



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAMANJODI
18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Flue Gas Desulphurization Group-FGD, Boiler Auxiliary Plant (BAP), Ranipet
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TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAMANJODI 18.5 MW

SPECIFICATION NO : NALCO:DMNJDI:FGD: OAB
END CUSTOMER : NALCO
BUYER (EPC) : BHEL, BAP Ranipet
PROJECT : DAMANJODI 18.5 MW COGENERATION PLANT
APPLICATION : WET LIMESTONE FLUE GAS DESULFURISATION

00	15-04-2021	Fresh Release			
REV	Date	Description	Prepared	Checked	Approved

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18.5 MW**

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A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Purpose
1.	Annexure to qualification requirements : Attachment - 3K	Qualification Requirement (QR)
2.	Reference plant details of similar or higher capacity oxidation blower supplied as per Annexure-II	Qualification Requirement (QR)
3.	Proforma Invoice of Supply	Consideration of Bid
4.	Proforma Invoice of Mandatory Spares	Consideration of Bid
5.	Proforma Invoice for Supervision of Erection & Commissioning	Consideration of Bid
6.	Seal & Sign of bidder on all pages of specification	Technical Evaluation of Bid (TEB)
7.	Filled Data Sheets of & All accessories as per Annexure-I	TEB
8.	Deviation List (if any) as per Annexure-III	TEB
9.	Schedule of Guarantee as per Annexure-IV	TEB
10.	Blower & Motor Sizing Calculation	TEB
11.	GA drawing including cross sectional view & BOM of Oxidation Blower	TEB
12.	GA drawing and Datasheet of the Motor	TEB
13.	P & ID diagram of oxidation blower & Lube oil system	TEB
14.	Performance curves i. Flow v/s Total Pressure ii. Flow v/s Efficiency iii. Flow v/s Power consumption iv. Torque v/s Speed curve for motor selection	TEB
15.	Required Electric power & other Utility List	TEB
16.	Make of all bought out items & sub vendor list	TEB
17.	Quality Plan	TEB
18.	List of Start-up & Commissioning Spares	TEB
19.	List of Special Tools	TEB
20.	Delivery Schedule	TEB
21.	Catalogue	TEB
22.	Price bid	Price Bid



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B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing over of Documents after Contract (in weeks)	Purpose
1.	Utility Consumption & Lubricating Oil List	2	Customer Approval
2.	Foundation Drawing, Anchor Bolts, static & dynamic details	2	Customer Approval
3.	GA drawing including cross sectional view of Oxidation Blower & Accessories with bill of material (in PDF & Autocad format)	2	Customer Approval
4.	P&ID drawing of Oxidation Blower & Lube Oil System in PDF & AUTOCAD format	3	Customer Approval
5.	Filled Data Sheets of Oxidation Blower & All accessories	3	Customer Approval
6.	Quality Plan with Inspection & Performance Test Procedure at site	3	Customer Approval
7.	Blower & Motor Sizing Calculation	3	Customer Approval
8.	Performance curves i. Flow v/s Total Pressure ii. Flow v/s Efficiency iii. Flow v/s Power consumption iv. Torque v/s Speed curve for motor selection	3	Customer Approval
9.	Motor Rating in Kw	3	Customer Approval
10.	Datasheet and GA of the Blower Drive Motor	3	Customer Approval
11.	Datasheet and Wiring Drawing of the VFD	3	Customer Approval
12.	Sub vendors List	4	Customer Approval
13.	Manufacturing Schedule	4	Customer Approval
14.	List of Special Tools	8	E&C
15.	List of Start-up & Commissioning Spares	9	E&C
16.	Required Electric power	10	E&C
17.	Pre- Commissioning Check List	10	E&C
18.	Installation & assembly procedure	10	E&C
19.	Erection & Commissioning Shedule	10	E&C
20.	Recommended Repair Procedure	10	E&C
21.	Operation and Maintenance Manual (10 hardcopies and 5 electronic copies in English)	10	E&C
22.	Electrical Load List with Single Line Diagram	10	BHEL Review
23.	Control Logic of Oxidation Blower	10	BHEL Review
24.	Catalogue	10	BHEL Review
25.	Proforma Packing List	12	Dispatch



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1.0 APPLICABLE CODES & REGULATIONS

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 Oxidation blower shall follow the latest applicable Indian/International (AISI / ASME/EN) Standards.

2.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, supervision of erection & commissioning and performance testing of Oxidation blower along with accessories which is to be furnished in the Flue Gas Desulphurization plant. The following points may be noted.

- a. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- b. The Bidder shall offer only proven design which meets the Provenness criteria indicated in **Annexure for Qualification Requirement**. Necessary document evidences as per **Attachment-3K** for qualification shall be submitted along with the bid. If the Bidder doesn't meet the specified proven ness criteria, then the Bidder will not be allowed to participate in the Tender.
- c. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (**Annexure-III**)".
- d. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.
- e. No deviation or exception shall be permitted without the written approval of the purchaser.
- f. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.
- g. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.
- h. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.



