Un-protected surfaces of steel and cast iron components, tools bearing, 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.
- 7m³ VCI paper is necessary for 1 m³ of packed item approximately as per AA51406.

Application Limitation:

VCI paper shall not be used for components made of aluminium, aluminium alloys as well as Zinc, copper, brass, cadmium and silver. VCI powder is sprinkled inside the piping components ends shall be protected with end cover as specified in plant standards, drawings.

8.2 Moisture Absorber:

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel depends on the dimension of the polyethylene sheet as well as transit and storage time.

8.3 Sling Plate:

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

8.4 Packing Slip Holders:

Two nos. of packing list with suitable protecting cover shall be fixed one inside and the other outside of the packing box as per specification AA7240901.

8.5 Nails

The length and diameter of the nails depends upon the size of planks

8.6 Strapping Strips:

These are used for strapping the boxes. Suitable size of box strapping strip can be used as per size and weight of consignment. The material shall be free from rust.

8.7 Brackets:

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of "L" shape, suitable holes shall be provided towards the end of each side for screwing /nailing.

8.8 Fasteners:

Bolts, double nuts, spring washers of suitable size will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box.

8.9 Polyethylene Sheet:

The polyethylene sheets are used to make covers to the jobs individually. multi-layered cross laminated polyethylene sheet as per AA 51420 can be used for packing of jobs.

8.10 Expanded Poly Foam Sheet and Air Bubble Film:

This item is used for covering the delicate items, Expanded Polyethylene Foam Sheet as per specification AA51423 and air bubble film as per specification AA51426

8.11 Thermocol (Expanded Polystyrene) Sheets:

This is used for covering delicate items. This material shall be as per spec. no AA51416

8.12 Cotton Bags:

These are used for holding silica gel.

**8.13 Marking Ink:**

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water

8.14 Polyethylene Bags:

These are to be used for keeping the, Packing slips. The bag shall be of size 70 mm X 100 mm (minimum).

8.15 Mechanical Latching Clamps:

For specific items self locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement, if needed.

9 DESIGN OF PACKING BOXES

Design/drawing of packing boxes shall be prepared based on actual weight and size of the equipment and shall be covered by concern product standards.

10 GENERAL PRECAUTIONS:

- 1) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.
- 2) Sling protection brackets to be provided on cases wherever required.
- 3) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.
- 4) For packing of small/delicate items - Item may be wrapped properly with M.L.C. laminated polyethylene and wrapped item may be further wrapped with air bubble film as per spec. AA51426, these curtains will be subsequently packed in wooden/ply boxes as at clause 8.0.
- 5) The various caution signs shall be marked with stencil on both sides of the packing box.
- 6) Instructions on handling, storage, preservation, represervation and transport of export order components at works and site shall be covered by product standards.

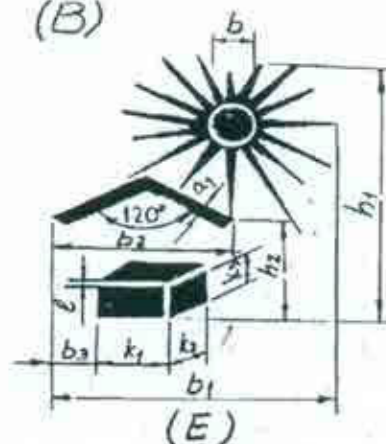
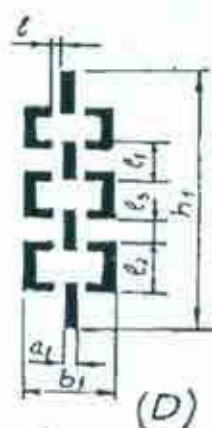
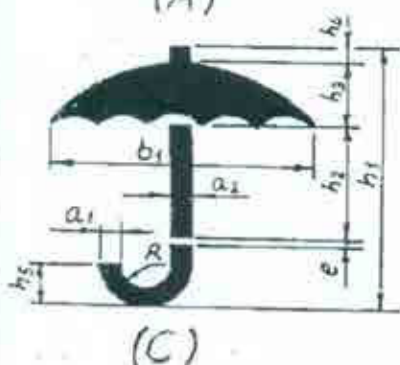
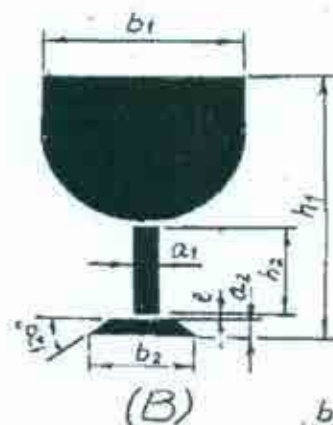
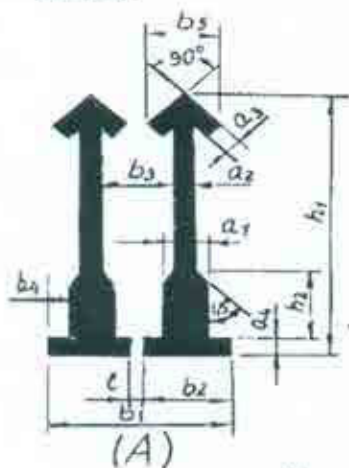
11 MARKING

The following details are to be marked on the packing cases.

- a) Address of consignee.
- b) Purchase Order No.
- c) Description of item or title of packing list.
- d) Case identification Number.
- e) Net Weight.
- f) Gross Weight.
- g) Dimensions of box
- h) Marking showing upright position.
- i) Marking showing sling position.
- j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage).

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.

CENTER OF GRAVITY

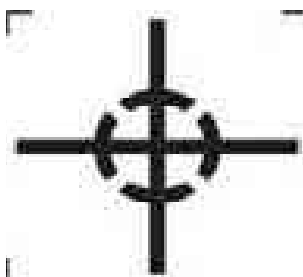


Figure 1 – Markings

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DESIGN- ATION	DIMENSIONS IN mm.																						
	a ₁	a ₂	a ₃	a ₄	b ₁	b ₂	b ₃	b ₄	b ₅	b	l	h ₁	h ₂	h ₃	h ₄	h ₅	K ₁	K ₂	K ₃	l ₁	l ₂	l ₃	R
A	1	12	5	5	4	52	25	19	8	21	-	2	84	23	-	-	-	-	-	-	-	-	-
	2	17	7	7	6	75	36	29	11	30	-	3	119	33	-	-	-	-	-	-	-	-	-
	3	24	10	10	8	104	50	38	16	42	-	4	168	46	-	-	-	-	-	-	-	-	-
	4	34	14	14	11	147	71	59	23	60	-	5	239	65	-	-	-	-	-	-	-	-	-
B	1	5	5	-	-	50	33	-	-	-	-	2	84	25	-	-	-	-	-	-	-	-	-
	2	7	7	-	-	71	47	-	-	-	-	3	119	36	-	-	-	-	-	-	-	-	-
	3	10	10	-	-	100	66	-	-	-	-	4	168	50	-	-	-	-	-	-	-	-	-
	4	14	14	-	-	142	94	-	-	-	-	5	239	71	-	-	-	-	-	-	-	-	-
C	1	4	3	-	-	66	-	-	-	-	-	2	80	39	19	5	11	-	-	-	-	-	6
	2	6	4	-	-	85	-	-	-	-	-	3	114	55	27	7	16	-	-	-	-	-	9
	3	8	6	-	-	120	-	-	-	-	-	4	160	78	38	10	22	-	-	-	-	-	12
	4	11	9	-	-	170	-	-	-	-	-	5	227	110	54	14	31	-	-	-	-	-	17
D	1	6	-	-	-	30	-	-	-	-	-	4	148	-	-	-	-	-	-	30	30	10	-
	2	9	-	-	-	42	-	-	-	-	-	5	209	-	-	-	-	-	-	42	42	14	-
E	1	3	-	-	-	69	47	10	-	-	16	2	91	26	-	-	-	17	8	11	-	-	-
	2	4	-	-	-	98	67	15	-	-	23	3	128	35	-	-	-	24	11	16	-	-	-
	3	6	-	-	-	138	94	20	-	-	32	4	182	62	-	-	-	34	16	22	-	-	-

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

Incase of consignment consists of more than one package; each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, and then hand written letters/figures shall be allowed.

12 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 1) Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 2) Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.
- 3) Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.