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3.0 PROVENNESS CRITERIA/ QUALIFICATION REQUIREMENT/ SUB-QR/ PQR:

The Bidders are required to meet the following Qualification Requirement (QR) for Oxidation Blower **and bidder shall submit all the documents as required for meeting the Qualification Requirement.**

Only Manufacturers of Oxidation Blowers can seek for qualification. In the event of Order, only Manufacturers will be considered for placement of order. The bidder is required to meet the provenness criteria and/or qualification requirement for Oxidation Blower as stipulated below:

Oxidation Blower vendor (for the Wet Limestone based Flue Gas Desulphurisation system) should have previously manufactured and supplied the oxidation blower of the type, application and minimum equipment rating as stipulated below and the oxidation blower should have been in successful operation in at least one (1) plant for a period not less than one (1) year reckoned as on the technical bid opening date:

S.NO	Name of Equipmen	Type of Equipment	Application	Equipment Rating
1	Oxidation Blowers	Centrifugal/positive displacement type blower	Wet Limestone based FGD Application in coal fired power plant or any other process application	Capacity = 1720 Nm ³ /hr-wet; Head = 5810 mm wc;

Bidder shall offer and supply only the type of blower for which he is getting qualified. (i,e) If vendor is meeting the PQR for Centrifugal Blower, then vendor shall quote and supply only Centrifugal Blowers . If vendor is meeting the PQR for Positive Displacement Type Blower, then vendor shall quote and supply only Positive Displacement Blower.

Buyer reserves the right to fully satisfy himself regarding capability and capacity of Bidder before allowing manufacture of the equipment for this contract.

REMARKS: Blower vendor shall furnish the 3K- form as per the enclosed format along with all supporting documents. The offer will be considered only after obtaining approval from the end-customer (NALCO) and the above conditions for qualification criteria may be relaxed subject to the end-customer's approval for the vendors participating in this enquiry.



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4.0 TECHNICAL INFORMATION OF OXIDATION BLOWERS (OXIDATION BLOWER SELECTION PARAMETERS)

S. NO	DESCRIPTION	REQUIREMENT		
1.	Site Condition			
	Barometric Pressure	908.6 hpa		
	Ambient temperature	Normal: 35 deg C; Max: 46.6 deg C		
	Relative Humidity	Design: 60 %; Max: 89%		
	Site elevation	+910 meters above sea level		
2.	Quantity	1 No. Working + 1 No. Standby for each absorber Total = 2 No's (1 Absorbers).		
3.	Parameters			
3.1	Operating Points	(1) Design Point	(2) Operating Point-1	(3) Guarantee Point
3.2	Blower capacity	2150 Nm³/hr-wet.	1870 Nm³/hr-wet.	600 Nm³/hr-wet.
3.3	Discharge pressure(min)	5810 mmWC	5110 mmWC	2800 mmWC
3.4	Efficiency(min)		72.5%	
3.5	Relative humidity	60%	60%	60%
3.6	Suction temperature	35.0° C	35.0° C	35.0° C
3.7	Discharge temperature	<70° C		
3.8	Type of Blower	The oxidation air blowers/ compressors shall be of centrifugal/rotary/ positive displacement type* and supplied with motor, base frame with shock absorbers and mounting bolts, intake filter with hood, silencers, safety valves and check valves etc. The blower will be used for supplying a variable volume of air to the absorber reaction tank. *VFD shall be provided by vendor for rotary/positive displacement type blower to achieve varying operating points 3.1 (1), (2) & (3) specified above		
3.9	Duty	Continuous		
3.	Cooling water (for blower)			
	Inlet temperature	36.0° C		
	Outlet temperature	<46.0° C		
	Pressure loss	0.05 MPa		
	Supply pressure	0.2-0.3 MPa		
	Cooling water consumption(max)	2 m ³ /hr		
4.	Air Composition (Wet)	(1) Design Point	(2) Operating Point-1	(3) Guarantee Point
	H ₂ O	3.35 Vol%	3.35 Vol%	3.35 Vol%
	O ₂	20.20 Vol%	20.20 Vol%	20.20 Vol%
	N ₂	Balance	Balance	Balance
5.	Cooling system for reducing the temperature of air at the blower outlet to <70 Deg. Celsius	Quenching with water injection arrangement to be provided. Water analysis is given in below Table A. Reference drawing of Quenching Nozzle - Refer Annexure.		
6.	POWER LOADING AND PENALTY	Bidder to specify in their offer the guaranteed power consumption of Blower operating at guarantee point given in sl. No. 3.1.(3). The following equipment shall be considered for Guaranteed Power consumption calculation (GPC). a. Oxidation Blower-1 No.		



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		b. Lube oil system if applicable – 1 Set.	
6.1	Ceiling kW value for power loading	22 kW	No power loading upto ceiling kW value
6.2	Power loading for excess kW	Rs. 1.7 lakhs per kW	Applicable if bidder's guaranteed power consumption exceed ceiling kW value
6.3	Penalty / kW	Rs. 1.7 lakhs per kW	
7.	POWER SUPPLY		
7.1	For > 185 kW rated motors	Voltage: 6.6kV +/-10%; Frequency: 50hz +/-3%; 3Phase - 3wire	
7.2	For < 180 kW rated motors	Voltage: 415V +/-10%; Frequency: 50hz +/-5%; 3Phase - 4wire	
	Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.		

TABLE–A: WATER ANALYSIS:

The following water is to be used for air quenching at the outlet of the blower.