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- 4) For critical items, where specified, special handling fixtures shall be used for lifting.
- 5) Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 6) Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 7) Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

8) HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

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

- The markings showing the upright position.
 - The markings showing the sling position
 - Markings showing the fragile contents.
 - Other required markings as per Cl.No:11
- a) 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°.
 - b) Handling and lifting should be done without jerks or impacts.
 - c) 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.
 - d) On receipt of the equipment it 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.
 - e) 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.
 - f) Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

13 PROVISION FOR INSPECTION:

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched until destination. This inspection may require opening of the package and subsequently closing it again. For this purpose, suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment, the size of the opening shall be suitable to facilitate entry of personnel.

14 REFERRED STANDARDS (Latest publications including amendments):

- | | | | |
|------------|-------------|-------------|-------------|
| 1) AA51401 | 2) IS:303 | 3) IS:710 | 4) AA10166 |
| 5) ISPM:15 | 6) AA51420 | 7) AA51423 | 8) 55619 |
| 9) AA51406 | 10) AA51416 | 11) AA51426 | 12) AA56126 |



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DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/Assemblies/Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 TYPES OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' – Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing - Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing - Electrical Components/Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film to Specification No.AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of

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Corp. R&D

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silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

4 PREPARATION OF PACKING CASES

4.1 DOMESTIC:

Based on the availability, the wood shall be Rubber wood (Havea Brasiliensis)/Pine wood for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

4.2 DIMENSIONS:

- Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.
- Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- Minimum number of planks shall be used for a shook.
- Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- External sides of front and rear planks to be planed to facilitate writing of address and other markings.
- Width of binding planks shall be minimum 100mm.
- Distance between any 2 binding planks shall be less than 750mm.
- diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.3 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.4 TONGUE AND GROOVE JOINTS

Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.5 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.



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End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shooks. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.6 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD

- 1) This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.
- 2) The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.
- 3) The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 4.6.5) can also be used.
- 4) The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.
- 5) Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]: Copper – Chromium – Arsenic preservative formulation shall be as per IS:10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

– Arsenic Pent oxide	AS ₂ O ₅ 2H ₂ O	12.5
– Copper Sulphate	CuSO ₄ 5H ₂ O	37.5
– Sodium Dichromate	Na ₂ Cr ₂ O ₇ 5H ₂ O	50.0
– Or Potassium Dichromate	K ₂ Cr ₂ O ₇	

4.7 OTHER MATERIALS

4.7.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.7.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.7.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6 +0.01mm. The material shall be free from rust.

4.7.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.7.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

**4.7.6 FASTENERS**

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.7.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

70GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.7.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.7.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.7.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Details and specifications are given in Fig-4

4.7.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.7.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.

4.7.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.7.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.7.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.7.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).



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4.7.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.7.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.7.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1. Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 6) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 7) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 8) Direction sticker " Front " & " Back " - 4 nos. Size 2.0Cm x 0.75Cm
- 9) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 10) "Fragile " sticker: 2 Nos Size. 2.1Cm x 1.5Cm
- 11) "DO NOT STACK " sticker - 2 Nos. Size 3.0Cm x 2.2Cm

5 PACKING OF CUBICLES WITH RUBBER WOOD:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shoo's shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7) using blue nails (as per 4.7.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.7.7).

5.5 SILICA GEL:

Silica gel (as per 4.3.15) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.7.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 4.7.8) with distance between consecutive layers less than 500mm.

**5.9 CLAMPING:**

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 4.7.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 4.7.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 4.7.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 4.7.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

5.14 PACKING OF CUBICLES WITH PINE WOOD

Packing of cubicles for export shall be done exactly in same manner as described at Cl.No 5 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.

- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

6 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall be rubber wood with Tongue and Groove joint as per clause 4.4.
- 3) Chemical treatment as per Clause 4.6 to be done.
- 4) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 5) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 6) Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 4.7.7) using blue nails.
- 7) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 8) Internal packing: Items that go into the box shall be packed using 70GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect .
- 9) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.



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- 10) Silica gel as per clause 4.7.12 held in cotton bags as per clause 4.7.13 shall be kept at proper places in the box.
- 11) Packing slip kept in polyethylene bag (clause 4.7.16) shall be placed in the box.
- 12) Marking plate as per clause 4.7.10 shall be nailed to side of the box.
- 13) Two numbers of hoop iron strips as per clause 4.7.3 shall be strapped tightly on the case using clips.
- 14) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 15) Loose items to be kept inside the cubicle
- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
 - Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

7.2 BOX SIZES**Table 2 – VALVES WOODEN BOX DETAILS**

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1A	320X250X260	10	
1	320X250X430	15	
2	430X370X430	25	
3	670X670X470	65	
4	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
10	1300X770X1050	155	
11	2500X850X800	225	
12	2000X1500X1200	305	
14	1850X1050X1250	260	
15	2000X800X800	180	
17	2600X1500X1600	470	
21	250X250X600	20	
22	250X250X880	30	
23	300X300X700	25	
24	380X380X880	45	
25		25	
26	510X510X1400	60	
27	570X570X1400	80	
28	575X575X1875	105	
29	3600X1100X1100	390	
30	900X500X800	110	
52	2000X950X740	225	
53	1600X1120X700	220	
54	2500X2000X1200	490	
55	2900X1900X1400	525	
56	3000X1000X900	370	
57	3200X2200X950	450	
58	2150X1100X750	325	
61	2000X2000X700	130	
62	700X1200X1325	130	

TYPICAL PATTERN OF WOODEN BOX

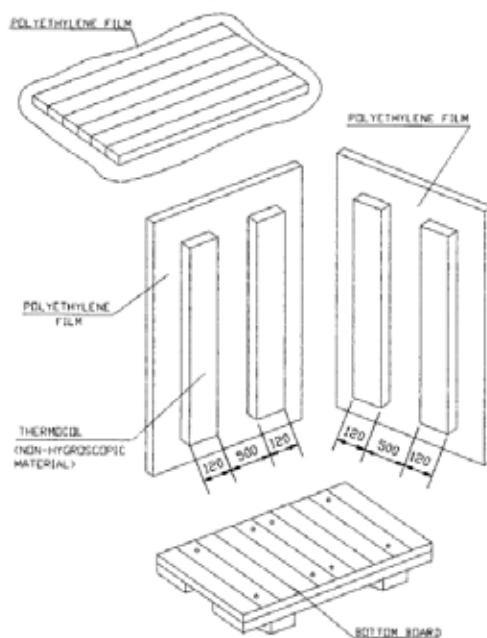


Figure 1

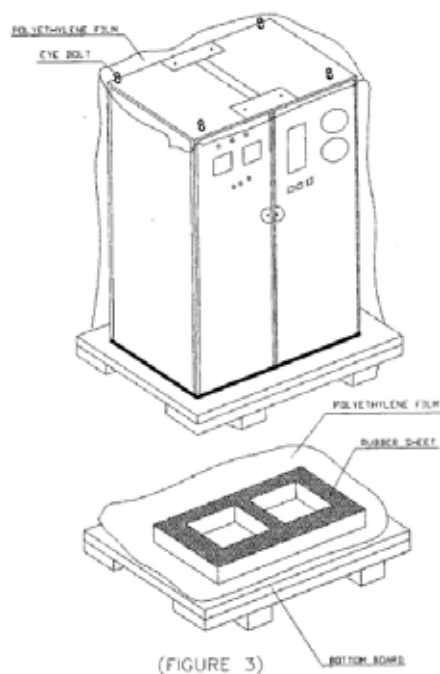


Figure 2



7.3 STANDARD BOX SIZES

WOODEN BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
01	I	2370	1570	1650	675	4000
02	IIA	1570	720	885	200	2500
03	II	1200	900	600	150	2000
04	III	900	600	600	100	1000
05	IV	600	450	450	40	750
06	V	600	300	300	35	500

STEEL BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
07	I	2480	1680	1500	339	4500
08	II	1200	900	600	061	2000
09	IIB	1800	850	950	115	2500
10	III	900	600	600	029	1000
11	IV	600	450	500	019	750
12	V	400	350	300	011	500

Table 3

7.4 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

- Following precautions are to be taken during packing: -
- Put the machine in the steel container properly,
- Cover the machine with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- Put cover on steel, container and Bolt Properly