Process Water (Filtered Water)

Temperature at B.L.		deg.C	35
pH		-	6.5 - 8.2
Pressure at B.L.		MPa	0.2
S.S.		mg/l	30
Composition			
	Ca ²⁺	ppm CO ₃ Ca	80
	Mg ²⁺	ppm CO ₃ Ca	
	Na ⁺	ppm CO ₃ Ca	100.6
	K ⁺	ppm CO ₃ Ca	-
	HCO ₃ ⁻	ppm CO ₃ Ca	150
	CO ₃ ²⁻	ppm CO ₃ Ca	-
	Cl ⁻	ppm CO ₃ Ca	28.2
	SO ₄ ²⁻	ppm CO ₃ Ca	2.3
	Fe	mg/l	0.21
	Slica (reactive)	mg/l	30
Total alkalinity		ppm CO ₃ Ca	150
Total Hardness		ppm CO ₃ Ca	80
Tubidity		NTU	30
Conductivity		micro S/cm	300

5.0 SCOPE OF SUPPLY

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

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions



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commissioning procedures, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from END CUSTOMER.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing

Supervision of Erection & commissioning: Includes supervision of erection & commissioning, supervision of trial operation, training of customer's O&M Personnel.

Supplier's scope shall cover complete air blower unit including sub-systems, start-up spares and special tools (typically) as given below. The scope of supply for air blower shall include but not limited to the following:

Sl. No	Scope of Supply for each Blower
1.	Suction filter including silencer along with filter support structure and foundation/anchor bolts. Differential Pressure Indicator across suction filter.
2.	Suction expansion joint.
3.	Suction piping from filter up to blower suction nozzle
4.	Air Blower (centrifugal/rotary/Positive Displacement type)
5.	Suction throttler/IGV (in case of Centrifugal Blowers)
6.	Blower Drive Motor
7.	VFD shall be provided in case of Rotary or Positive Displacement Blower.
8.	Gear Box (or) Belt & Pulley (if required). Direct Drive is also acceptable.
9.	Coupling between motor & gear box and Gear box & blower (as applicable)
10.	Non sparking coupling guards (between motor & gear box and between gear box & Blower as applicable) Or Guards shall be provided for Belt & Pulley
11.	Discharge expansion joint
12.	Blow-off control valve with required accessories such as solenoid valve limit switches, positioner etc completely tubed and wired to junction box
13.	Blow-off silencer along with support structure and foundation/anchor bolts.
14.	Complete Blow-off piping
15.	Discharge non return valve
16.	Discharge Silencer along with support structure and foundation/anchor bolts.
17.	Isolation valve (Gate valve) in discharge line
18.	Common Base frame for Blower, gear box (as applicable) and motor
19.	Discharge piping from Blower outlet up to isolation valve
20.	Foundation bolts for complete blower and Motor frame.
21.	Anti-vibration pad
22.	Complete Lube Oil System for blower and gear box (details to be provided by vendor)
23.	Casing drain terminated at battery limit with drain valve and flange
24.	Acoustic hood for the entire blower & Motor with ventilating fans.
25.	Accessory Piping within the skid
26.	Companion flanges with gaskets and fasteners at all terminal points
27.	Pressure Indicator in the discharge line with root valve.
28.	All Cabling up to junction boxes with double compression cable glands



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29.	Junction Boxes
30.	Safety Valves required for the blower
31.	Electrical items as required like lube oil pump motors, heaters etc are to be included in vendor scope
32.	Instruments for the Blower: Adequate temperature detectors and indicators shall be provided for remote and local monitoring of the bearing metal temperatures of Blower. 2 Nos of RTDs for each bearing shall be provided for measuring the bearing temperature . All RTD type temperature elements shall be Pt-100 duplex, three-wire type. Provision for Mounting Vibrations sensors shall be provided in the blower. Any other instruments required as per the standard practice or required for the completeness of the system shall also be provided.
33.	Mechanical Running at shop with the job motor
34.	Performance test at shop
35.	Supervision of erection / commissioning , start-up and trial run of blower
36.	Start-up & Commissioning spares as applicable to be included in base quote
37.	O&M spares with price breakup
38.	Special tools & Tackles as applicable
39.	Painting as per approved painting schedule.
40.	Packing & Forwarding
41.	Power cabling is not in vendor scope. Power cable from Feeder to VFD panel and from VFD panel to the Motor will be provided by buyer. However, vendor shall provide Double Compression Nickel Plated Brass Cable Glands for Motor and the VFD panel. Cable Size will be informed during detailed engineering. The Cable Glands shall match to the incoming feeder size.
Common Scope: For two Blower	
42.	Pressure Transmitter (3 Nos) , Temperature Indicator(1 no), Temperature Transmitter(1no) and Flow Transmitter(1no) in the common discharge line.
43.	Discharge air piping for with required end connections for mounting the Flow Transmitter, pressure transmitter & temperature indicator and temperature transmitter. Edge preparation shall be done so that the Discharge Pipe will be welded to buyers pipe at site.
44.	Quenching system to bring the discharge temperature to <70 deg C . Bidder shall refer to the drawing in the Annexure for details of Quenching System. The Quenching System shall be flanged and required counter flanges shall be provided
45.	Cooling water supply to Gearbox or Bearing and return will be provided at one point near battery limit. Further distribution is in vendor scope.
46.	Instrument air supply will be provided at one point near battery limit. Further distribution is in vendor scope.
All the instruments/items which have to be supplied by Blower vendor is indicated in the P&ID enclosed . Any other items / components not indicated in the P&ID, but required as per blower manufacturer's standard practice or required for the completeness of the System or required for the blower operation shall also be provided.	



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5.1	CONSTRUCTION FEATURES
a.	Each blower shall be a complete unit with casing, rotor, shaft and drive unit etc.
b.	The oxidation air blowers/ compressors shall be of centrifugal/ rotary/ positive displacement type and supplied with base frame with shock absorbers and mounting bolts, coupling, guards, dry intake filter with hood, blower stage with drive, Gearbox or belt pulley (as applicable), Acoustic enclosures, silencers, safety valves and check valves etc. The blowers shall be of sturdy construction with various components made of suitable corrosion resistant material.
c.	The air blower shall be compact and simple in design requiring minimum number of spare parts. The blower shall be designed for continuous operation and shall be of watercooled/ air cooled type. The rotor shall be ground all over and accurately machined. The rotor blades shall be made of chrome steel or equivalent and shall move freely and smoothly in the rotor slots. The shaft shall be of hot rolled steel or equivalent accurately ground, polished and keyed to the rotor. It shall run in precision heavy duty roller bearings. Lubrication system provided shall be designed such that visual checking of lubricant level is possible. The blower shall be provided with water jackets for cooling the bearings and the casing and prevent excessive heating of parts. The casing shall be of grey cast iron conforming to IS: 210 grade 25 designed for the duty specified. The cooling water jackets shall be readily accessible for maintenance purposes. Provision shall be made to shut off the blower automatically should the level of the lubricating oil falls below the design value. The blower shall also shut-off automatically whenever the pressure of the cooling water supply line falls below a preset value. The first fill of the lubricant shall be given by the supplier.
d.	The blower shall be of twin lobe type with grey iron casing with alloy steel heat treated and lobes. The shaft shall be of high carbon steel accurately ground running in roller bearings. The bearing on both drive and end gear end and gears shall be oil lubricated. Both shafts shall have lip and labyrinth seals to prevent leakage of oil and air respectively
e.	The base plate for the blower, driver V-belt, pulleys, coupling, guards, pressure relief valves, air filter and silencer shall be included.
f.	The blower shall be driven by an electric motor either directly coupled via flexible coupling or through v-belt drive. The bidder shall quote for both the alternatives. The belting system in the case of v-belt drive shall be provided with a heavy screen guard for ensuring safety and the motor shall be mounted on slide rails for adjustment of belt tension
g.	The Rotor along with other rotating parts shall be statically balanced and then dynamically balanced as per ISO 1940 to ensure efficiency, vibration, performance and long bearing life.
h.	One cleanable, dry, air intake filter cum silencer to prevent dust and other atmospheric impurities from entering the blower shall be provided for each blower. The silencer shall reduce the noise level to 85 decibels at a distance of 1 meter from the blower. The filter area shall be at least that of the inlet pipe area. The filter shall be suitable for removing dust particles down to 5 microns size.
5.2	COOLING ARRANGEMENT
a.	The discharge air temperature <70 Deg C shall be obtained by Quenching arrangement with water injection at the common discharge.
b.	In case of Casing cooling, the vendor shall consider the water quality available and accordingly select the casing material to withstand the corrosion, if any. The inside of the casing also to be coated with corrosion resistant materials of adequate thickness to enhance corrosion resistance



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	of the Blower.
c.	The vendor to provide the following accessories along with cooling arrangement (with auto drain) ▪ Required pipe fittings within the scope of terminal points ▪ Required number of spray nozzles ▪ Water quantity required ▪ Required flow control devices like valves, pressure gauges and other instruments. ▪ Scheme & arrangement drawing shall be mentioned in offer.
5.3	CASING
a.	Casing shall be of robust construction. It shall be made from Casting or fabricated from heavy gauges steel sheets or plates or bidder's proven design standard.
b.	In case of castings, the casing will be of Gray Cast Iron confirming to IS: 210 grade 25 or equivalent, designed for the duty conditions or proven design standard meeting the provenness criteria as stipulated in Clause 3.0. Castings shall be free from all defects and blowholes and shall be machined to close tolerance. In case of fabricated casings, it shall be rigidly reinforced and supported by structural members. Weld seams shall be continuous to have air-tight enclosure.
c.	Casings shall also have smooth interior to avoid accumulation of dense particles. Inlet shall be spun to have a smooth contour.
d.	If necessary, provision for ready access to the interiors of casings and other possible trouble points shall be made by means of readily removable, bolted on plates or by hinged and latched doors.
e.	Any connections shall be flanged. Flange diameter and drilling shall conform to ANSI B16.5 Class 150
5.4	ROTORS & Impellers
a.	The rotor shall be ground all over and accurately machined.
b.	The rotor shall be made of Cast iron or forged steel or proven design standard meeting the provenness criteria as stipulated in Clause 3.0.
c.	The rotor blades shall be made of chrome steel or equivalent and shall move freely and smoothly in the rotor slots
d.	Rotor assemblies shall be statically balanced and then dynamically balanced as per ISO 1940.
e.	In case of Twin Lobe Blower, lobes shall be made of heat treated alloy steel.