8 MARKINGS/STENCILINGS

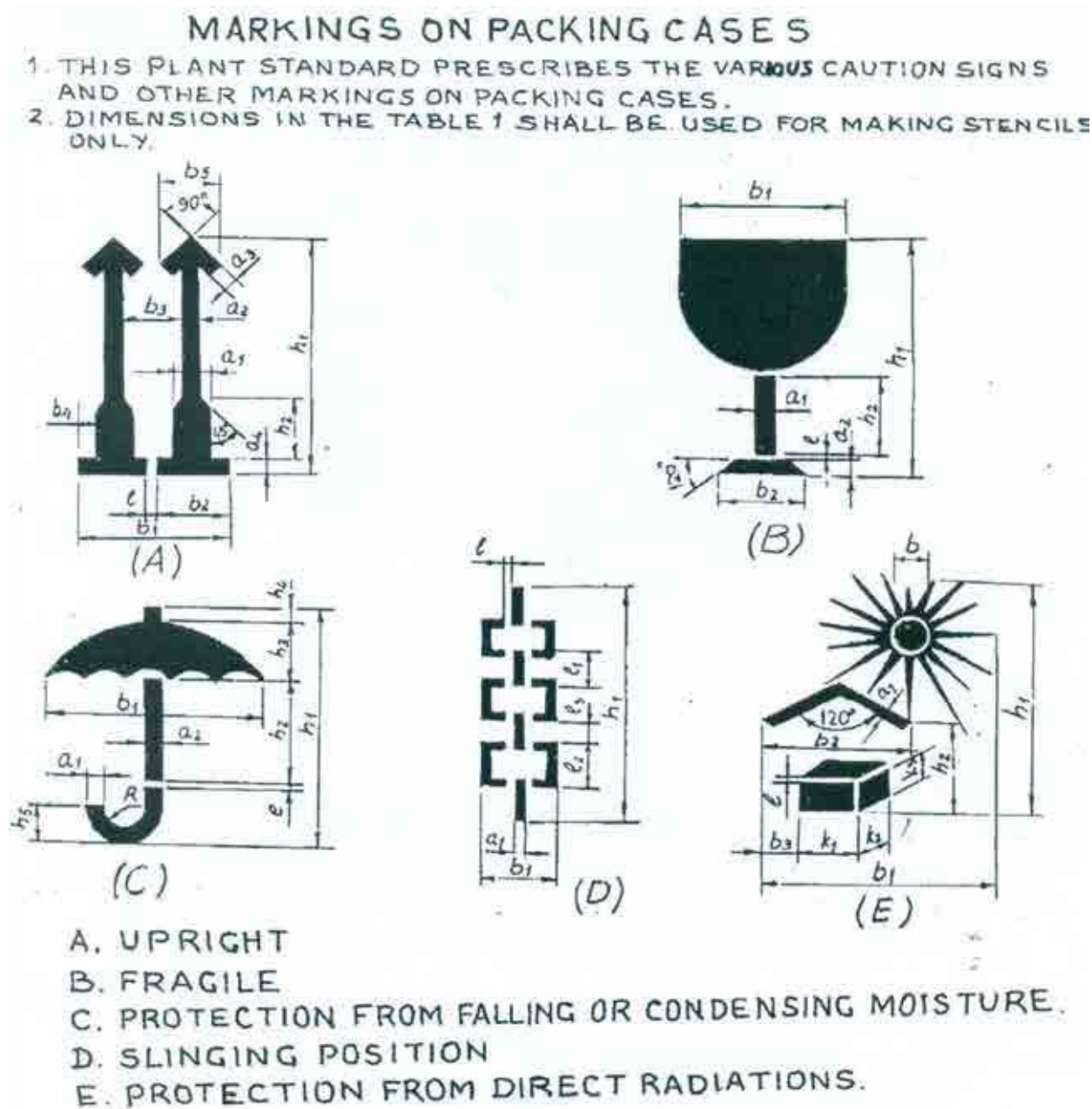


Figure 3

DESIGN- ATION		DIMENSION IN MM																							
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R	
A	1	12	5	5	4	52	25	19	8	21		2	84	23											
	2	17	7	7	6	75	36	29	11	30		3	119	33											
	3	24	10	10	8	104	50	38	16	42		4	168	46											
	4	34	14	14	11	147	71	59	23	60		5	239	65											
B	1	5	5			50	33					2	84	25											
	2	7	7			71	47					3	119	36											
	3	10	10			100	66					4	168	50											
	4	14	14			142	94					5	239	71											
C	1	4	3			66						2	80	39	19	5	11								6
	2	6	4			85						3	114	55	27	7	16								9
	3	8	6			120						4	160	78	38	10	22								12
	4	11	9			170						5	227	110	54	14	31								17
D	1	6				30						4	148								30	30	10		
	2	9				42						5	209								42	42	14		
E	1	3				69	47	10			16	2	91	26				17	8	11					
	2	4				98	67	15			23	3	128	33				24	11	16					
	3	6				138	94	20			32	4	182	62				34	16	22					

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

225		170	
BHEL-EDN-BANGALORE-26			
CONSIGNEE			
MATERIAL			
CUSTOMER REF.		MO. NO.	
DESPATCH ADVICE NOTE NO.		CASE NO.	
DIMENSIONS(MM) LXBXH		NET WT -KGS	GROSS WT -KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE – KEEP DRY DO NOT DROP – DO NOT TILT		

Figure 4 – TYPICAL MARKING PLATE



Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.

- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to weighment bridge for weighment, thereafter, he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of de-nailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will be handed over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS –STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings" duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

10 STANDARD METHOD OF PACKING

Table 5 –

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSURE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							



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STANDARD METHOD OF PACKING

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
BOILERS								

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BOILER DRUMS					O					
BOILER ITEMS										
COILS			O							
PANELS					O					
HEADERS			O		O					
FEEDERS										
MACHINED ITEMS										
SHELL SEGMENTS					O					
SHELL SEGMENTS IN STACKS					O					
SPHERE PETALS										
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O					
ROLLERS	O									
VALVE TRAYS										
VALVE TRAY COMPONENTS	O									
LATTICE GIRDERS		O								
FASTENERS	O									
GASKETS	O									
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARRE	DRUM	METAL DRUM	FIBRE DRUM		
SUB CONTRACTS										
FAB STRUCTURALS					O					
SUPPORTING STRUCTURALS					O					
STRUCTURE SUB ASSEMBLY					O					
FAB PIPES					O					
GRATINGS					O					
STAIR CASES					O					
HANDRAILS/ PLATFORMS					O					
BOUGHT OUT COMPONENTS										
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O					
PIPE FITTINGS										
CS PIPES, TUBES					O					
SS PIPES, TUBES					O					
FIN TUBES	O									
ELBOWS		O			O					
FLANGES	O	O								
VALVES	O									
GAUGES	O									
DEMISTERS		O								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARRE	DRUM	METAL DRUM	FIBRE DRUM		



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ABSORBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)								
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

11 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- 11.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 11.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- 11.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 11.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- 11.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- 11.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- 11.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

11.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

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

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per CI.no:08



- 11.8.1** 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°.
- 11.8.2** Handling and lifting should be done without jerks or impacts.
- 11.8.3** 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.
- 11.8.4** On receipt of the equipment it 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.
- 11.8.5** 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.
- 11.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

12 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

12.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length:	10000mm
Over Gooseneck:	13000mm
Width:	3000mm
Carrying Capacity:	40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length:	12000mm
Over Gooseneck:	16000mm
Width:	3000mm
Carrying Capacity:	75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length (for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

12.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

For Diameter up to 4000mm



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Wooden Saddles Length: 1836/2743mm (6'0"/9'0")
Width: 300mm (1'0")
Height: Saddle + one/two wedges a top.

For Diameter up to 4000mm

Wooden Saddles Length: 3353mm (11'0")
Width: 300mm (1'0")
Height: Saddle + three/four wedges a top.

NUMBER OF SADDLES:

Minimum: 3 in case of Loading inside Well
+ 1 when loaded on Gooseneck.
Maximum: 4 in case of Loading inside Well
+2 when loaded on Gooseneck.

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12.3 NUMBER OF LASHINGS ARE:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3 Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

13 GUIDELINES FOR HANDLING/LOADING/LASHING

13.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

**Figure 10****13.2 LOADING**

All the components to be transported by putting inside the properly fabricated Crating

**Figure 11**

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

**Figure 12**

No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.

**Figure 15**

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

**Figure 16**

13.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

**Figure 17**

Nylon Belts used for lashing the beams.