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5.5	SHAFT, SHAFT SEALS AND BEARINGS:
a.	The shaft shall be made of alloy steel or bidder's proven design standard meeting the provenness criteria as stipulated in Clause 3.0. In case of Twin Lobe Blower, the shaft shall be of high carbon steel accurately ground running in roller bearings. The bearing on both drive and end gear end and gears shall be oil lubricated. Both shafts shall have lip and labyrinth seals to prevent leakage of oil and air respectively.
b.	Shafts shall be conservatively designed to transmit maximum power required and to assure rigidity. Shafts shall be machined and ground to close tolerances and shall be tapered to permit easy removal of the seals and bearings.
c.	Shaft shall run in high precision heavy duty bearings. Lubrication system provided shall be such that visual checking of lubricant level is possible.
d.	The shaft shall be finished to close tolerance at the rotor, coupling, pulley and bearing diameters. The size of shaft shall be calculated on the basis of maximum combined shear stress. This shear stress shall not exceed 30 percent of the elastic limit in tension or 18 percent of ultimate tensile strength.
e.	The design of shaft shall also take into consideration the critical speed of the shaft, which shall be at least 20% above the operating speed or 60 to 75% of the operating speed to minimize vibrations. Shafts shall be tapered to permit easy removal of the seals and bearings
f.	Shaft seals shall be provided to seal rotating shafts. Shaft seals shall be of the labyrinth type, of non-sparking material and shall be horizontally split to facilitate maintenance. The housing shall be of cast iron or fabricated steel construction and shall be horizontally split to provide access to all bearings and shafts.
g.	The bearings may be ball, roller or sleeve bearing. If sleeve bearings are used these shall be machined for close running fit. The bearings shall be designed to take the necessary radial load as well as the net axial thrust. Bearings shall be lubricated properly and sized for an operating life of 50,000 hours on the basis of maximum load. Bearing make shall be SKF/FAG/TIMKEN.
h.	Blower induced vibration due to flow pulsations shall be avoided through suitable design.
i.	Bearing temperature sensor shall be provided for local monitoring of the bearing metal temperature of blowers. 2 Nos of Duplex RTD at Drive End and 2 Nos of Duplex RTD at Non Drive End shall be provided for each blower.
5.6	MOTORS
a.	Drive Motor has to be supplied along with the blower by vendor. Datasheet for the all the motors shall be submitted as per the details given in Annexure. Motors shall be of Efficiency class IE-3. Motor rating shall be atleast 1.2 times the maximum power requirement of the driven equipment under all the range of Operating conditions.
b.	The blower shall be driven by an electric motor preferably directly through flexible coupling. In case of v-belt drive, the motor shall be mounted on slide rails for adjustment of belt tension.



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5.7	BELT & PULLEY/ COUPLING
a.	Coupling shall be of flexible type. The Bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the blower and the motor.
b.	All rotating parts such as coupling or belt & pulley shall be covered with suitable protective guards. Guards shall be easily removable type.
5.8	BASE PLATE
a.	A common base plate shall be provided for Blower assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting blower.
b.	Suitable holes shall be provided for grouting and these shall be so located that the base plate can be grouted in place without disturbing the blower and motor.
c.	Common base plate for Blower and Motor shall be in the scope of the bidder and the details of the Motor will be furnished to the bidder to provide Motor mounting bolts.
5.9	ACCESSORIES:
1.	Lube Oil Unit : (If applicable)
i.	Each blower shall be furnished with an integral lubricating oil package. Each package shall be complete with single water to oil heat exchanger, full flow oil filter and oil pump. The oil pump shall be direct driven from the blower shaft. The complete package shall be factory wired, assembled and mounted on the base plate. Air cooled LO System shall be applied. If cooling water is required, bidder shall provide the supply requirements(flow, pressure) and the return conditions(temperature, pressure drop).Lubrication system provided shall be designed such that visual checking of lubricant level is possible.
ii.	Emergency power supply is not available. The Lubricating oil system shall be designed that will satisfy the required lubrication for bearing at the time of electric power failure also.
iii.	Oil Bath System for Lubrication shall also be provided instead of Lube oil system.
2.	Coupling Guards- All rotating parts outside casing such shall be covered by the guard.
3.	Timing Gears
i.	Timing gears shall be of the wide faced spur or helical type, hardened & ground to DIN Class V or better accuracy.
ii.	Lubrication is required for Timing gear pair and bearings.
4.	Intake Air Filter Silencers:
i.	Each blower shall be provided with an inlet filter silencer of dry type and a conical shaped screen ahead of the filter. Filters shall be capable of removing minimum 82 Percent of all particles 10 microns and larger. Suitable filter area shall be provided for air suction. The suction area shall be minimum of twice the inlet pipe area. Differential pressure gauges shall be



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	provided in filters to monitor any clogging in filters. Silencers shall be provided in discharge also.
5. Expansion Joints:	
i.	Expansion Joints shall be provided at the inlet and discharge of each blower
6. Safety Valves:	
i.	Each blower shall be provided with a safety relief valve on its discharge.
ii.	The valve, valve operator and controller shall be remotely mounted to prevent vibration damage. The valve shall be mounted in an easily accessible location to allow for maintenance and testing
iii.	The safety valve discharge piping shall be routed to a location such that personal exposure to the discharge is prevented.
7. Piping and Valves:	
i.	All interconnecting piping (as indicated in PID) for operation of each unit shall be provided complete with shut off valves, check valves, strainers and fittings. Details of Oxidation blower piping : Material: A53-B, Thickness: Sch -20. Flange diameter and drilling shall conform to ANSI B16.5 Class 150
ii.	Details of valves are given below: i) CHECK VALVE: Rating: CL 150, Body:A395, Trim: 13CR, Connection: RF Type: BC,SWING. ii) GATE VALVE: Rating: CL 150, Body: A105, Trim:13CR, Lining: Seat STL, Connection: SW/RF, Operation: Hand wheel, Bonnet: BB,OS&Y
8. Blower control:	
i.	Bidder to provide the control logic for the oxidation blower.
ii.	Control of the blower will be done from the DCS located in the FGD Control room. Bidder shall provide all inputs for the same.
9. Blower Shut Down:	
i.	Following is a typical list of abnormal conditions which might require blower shut down/Alarm. The contractor shall propose the exact conditions which require shutdown/alarm Blower shutdown signals: a) Discharge air temperature high b) Discharge pressure low or high. c) Bearing temperature high



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	d) Vibration high e) Cooling water flow low Temperature transmitter for initiating Shutdown of blower during when "Discharge air temperature high" shall be supplied by vendor. Kindly refer to the P&ID for the scope. Pressure Switch for initiating Shutdown of blower during when "Discharge pressure low or high" shall be supplied by Bidder. Kindly refer to the P&ID for the scope
ii.	In addition to the Instrumentation & Control devices sensing conditions which require shut down an emergency stop push button shall be provided. The push button shall be wired to the terminal blocks in the control cabinet for external connection to the blower controller.
iii.	Provision shall be made to shut off the blower automatically should the level of lubricating oil falls below the design value. Suitable provision shall be made to take the signal to PLC / DCS system. In case of water cooling, the blower shall be shut off automatically whenever the pressure of the cooling water supply line falls below preset value.
10.	PROVISSION FOR VIBRATION M ONITERING:
	Bidder shall make provision for mounting 2 vibration sensors per measurement location - Driven end & non driven end (one for horizontal & one for vertical measurement). For mounting of vibration pads/pickups flat surfaces shall be provided, both in X & Y directions, by the bidder on the bearing housing in such a way, so that welding/screwing of the pads shall be possible.
11.	INSTRUM ENTS AND ACTUATORS:
i.	All instruments which are in blower vendor scope is indicated in P&ID. All the electrical actuators shall be with integral starters. Bidder shall refer to Annexure for datasheet/specification of Actuator.
ii.	All valve positioners provided for regulating valves/IGV Pneumatic actuators shall be SMART type and shall support HART Protocol
iii.	All outdoor electronic instruments such as transmitters, converters and the electronic units shall be provided with IP-65 and above enclosure.
iv.	Pressure gauges shall be provided with snubber for pump discharge pressure measurements. Bourdon/ movement material of all gauges shall be of SS. Dial sizes of gauges shall be 150/250 mm wherever applicable. Gauge cocks with drain plugs shall be provided for all gauges. For steam services, pig-tailed siphons shall be provided.
v.	All RTD type temperature elements shall be Pt-100 duplex, three-wire type. Wherever Temperature Transmitter is applicable as per PID, SMART type temperature transmitters with local digital indication having 4 - 20 mA DC output shall be provided along with the RTD . Motors above 90kw shall be provided with duplex/ 2 Nos of simplex for all bearing & winding temperature RTD's for bearing & winding temperature measurement
v.	Flow measuring elements shall be Orifice (or) Venturi type. For main steam flow measurements nozzle type flow elements shall be provided. Tapping for flow elements shall be flanged or D & D/2 tapping. Vortex Type / Coriolis type Mass flow transmitter shall also be considered wherever suitable.
vi	All field transmitters shall be HART based two-wire SMART type with in-built local digital indication in engineering units having signal transmission level of 4 - 20 mA DC



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6.0	GENERAL REQUIREMENTS
S.No	Description
1.	Metric unit shall be used in the drawings and in the any displays on the equipments. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm ² G. For instance the pressure gauges should have dual units indication.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English
3.	All rotating parts such as coupling, shall be covered with suitable protective guards. Guards shall be easily removable type.
4.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5.	Noise level produced shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor. Predicted sound pressure levels for the blower drive assemblies shall be submitted as part of the proposal data. The Acoustic enclosure should be suitably designed to meet the required Noise Level.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each nozzle. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.
10.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.
11.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable international standard.
12.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
13.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
14.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
15.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference



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	dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
16.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
17.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
18.	Provide double nuts for anchor bolts
19.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
20.	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
21.	The bidder shall have full responsibility for vibration control of the equipment train at the site and the unit's satisfactory performance, even if the foundation and drivers are provided by the BHEL.
22.	Bidder shall provide the mating flanges with the necessary gaskets.
23.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
24.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
25.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
26.	Quality Plan to be submitted along with the offer.
27.	During entire period of the equipment / project erection, commissioning & operation, the bidders shall strictly follow and adhere to the guidelines for effective Health & Safety Management. Supply of safety gears/PPE for bidder's/bidder's sub vendor personnel deputed at site for Supervision of E&C, PG tests etc. shall be in bidder's scope.
28.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
29.	Material of construction for all equipment/components shall be subject to BHEL/END CUSTOMER approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
30.	Bidder to provide sub vendor list and Bidder shall strictly adhere to BHEL/END CUSTOMER approved vendor list.
31.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from END CUSTOMER for all equipments & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of END CUSTOMER, the same may be replaced with another END CUSTOMER