**Figure 18**

14 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard

**15 REFERRED STANDARDS (Latest publications including amendments):**

- | | | | |
|------------|------------|------------|------------|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 |
| 5) AA10108 | 6) AA56126 | | |



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DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/Assemblies/Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 TYPES OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

- 1) 'OP' - Open Type.
- 2) 'PP' - Partially Packed.
- 3) 'CP' – Crate/Box Packing - Components/Equipment requiring physical protection.
- 4) 'CQ' - Case Packing - Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' - Case Packing - Electrical Components/Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

3 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

3.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

3.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film to Specification No.AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

3.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

3.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of

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silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required.

3.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 70GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

4 PREPARATION OF PACKING CASES

4.1 DOMESTIC:

Based on the availability, the wood shall be Rubber wood (Havea Brasiliensis)/Pine wood for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

4.2 DIMENSIONS:

- Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.
- Width of all planks including the tongue shall be more than 125mm and after planing it shall be minimum 100mm.
- Minimum number of planks shall be used for a shook.
- Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel).
- External sides of front and rear planks to be planed to facilitate writing of address and other markings.
- Width of binding planks shall be minimum 100mm.
- Distance between any 2 binding planks shall be less than 750mm.
- diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

4.3 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

4.4 TONGUE AND GROOVE JOINTS

Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

4.5 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.



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End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shooks. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

4.6 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD

- 1) This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.
- 2) The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.
- 3) The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 4.6.5) can also be used.
- 4) The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.
- 5) Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]: Copper – Chromium – Arsenic preservative formulation shall be as per IS:10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

– Arsenic Pent oxide	AS ₂ O ₅ 2H ₂ O	12.5
– Copper Sulphate	CuSO ₄ 5H ₂ O	37.5
– Sodium Dichromate	Na ₂ Cr ₂ O ₇ 5H ₂ O	50.0
– Or Potassium Dichromate	K ₂ Cr ₂ O ₇	

4.7 OTHER MATERIALS

4.7.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

4.7.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

4.7.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6 +0.01mm. The material shall be free from rust.

4.7.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

4.7.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

**4.7.6 FASTENERS**

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

4.7.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

70GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

4.7.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

4.7.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

4.7.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Details and specifications are given in Fig-4

4.7.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

4.7.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.

4.7.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

4.7.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

4.7.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

4.7.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).



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4.7.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

4.7.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

4.7.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1. Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 6) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 7) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 8) Direction sticker " Front " & " Back " - 4 nos. Size 2.0Cm x 0.75Cm
- 9) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
- 10) "Fragile " sticker: 2 Nos Size. 2.1Cm x 1.5Cm
- 11) "DO NOT STACK " sticker - 2 Nos. Size 3.0Cm x 2.2Cm

5 PACKING OF CUBICLES WITH RUBBER WOOD:

5.1 The packing is to be done as per clause 4 in all respects.

5.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

5.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

5.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shoo's shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7) using blue nails (as per 4.7.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 4.7.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 4.7.7).

5.5 SILICA GEL:

Silica gel (as per 4.3.15) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 4.7.13).

5.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

5.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

5.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 4.7.8) with distance between consecutive layers less than 500mm.

5.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 4.7.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

5.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 4.7.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 4.7.11) shall be nailed to front / rear of case.

5.11 MARKING PLATE:

One no. (As per 4.7.10) shall be nailed to the front side of the case.

5.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

5.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x 2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x 2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

5.14 PACKING OF CUBICLES WITH PINE WOOD

Packing of cubicles for export shall be done exactly in same manner as described at Cl.No 5 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.

- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

6 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall be rubber wood with Tongue and Groove joint as per clause 4.4.
- 3) Chemical treatment as per Clause 4.6 to be done.
- 4) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 5) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 6) Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 4.7.7) using blue nails.
- 7) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 8) Internal packing: Items that go into the box shall be packed using 70GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect .
- 9) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.



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- 10) Silica gel as per clause 4.7.12 held in cotton bags as per clause 4.7.13 shall be kept at proper places in the box.
- 11) Packing slip kept in polyethylene bag (clause 4.7.16) shall be placed in the box.
- 12) Marking plate as per clause 4.7.10 shall be nailed to side of the box.
- 13) Two numbers of hoop iron strips as per clause 4.7.3 shall be strapped tightly on the case using clips.
- 14) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 15) Loose items to be kept inside the cubicle
- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
 - Other items which are given loose in addition to cubicle shall be packed in separate boxes.

7 BOX SIZES

7.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

7.2 BOX SIZES

Table 2 – VALVES WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1A	320X250X260	10	
1	320X250X430	15	
2	430X370X430	25	
3	670X670X470	65	
4	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
10	1300X770X1050	155	
11	2500X850X800	225	
12	2000X1500X1200	305	
14	1850X1050X1250	260	
15	2000X800X800	180	
17	2600X1500X1600	470	
21	250X250X600	20	
22	250X250X880	30	
23	300X300X700	25	
24	380X380X880	45	
25		25	
26	510X510X1400	60	
27	570X570X1400	80	
28	575X575X1875	105	
29	3600X1100X1100	390	
30	900X500X800	110	
52	2000X950X740	225	
53	1600X1120X700	220	
54	2500X2000X1200	490	
55	2900X1900X1400	525	
56	3000X1000X900	370	
57	3200X2200X950	450	
58	2150X1100X750	325	
61	2000X2000X700	130	
62	700X1200X1325	130	

TYPICAL PATTERN OF WOODEN BOX

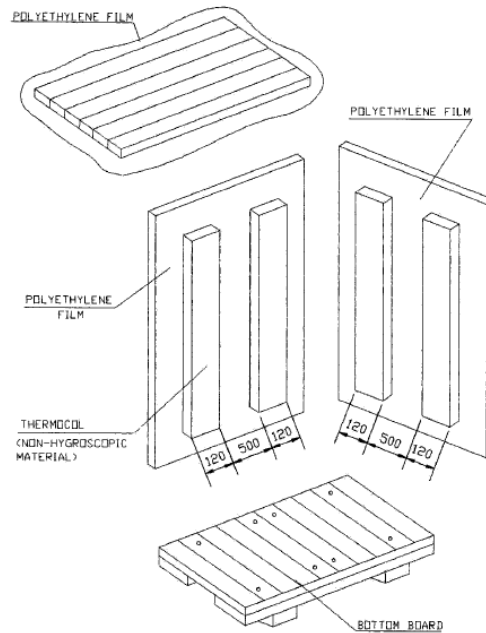


Figure 1

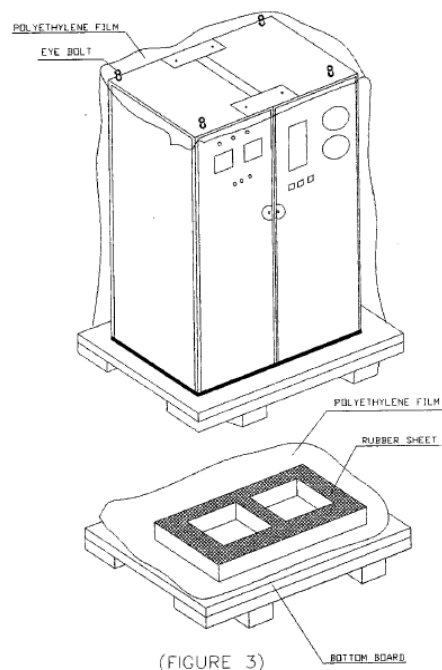


Figure 2

7.3 STANDARD BOX SIZES**WOODEN BOXES:**

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
01	I	2370	1570	1650	675	4000
02	IIA	1570	720	885	200	2500
03	II	1200	900	600	150	2000
04	III	900	600	600	100	1000
05	IV	600	450	450	40	750
06	V	600	300	300	35	500

STEEL BOXES:

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
07	I	2480	1680	1500	339	4500
08	II	1200	900	600	061	2000
09	IIB	1800	850	950	115	2500
10	III	900	600	600	029	1000
11	IV	600	450	500	019	750
12	V	400	350	300	011	500