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	approved sub-vendor only, without any price implications to BHEL.
32.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the END CUSTOMER and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the customer/customer's consultant along with BHEL.
33.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
34.	During detail engineering, bidder to strictly adhere to BHEL/ END CUSTOMER drawing formats, document numbering, quality plan & FQP formats.
35.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system).
36.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/END CUSTOMER during detail engineering
37.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
38.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/END CUSTOMER should be addressed timely by the bidder.
39.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
40.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work"



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	b. "Not considered in scope of work"
7.0	PACKING INSTRUCTIONS
1.	Proper packing to be ensured. Indigenous Supply: Pump & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the item internals during storage in the outer yard of power plant. Imported Supply: All imported supply (supplies from outside India) should be packed as per Sea worthy packing specification no. PE-TS-888-100-A001. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner.(END CUSTOMER)
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: - Destination - Package Number - Gross and Net Weight - Dimensions - Lifting places - Handling marks and the following delivery marking
8.	Separate packing has to be done for each unit. Each package or shipping units shall be clearly marked or stenciled on at least two sides as per the Dispatch Address given in the



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	indent/enquiry. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Blower & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks.



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	Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
8.0	SUPERVISION OF ERECTION, TESTING AND COM MISSIONING
1.	The erection of Oxidation Blower will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per boiler for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.
2.	The bidder will be informed well in advance for the visit. Bidder shall include quote for the visit and working days as per enquiry/PO.
3.	TA/DA, travel charges, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
4.	Price comparison for evaluating the lowest bid will be considered all main supply, supervision of E&C charges and mandatory spares price all together.
9.0	EXCLUSION
	The following work associated with the air blower will be by others: a. Civil foundations b. Walkways, platforms and ladders c. Element handling hoists
10.0	INSPECTION AND TESTING
	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 Blowers for review by BHEL/END CUSTOMER prior to manufacture.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/END CUSTOMER.
3.	All Oxidation blowers will be inspected at the Bidder's works before dispatch or where the test facilities are available. However, the quantum of check may vary as per the approved quality plan.
4.	The Bidder shall conduct performance test for the remaining blowers and submit the reports.



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5.	Final inspection and release by BHEL / END CUSTOMER is a mandatory requirement unless specially waived.
6.	A dynamic balancing certificate stating that the rotating assembly has been balanced dynamically shall be sent to BHEL/END CUSTOMER within one (1) week of the successful completion of balancing.
7.	Acceptance tolerance of actual versus guaranteed performance for capacity, Static head, efficiency and power absorbed shall be as per applicable standard.
8.	Vibration levels shall be measured during shop running/performance tests.
9.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.
10.	Blower shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
11.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
12.	BHEL/END CUSTOMER shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
13.	Bidder shall arrange all calibrated gauges, Instruments during inspection.
14.	Mechanical running and the performance test shall be carried out. Bidder shall arrange Motor with same/higher rating for the shop test and inspection.
15.	The performance test may be carried out using air at shop and shall be converted to the design condition.
16.	Inspection and testing will be done as per END CUSTOMER approved Quality Plan. In case of order placed on foreign Vendor, Vendor shall engage and appoint at their cost of any reputed Third Party Inspection Agencies having international presence for carrying out inspection of equipment's and material at vendor's & sub vendors works. Sample QP (indicative) is attached herewith for reference, however any change during final approval will be acceptable to vendor.
11.0	PAINTING
1.	Surface Preparation : Power Tool Cleaning
2.	Primer Coat(tentative) : Two coats of Red Oxide Zinc Phosphate primer as per IS12744 DFT 2X35 = 70 μ DFT – 70 μ
3.	Finish(tentative): Two coats of synthetic enamel as per IS 2932 smoke grey shade 692 of IS 5 Total 70 μ
4.	Total DFT – 140 (μm min.)
5.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope
6.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. The above painting schedule is tentative and will be subject to change during detailed Engg/after



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	placement of PO. Painting shall be as per paint schedule approved by End customer during contract stage.
12.0	SPARES, TOOLS & TACKLES
12.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of Oxidation blowers. Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares required for successful operation till commissioning of Oxidation blowers shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipments are energized. These start-up & commissioning spare part list shall not be included in "Mandatory spares".
12.2	Mandatory Spares
	Bidder shall quote for the "mandatory spares" as per the enquiry, and it will be considered for L1 evaluation. Initial spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the mandatory spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan. All spares to be used during this contract shall be strictly inter-changeable with the parts for which they are intended for replacements.
12.3	Recommended Spares
	In addition to the spare parts mentioned above, the bidder shall also provide a list of recommended spares 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 shall remain valid up to 6 months after placement of Notification of Award for the main equipment.
12.4	SPECIAL TOOLS & TACKLES:
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.