Table 3**7.4 STEEL CONTAINERS**

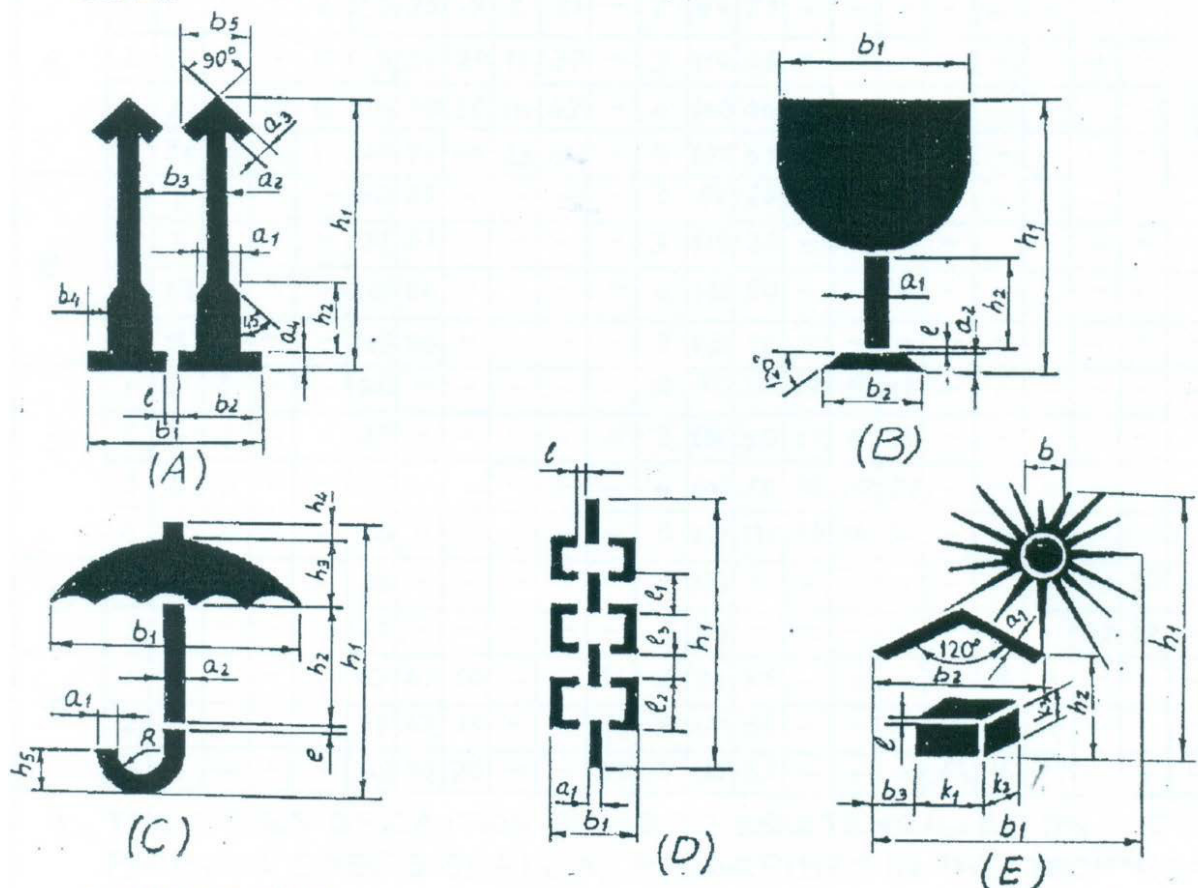
Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

- Following precautions are to be taken during packing: -
- Put the machine in the steel container properly,
- Cover the machine with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- Put cover on steel, container and Bolt Properly

8 MARKINGS/STENCILINGS

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
B. FRAGILE
C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
D. SLINGING POSITION
E. PROTECTION FROM DIRECT RADIATIONS.



Figure 3

DESIGN- ATION		DIMENSION IN MM																							
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R	
A	1	12	5	5	4	52	25	19	8	21		2	84	23											
	2	17	7	7	6	75	36	29	11	30		3	119	33											
	3	24	10	10	8	104	50	38	16	42		4	168	46											
	4	34	14	14	11	147	71	59	23	60		5	239	65											
B	1	5	5			50	33					2	84	25											
	2	7	7			71	47					3	119	36											
	3	10	10			100	66					4	168	50											
	4	14	14			142	94					5	239	71											
C	1	4	3			66						2	80	39	19	5	11								6
	2	6	4			85						3	114	55	27	7	16								9
	3	8	6			120						4	160	78	38	10	22								12
	4	11	9			170						5	227	110	54	14	31								17
D	1	6				30						4	148								30	30	10		
	2	9				42						5	209								42	42	14		
E	1	3				69	47	10			16	2	91	26				17	8	11					
	2	4				98	67	15			23	3	128	33				24	11	16					
	3	6				138	94	20			32	4	182	62				34	16	22					

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

225			
BHEL-EDN-BANGALORE-26			
CONSIGNEE			
MATERIAL			
CUSTOMER REF.		MO. NO.	
DESPATCH ADVICE NOTE NO.		CASE NO.	
DIMENSIONS(MM) LXBXH		NET WT -KGS	GROSS WT -KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE – KEEP DRY DO NOT DROP – DO NOT TILT		
		170	

Figure 4 – TYPICAL MARKING PLATE

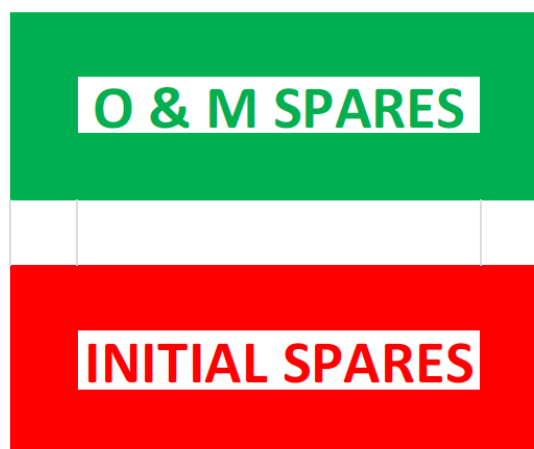


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

9 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.

- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to weighment bridge for weighment, thereafter, he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of de-nailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will be handed over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS –STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings" duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

10 STANDARD METHOD OF PACKING

Table 5 –

STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSURE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							

बी एच ई एल BHEL		CORPORATE STANDARD					AA0490010 Rev. No. 01 PAGE 15 of 26	
STANDARD METHOD OF PACKING								
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
COVERS		O						
EXCHANGERS								
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
BOILERS								



BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM

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ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)									
PAINT TINS									
PAINT DRUMS									
IGNITORS									
SPRAY NOZZLES									
ELECTRICAL INSTRUMENTATION									
MOTORS, PUMPS, COMPRESSORS, TURBINES									
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES									
INDICATORS, VIBRATOR SWITCHES									
CABLE BUNDLES, CABLE DRUMS									
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL									
OPERATIONAL SPARES									

11 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

11.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

11.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.

11.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.

11.4 For critical items, where specified, special handling fixtures shall be used for lifting.

11.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

11.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

11.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

11.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

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

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per CI.no:08



- 11.8.1** 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°.
- 11.8.2** Handling and lifting should be done without jerks or impacts.
- 11.8.3** 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.
- 11.8.4** On receipt of the equipment it 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.
- 11.8.5** 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.
- 11.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

12 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

12.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length:	10000mm
Over Gooseneck:	13000mm
Width:	3000mm
Carrying Capacity:	40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length:	12000mm
Over Gooseneck:	16000mm
Width:	3000mm
Carrying Capacity:	75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length (for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.

The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

12.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

For Diameter up to 4000mm

Wooden Saddles Length: 1836/2743mm (6'0"/9'0")
Width: 300mm (1'0")
Height: Saddle + one/two wedges a top.

For Diameter up to 4000mm

Wooden Saddles Length: 3353mm (11'0")
Width: 300mm (1'0")
Height: Saddle + three/four wedges a top.

NUMBER OF SADDLES:

Minimum: 3 in case of Loading inside Well
+ 1 when loaded on Gooseneck.
Maximum: 4 in case of Loading inside Well
+2 when loaded on Gooseneck.

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

12.3 NUMBER OF LASHINGS ARE:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3 Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

13 GUIDELINES FOR HANDLING/LOADING/LASHING

13.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

**Figure 10**

13.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

**Figure 11**

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

**Figure 12**

No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.

**Figure 15**

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

**Figure 16**

13.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

**Figure 17**

Nylon Belts used for lashing the beams.

**Figure 18**

14 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard

15 REFERRED STANDARDS (Latest publications including amendments):

- | | | | |
|------------|------------|------------|------------|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 |
| 5) AA10108 | 6) AA56126 | | |

ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032		Std. / Doc. Number	
				Annexure-6	
				Rev. No.	00

COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-6 (PQC/EQC FORMAT)

Revisions: Refer to record of revisions				



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : 1X660 MW BHUSAWAL TPS UNIT-6 FGD, MAHARASHTRA STATE
POWER GENERATION CO. LTD., BHUSAWAL

विषय / SUB : PQC FORMAT FOR HORIZONTAL OR SIDE ENTRY AGITATORS FOR
SLURRY APPLICATION

1. TECHNICAL CRITERIA:

Bidder shall submit the reference(s) for “**Agitators**” meeting the following criteria:

Bidder should have supplied at least 1 No. of Agitator of similar capacity (Refer Note-1) in the **last 7 years** for Wet Limestone based Flue Gas Desulphurization (FGD) application and the equipment should have been in trouble-free operation at site for **at least One (1) Year** as on initial enquiry submission due date

OR

Bidder should have supplied at least 1 No. of Agitator for any application other than FGD application **in the last 7 years** for capacity as per Note-2 and the equipment should have been in satisfactory operation / trouble-free operation at site for **at least One (1) Year** as on initial enquiry submission due date

The reference(s), which are furnished as above, should have been designed, engineered, manufactured, packaged, inspected & tested by bidder and supplied from bidder's manufacturing plant.

2. DOCUMENTATION REQUIRED FOR MEETING PQC:

The bidders shall furnish following documentary evidence (in English), along with technical offer, for the assessment of Bidder's Pre-Qualification Technical Criteria as indicated at Sl. No. (1) above [Also please refer to Note-3&4]:

i. Bidder's reference list for offered Agitator model to be submitted in enclosed format – “**Annexure-1**” to PQC.

ii. Documentary evidence such as following to be submitted:

- (a) Copies of Purchase Order OR LOI OR Invoice **AND**
- (b) Inspection Release Note (IRN) **AND**
- (c) Satisfactory Performance feedback certificates from End User indicating salient features like Project name, date of supply & commissioning, Application of Agitator etc.

In case, bidder is not able to submit satisfactory Performance feedback certificate(s) from End User, bidder shall submit the documents listed in Cl. No. II. ii (a) & (b) above, dated **at least three (3) years** prior to initial enquiry submission due date.

Notes:

- 1) The similar capacity refers to the case in which the following parameters shall be equal to to 70% to 130% of the highest of all the offered agitators in the present enquiry
 - Size of Tank (Diameter and Height)
 - Rating of the motor, kW
- 2) The Agitators shall be supplied for the industries such as petrochemicals, metals, mining, sugar, paper, fertilizers etc., and the capacity of Agitators shall be equal to 70% to 130% of the highest of all the offered agitators in the present enquiry.
 - Size of Tank (Diameter and Height)
 - Rating of the motor, kW
- 3) The details as mentioned in Annexure-1 shall be furnished considering the requirements indicated in Note-2 above should be available in any of the above documents submitted. Otherwise, bidder to submit other relevant documents duly approved by customer (such as copies of datasheet, drawing, curve etc.) having these details.
- 4) The details of manufacturing location should be available in any of the above documents submitted. Otherwise, bidder to submit other relevant documents (such as Test Report, LR copy etc.) having these details.

ANNEXURE-1: EXPERIENCE RECORD PROFORMA

Sl. No.	Name of Customer	Service / Working Fluid	Qty.	Pressure (kg/cm ² (g)	Temperature (DegC)	Viscosity (centipoise)	Specific gravity	Percentage of Solids	Material of construction (Impeller & Shaft)	Application of Agitators	Order Ref no & Date (copy to be enclosed)	Performance certificate/ Inspection Report/ Dispatch Clearance / Dispatch LR copy etc to be enclosed (Refer Cl.No.II(ii) in EQC for the details)	Remarks



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BHARAT HEAVY ELECTRICALS LIMITED

रामचन्द्रापुरम हैदराबाद - 32

RAMACHANDRAPURAM: HYDERABAD - 502 032.

परियोजना इंजीनियरिंग विभाग

PROJECT ENGINEERING & SYSTEMS DIVISION

परियोजना / PROJECT : 1X660 MW BHUSAWAL TPS UNIT-6 FGD, MAHARASHTRA STATE
POWER GENERATION CO. LTD., BHUSAWAL

विषय / SUB : PQC FORMAT FOR VERTICAL AGITATORS(TOP ENTRY) FOR SLURRY
APPLICATION

1. TECHNICAL CRITERIA:

Bidder shall submit the reference(s) for “**Agitators**” meeting the following criteria:

Bidder should have supplied at least 1 No. of Agitator of similar capacity (Refer Note-1) in the **last 7 years** for Wet Limestone based Flue Gas Desulphurization (FGD) application and the equipment should have been in trouble-free operation at site for **at least One (1) Year** as on initial enquiry submission due date

OR

Bidder should have supplied at least 1 No. of Agitator for any application other than FGD application **in the last 7 years**, for capacity as per Note-2 and the equipment should have been in satisfactory operation / trouble-free operation at site for **at least One (1) Year** as on initial enquiry submission due date

The reference(s), which are furnished as above, should have been designed, engineered, manufactured, packaged, inspected & tested by bidder and supplied from bidder’s manufacturing plant.

2. DOCUMENTATION REQUIRED FOR MEETING PQC:

The bidders shall furnish following documentary evidence (in English), along with technical offer, for the assessment of Bidder’s Pre-Qualification Technical Criteria as indicated at Sl. No. (1) above [Also please refer to Note-3&4]:

i. Bidder’s reference list for offered Agitator model to be submitted in enclosed format – “**Annexure-1**” to PQC.

ii. Documentary evidence such as following to be submitted:

(a) Copies of Purchase Order OR LOI OR Invoice **AND**

(b) Inspection Release Note (IRN) **AND**

(c) Satisfactory Performance feedback certificates from End User indicating salient features like Project name, date of supply & commissioning, Application of Agitator etc.

In case, bidder is not able to submit satisfactory Performance feedback certificate(s) from End User, bidder shall submit the documents listed in Cl. No. II. ii (a) & (b) above, dated **at least three (3) years** prior to initial enquiry submission due date.

Notes:

- 1) The similar capacity refers to the case in which the following parameters shall be equal to to 70% to 130% of the highest of all the offered agitators in the present enquiry
 - Size of Tank (Diameter and Height)
 - Rating of the motor, kW
- 2) The Agitators shall be supplied for the industries such as petrochemicals, metals, mining, sugar, paper, fertilizers etc., and the capacity of Agitators shall be equal to 70% to 130% of the highest of all the offered agitators in the present enquiry.
 - Size of Tank (Diameter and Height)
 - Rating of the motor, kW
- 3) The details as mentioned in Annexure-1 shall be furnished considering the requirements indicated in Note-2 above should be available in any of the above documents submitted. Otherwise, bidder to submit other relevant documents duly approved by customer (such as copies of datasheet, drawing, curve etc.) having these details.
- 4) The details of manufacturing location should be available in any of the above documents submitted. Otherwise, bidder to submit other relevant documents (such as Test Report, LR copy etc.) having these details.

ANNEXURE-1: EXPERIENCE RECORD PROFORMA

Sl. No.	Name of Customer	Service / Working Fluid	Qty.	Pressure (kg/cm ² (g)	Temperature (DegC)	Viscosity (centipoise)	Specific gravity	Percentage of Solids	Material of construction (Impeller & Shaft)	Application of Agitators	Order Ref no & Date (copy to be enclosed)	Performance certificate/ Inspection Report/ Dispatch Clearance / Dispatch LR copy etc to be enclosed (Refer Cl.No.II(ii) in EQC for the details)	Remarks

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				Annexure-7	
				Rev. No.	00

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Revisions: Refer to record of revisions				

TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - Rev No. 00 Page 1 of 3
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. QAP GUIDELINES & FORMAT (ANNEXURE -) The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement. Note : 1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval. 2. No deviation to reference document is acceptable.				

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE
	Rev No. 00		
	Page 2 of 3		
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	<u>GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN</u> - QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10. - Each page of QAP shall contain the following information. - Vendor's name & address. - Customer: BHEL, Hyderabad. - Project. - BHEL Product Standard Number/revision number as referred in P.O. - BHEL Purchase Order Number & Date. - Product as per P.O. description. - QAP Number (unique and shall not repeat)/revision number/date. - Page number and number of pages - QAP shall contain four parts / stages as follows. - Raw materials and bought out items. - In process Control / Inspection. - Final assembly, Inspection & Testing. - Painting, preservation & packing. - Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc). - Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.) - Under 'Class', indicate minor, major or critical depending on the importance of characteristic. - Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.) - Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.) - Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept. - Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.		
		Ref. Doc	Please refer 'Agency' in QAP format. Under P: Perform, W: Witness, V: Verify Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR 2: (Vendor / Sub vendor)

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE
			Rev No. 00
			Page 3 of 3
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, Under Witness (W) column use 1. Under 'Verify' column, use code 1. 12. Under 'D' please put (☐ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification. 13. Vendor's signature & stamp should be available on each page of QAP. 14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings. 15. The following operations/characteristics/check points may be included (AS APPROPRIATE) a) Visual check b) Dimensional check c) Mechanical and Chemical properties. d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.) e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc. f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc. g) Verification of test certificate for protection class for the enclosures. h) Mechanical functioning of switches. i) Continuity of earthing and provision of earth points. j) Colour coding of wiring, size, tightness & dressing of wiring. k) Review of test certificates of assembled items, raw materials, internal test reports etc. l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc. m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc. n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.) o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non-Destructive Tests. p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating) q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole. r) Packing and Preservation. 16. QAP Format enclosed. 17. Typical Manufacturing QAP(s) is /are attached.		
	Ref. Doc		

VENDOR'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.				BHEL P.O.NO.:			REV NO:		DATE:		
		PROJECT:				P.O.DATE:			PAGE 1 OF 1				
PRODUCT:		BHEL SPEC:			REV:								
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
2.0	INPROCESS INSPECTION												
3.0	FINAL INSPECTION & TESTING												
4.0	PRESERVATION & PACKING												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D'; TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP



**PROJECT ENGINEERING & SYSTEMS DIVISION
RC PURAM, HYDERABAD.
QUALITY & BUSINESS EXCELLENCE**

INSPECTION / TC REVIEW FORMAT

1	Vendor's Name:		5	Applicable BHEL Spec No:	
2	Project:		6	Approved Drawing No:	
3	PO No:		7	Approved Data Sheet No:	
4	Item Description:		8	Approved QAP No:	

OFFER LIST

S.No	BBU/ PO Sr. No.	Item Description	Total Qty as per PO/BBU	Qty. already accepted	Qty offered for TC review	Cumulative Qty	Balance Qty
A							
B							
C							
D							

TC REVIEW REQUISITION

BBU / PO Sr. No.	QAP Clause No.	Format of Record	Certificate No. & Date	Page No.	REMARKS
---------------------	-------------------	---------------------	------------------------	-------------	---------

A. Item Description:

B. Item Description:

C. Item Description:

D. Item Description:

E. Item Description:

SUPPLIER / VENDOR SIGNATURE WITH SEAL

BHEL/ BHEL's TPIA SIGNATURE WITH SEAL

Dt:

Dt:

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				Annexure-8	
				Rev. No.	00

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Revisions: Refer to record of revisions				

TABLE-A
VENDOR LIST

SL. NO.	ITEMS	VENDORS
1	MOTOR ACTUATORS	ROTORK
		AUMA
		LIMITORQUE
		ANTIREB
2	DRY TYPE TRANSFORMERS	KIRLOSKAR
		VOLTAMP
		CROMPTON
		VIJAY ELECTRICALS, HYD.
		BHEL
		POWER PACK UPTO 100 KVA
3	AUXILIARY TRANSFORMER	AREVA
		ABB
		CROMPTON GREAVES LTD.
		VOLTAMP TRANSFORMERS (P)LTD.
		VIJAY ELECTRICALS
		KIRLOSKAR
		BBL
		BHEL
		STAR DELTA, BHOPAL
		EMCO
4	LT POWER AND CONTROL	UCL
	CABLES	CCI
		KEI INDUSTRIES LTD
		FINOLEX
		FORT GLOSTER
		POLYCAB
		DELTON
		ASIAN
		NICCO

SL. NO.	ITEMS	VENDORS
		PARAMOUNT CABLE CORPN.
		PARAGON CABLE
		KRISHNA ELECT. INDUSTRIES
		DASHMESH CABLES
		INCOM WIRES & CABLES LTD.
		TERACOM LTD. (P) RALLISON ELECT
	FOR CONTROL CABLES ONLY	CORDS
		THERMO CABLES LTD. HYDERABAD
5	HT POWER CABLE	UCL, CCI, FORT GLOSTER,
	(HT CABLE MANUFACTURERS	CRYSTAL CABLES INDUSTRIES
	HAVING TRIPLE EXTRUSION	POLYCAB, ASIAN, NICCO,
	DRY CURE (CCV) PROCESS	HINDUSTAN VIDYUT PRODUCTS
	USING NITROGEN ONLY ARE	KEI INDUSTRIES, RPG CABLES LTD.
	TO BE SELECTED)	
6	GEARED MOTORS	POWER BUILD
		CROMPTON
		KIRLOSKAR
		LAXMI HYDRAULICS PVT LTD FOR 415V
7	CABLE TRAYS	VENUS STEEL, INDIANA, BHARTI
		EXPORT, VATCO, RATAN PROJECTS & ENGG LTD. KOLKATA, KANADE ANAND UDYOG, MUMBAI, PATNY SYSTEMS(P) LTD. HYD, DOLPHIN
		M/S INAR PROFILES PVT LTD., ANKAPALLE
		M/S INDUSTRIAL PERFORATION (I) PVT LTD., KOLKATA
		M/S PREMIER POWER PRODUCTS (CAL) PVT LTD, KOLKATA
		M/S RABI ENGINEERING WORKS PVT. LTD. KOLKATA
		M/S UNITECH FABRICATORS AND ENGINEERS PVT LTD., KOLKATA
		M/S ASSOCIATED POWER STRUCTURES PVT. LTD., GUJRAT

SL. NO.	ITEMS	VENDORS
		M/S JAMNA METAL CO. PVT LTD., DELHI
		M/S RUKMANI ELECTRICALS & COMPONENTS PVT LTD., KOLKATA
		M/S RATAN ENGINEERING CO., KOLKATA
8	PROXIMITY SWITCH	AW
		JAYASHREE
9	VFD (LT MOTORS)	ABB
		SIEMENS
		L&T
		ALLEN BRADLEY
		GE FANUC
10	SAFETY SWITCHES	AG
		JAYASHREE
11	ANNUNCIATOR	PROCON
		I/C
12	HOOTER	KHERAJ
		TULLU
		VAISHNO
13	CONTROL PANELS/ LIGHTING	POSITRONICS.
	PANELS/ JBS	CONTROL & SCHEMATIC
		VIMAC ELECTRIC
		PRITHVI TECHNOLOGY
		POWEROL PANEL & CONTROL
		L&T
		SIEMENS
		SCHNEIDER
14	LT BUS DUCT	STAR DRIVE
		ELEC MECH
		CONTROL SCHEMATIC
		REEP

SL. NO.	ITEMS	VENDORS
		C&S DELHI
15	BATTERY	EXIDE
		AMARA RAJA
		HBL
		AMCO
16	BATTERY CHARGER	CHHABI
		AMARA RAJA
		HBL
		MASS- TECH.
		AMCO
17	CIRCUIT BREAKER	L&T
		SIEMENS
		ABB
		SCHNEIDER
		GE
18	POWER CONTACTOR/	SIEMENS
	AUXILIARY CONTACTOR	L&T
		ABB
		SCHNEIDER
19	NUMERIC PROTECTION RELAYS FOR LT SWITCHGEAR	ABB
		ALSTHOM
		SCHNEIDER
		AREVA
		L&T
20	AUXILIARY RELAY	GEC
		SIEMENS
		JYOTI RE-300
		L&T
		ABB
		SCHNEIDER
21	THERMAL O/L RELAYS	L&T

SL. NO.	ITEMS	VENDORS
		SIEMENS
		ABB
		SCHNEIDER
22	PUSH BUTTONS/INDICATING	SIEMENS
	LAMP	L&T
		CANDS
		TEKNIC
		SCHNEIDER
23	ELECTRICAL PANEL METER /	AEP
	INDICATING INSTRUMENTS	IMP
	(AMMETER / VOLTMETER)	MECO
		RISHABH
24	CT (LT)	KAPPA
		SILCON
		PRAYOG
		PRAGATI
		CANDS
		PRECISE
25	PT (LT)	KAPPA
		SILCON
		PRAYOG
		PRAGATI
		CANDS
		PRECISE
26	CONTROL TRANSFORMERS (LT)	KAPPA
		SILCON
		POWER PACK
		PRAGATI
		CANDS
		PRECISE
27	POWER SWITCH	SIEMENS

SL. NO.	ITEMS	VENDORS
		L&T
		GE
		ABB
		SCHNEIDER
28	SELECTOR SWITCHES AND CONTROL SWITCHES	KAYCEE
		SIEMENS
		L&T
		RECON
		SWITRON
29	TIMERS	GEC
		ABB
		SCHNEIDER
		L&T
		EIPL
30	FUSES FOR LT	GEC
		SIEMENS
		L&T
		STANDARD
		BUSSMANN
31	MCCB	L&T
		SIEMENS
		AEG
		SCHNEIDER
32	MCB	MDS
		SIEMENS
		SCHNEIDER
33	TERMINAL BLOCKS & ACCESSORIES, SIDE CLAMP	CONNECT WELL IND.
		ELMEX CONTROLS
		WAGO AND CONTROLS
34	DOUBLE COMPRESSION	COMET
	CABLE GLAND	ELECTRO MAG

SL. NO.	ITEMS	VENDORS
		COSMOS
		POWER ENGG
35	CRIMPING LUGS	DOWELL
36	NUMERIC RELAY FOR HT	ABB
	SWTICHGEAR (3.3/6.6/11KV)	AREVA
38	LIGHTING FIXTURES	PHILIPS
		CGL
		BAJAJ
		GE
39	CONDUIT	SENCO
		M. CHANDRA
		NAGARJUNA
		K. K. IND. KOLKATA

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Revisions: Refer to record of revisions				

Annexure-9: MASTER DOCUMENT LIST - AGITATOR												
	Vendor Name:				PROJECT:							
	Vendor Contact Person:			BHEL PO No.			PO date:			PO Dly. Date:		
	Vendor contact No.				Supplier's Job No.							
	SYSTEM/PACKAGE:	Foam Pump				TODAY-DATE	21/Jul/20			Sumission status to BHEL		
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT
1.0 Mechanical												
A	MECHANICAL											
1	Data Sheet of Agitator	Later		A	Y	Y	Within 2 weeks after PO					
2	Performance Curve of Agitator	Later		I	Y	Y	Within 2 weeks after PO					
3	GAD of Agitator	Later		I	Y	Y	Within 2 weeks after PO					
4	Motor Data Sheet	Later		A	Y	Y	Within 2 weeks after PO					
5	Motor GA drawing	Later		A	Y	Y	Within 2 weeks after PO					
6	Motor TB drawing	Later		I	Y	N	Within 2 weeks after PO					
7	Motor Curves	Later		I	Y	N	Within 2 weeks after PO					
8	T-S Curve	Later		A	Y	Y	Within 2 weeks after PO					
9	Gear Box Data sheet	Later		A	Y	Y	Within 2 weeks after PO					
10	Gear Box GAD	Later		I	Y	N	Within 2 weeks after PO					
11	Mechanical Seal Documents	Later		I	Y	Y	Within 2 weeks after PO					
12	Foundation Drawing and Details of Agitator Assembly	Later		I	N	N	Within 2 weeks after PO					
B	MISCELLANEOUS											
1	Performance Test Procedure	Later		A	Y	N	Within 8 weeks after PO placement					
2	Vibration test procedure & Noise test procedure	Later		I	N	N	Within 8 weeks after PO					
3	Hydro Test Procedure	Later		I	N	N	Within 8 weeks after PO					
4	NDE Test Procedure	Later		I	N	N	Within 8 weeks after PO					
5	Painting procedure	Later		A	N	N	Within 10 weeks after PO					
6	Packing List	Later		I	N	N	Before Despatch					
7	BILL OF MATERIAL	Later		A	N	N	Within 10 weeks after PO					
8	BILLING BREAKUP	Later		A	N	N	Before Despatch					

Annexure-9: MASTER DOCUMENT LIST - AGITATOR												
	Vendor Name:				PROJECT:							
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:		
	Vendor contact No.				Supplier's Job No.							
	SYSTEM/PACKAGE:	Foam Pump				TODAY-DATE	21/Jul/20			Sumission status to BHEL		
SL.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" "PV/PB /PC/AA	SD	AD	APP.CAT
9	QUALITY ASSURANCE PLAN	Later		A	N	Y	Within 4 weeks after PO					
10	SUB VENDOR LIST	Later		I	N	N	Within 4 weeks after PO					
11	COMMISSIONING SPARES LIST	Later		A	N	N	Within 4 weeks after PO					
12	Mandatory Spares List	Later		A	N	N	Within 4 weeks after PO					
13	LUBE OIL SCHEDULE	Later		I	N	N	Within 8 weeks after PO					
14	O& M Manuals(Soft Copies)	Later		A	N	N	After Approval of all engineering drawings/docum ents					
15	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.	Later		I	N	N	After Approval of all engineering drawings/docum					
							TOTAL	0		^APP.CA T		
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved		
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments		
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.		
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.		
		OD-Overdue					TOTAL "OD"		0			
		" " - Not yet Due.							5			

Note : Post order Stage, Vendor to provide data sheet in Customer Standard Format Data Sheet. The Standard format shall be furnished during detail Engg.

Vendor documentation status									
Total No of Docs	Due as on Date	Submited by vendor as on Dt.	Approved by BHEL as on	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/ Remarks
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)./(IF Y) put Dt.	
0	0	0	0	0	0	#DIV/0!	0.00%	Y	

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				Annexure-10	
				Rev. No.	00

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Revisions: Refer to record of revisions				

ANNEXURE-10: DEVIATION FORMAT

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification Requirement	Bidder's Deviation

Notes:

1. Bidder to furnish duly filled format along with SEAL & SIGN along with their offer.
2. All the pre-bid queries (if any) shall be raised before submission of the offer as per pre-bid query format (Annexure- 11).
3. Deviations, which are impractical, and the same were raised during pre-bid stage as per pre-bid query format (Annexure-12), but still purchaser's reply/clarifications could not be met shall only be raised in this format.
4. If there are no deviations, bidders shall indicate as "No deviation" and submit the same along with their offer.
5. Deviations indicated elsewhere in bidders offer except raised through this format shall not be considered and reviewed during technical evaluation of their offer.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

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				Annexure-11	
				Rev. No.	00

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Revisions: Refer to record of revisions				

ANNEXURE-11:PRE-BID QUERIES FORMAT

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification (along with all Annexures) shall also be referred.

ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032		Std. / Doc. Number	
				Annexure-12	
				Rev. No.	00

COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-12 (GUARANTEED POWER CONSUMPTION FORMAT)
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Revisions: Refer to record of revisions				

ANNEXURE-12					
GUARANTEED POWER CONSUMPTION FORMAT (AGITATORS)					
PROJECT: 1 X 660 MW BHUSAWAL TPP FGD SYSTEM					
Sl.No.	Description / Item	Working	Standby	Power Consumption (kW) per Agitator (at motor input terminals)	Total Power Consumption (KW)
Col. (1)	Col. (2)	Col. (3)	Col. (4)	Col. (5)	Col.(6) = Col.(3) * Col.(5)
A)	Limestone slurry storage tank agitator	1	0		
B)	Secondary hydro-cyclone feed tank agitator	1	0		
C)	Filtrate water Tank Agitator	1	0		
D)	Waste Water Tank Agitator	1	0		
E)	Total Guaranteed Power(kW) = (A) + (B) + (C) + (D)				
Notes :					
1	Power consumption (kW) of motors shall be measured at motor input terminals when the system operating at the rated capacity. For this purpose, the drives of standby equipment shall not be considered.				
2	Power quoted by bidder shall be termed as 'Guaranteed Power consumption' (GPC) and bidder to demonstrate Guaranteed Power Consumption (kW) value during PG test at site. If the actual power consumption exceeds the guaranteed power consumption, liquidated damages shall be payable by the successful bidder at the rate of INR 4,50,000/- per kW for excess power consumption over the guaranteed power consumption indicated by bidder in his bid. Such liquidated damages may be recovered by the BHEL by deduction from the contract price or by enforcing the contract performance guarantee or in any other manner deemed fit by the BHEL.				
3	For evaluation of Liquidated Damage (LD), the total power consumption of all the above mentioned agitators (as indicated at Sl.no.E) will be considered based on actual power consumption at site (and not individual power consumption against each agitator)				