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13.0	PERFORMANCE GUARANTEE
	All performance tests for blowers shall be carried out in accordance with any latest international codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Oxidation Blower and its accessories 2) Capacity and pressure/head of the blower has to be guaranteed. 3) The bidder shall guarantee 98% availability of equipment for a continues period of 120 days 4) Noise level-≤85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 5) Vibration levels measured on the non-rotating parts shall not exceed the zone limit “B” as defined in ISO 10816 at steady conditions and shall not exceed the zone limit “C” as defined in ISO 10816 at transient conditions. 6) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for END CUSTOMER’s approval. 7) In the event that the performance test is unsuccessful in meeting performance guarantees, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
14.0	GUARANTEED POWER CONSUMPTION:
	POWER GUARANTEE Bidder to specify the guaranteed power consumption per blower operating at the guarantee in their offer. Vendor shall guarantee the power consumption of the blower at Motor Terminal at the <i>Guarantee Point conditions</i>. The following equipment shall be considered for Guaranteed Power consumption calculation (GPC). a. Oxidation Blower-1 No. b. Lube oil system if applicable – 1 Set. The Power consumption shall include all the losses and also the Motor Efficiency. Detailed calculation on the guaranteed power consumption shall be submitted by the bidder along with the bid. The Guaranteed Power consumption shall not exceed 22 KW(ceiling value). Bidder has to choose better efficient blowers to so that power consumption is very low. Bidder’s offer will be loaded with INR 1.7 Lacs for every KW increase beyond the ceiling value.
15.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
1.	If actual Power Consumption during prove out (or) PG Test measured at motor input terminals operating at the guarantee point 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 USD = (GPC-APC) X P • GPC- Guaranteed Power Consumption quoted by bidder in KW/ blower. • APC- Actual Power Consumption in KW/blower.



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	• P- Penalty per KW which is INR 1.7 Lacs per KW. Note : 1. LD will be levied after conducting performance test as above subjected to the maximum 10% of the main equipment value. LD will be adjusted from the pending bills payable to the bidder. 2. For conducting PG test at project site for demonstrating the guaranteed parameters of blower, vendor has to make own arrangement for TA/DA and hotel charges, which is to be considered while submitting the offer.
16.0	WARRANTY
1.	The Bidder shall warrant 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 24 months from the date of supply or 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..
2.	In case of failure of the equipment to meet the guarantee, END CUSTOMER/BHEL reserves the right to reject the equipment. However, END CUSTOMER/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .
17.0	FIRST FILL OF CONSUM ABLES:
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to COD including top up requirements at the time of issuance of PAC/declaration of COD. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the END CUSTOMER/BHEL's approval herein shall be furnished eighteen (18) months prior scheduled COD of the 1 st unit. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to END CUSTOMER along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
18.0	TRAINING
	Successful bidder shall provide comprehensive training for END CUSTOMER Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Oxidation blower- Operation & Maintenance, Troubleshooting etc.



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NALCO:DM NJDI:FGD: OAB:R00

19.0	CONFLICT
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising BHEL in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.
20.0	DOCUMENTATION
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements as specified in this specification. Drawings that are reviewed by the END CUSTOMER/BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. END CUSTOMER / BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by END CUSTOMER must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per END CUSTOMER's requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.



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Annexure 3K: Pre-Qualification Requirement of Oxidation Blower

We declare that, we, have manufactured and supplied at least one (1) number of Oxidation Blower with **Flow 1720 nm³/ hr-wet (min) and Head of 5810 mmWC(min)** of Centrifugal/Rotary positive displacement type and working in Wet Limestone based FGD application in Coal fired power plant or any other Process application and which has been in successful operation for minimum one(1) year reckoned as on technical bid opening date

Sl. No.	Description	Reference Work
1	Name of the reference plant & location:	
2	Client name and his address:	
3	No. of units and capacity in MW of unit:	
4	Whether power plant is coal fired	-*Yes/*No
5	Whether operating in a Wet Limestone based FGD application in Coal fired power plant	-*Yes/*No
6	Name of equipment manufacturer & address:	
7	Date of commission of the equipments:	
8	Model no. of the equipment:	
9	Brief Technical particulars of the equipments:	
10	Flow in Nm ³ /hr Dry	
11	Head in mmWC	
12	Whether the equipment(s) are in successful operation in atleast one (01) plant for a period not less than one(01) year reckoned as on 02nd Nov 2015	*Yes/*No
13	Flue gas Desulphurization system details:	*Technical extract/ *paper letter/ *email/
		*Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure....
14	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....
15	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.....

*** Strike off whichever is not applicable**

Bidder sign:

Bidder seal with Name and

Designation: Date:



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

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Annexure-I: TECHNICAL DATASHEET

Enquiry No : _____; Project : _____

Sl. No	Description	Data
1.0	GENERAL	
	a. Purchaser	: BHEL-Ranipet
	b. Project	:
	c. Ultimate/End Customer	:
	d. Location	:
	e. Service	: Continuous
	f. Installation	: In-door
	g. No of Blowers for each unit	: 1 Working + 1 Standby
	h. No of stand-by Blowers per unit	: 1
	i. Total number of Blowers	:
2.0	MANUFACTURER DETAILS	
	a. Model	:
	b. Type	:
	c. Type of Driver	:
	d. Area classification	: Safe
	e. No of Stage	:
3.0	OPERATING CONDITION	
	a. Gas composition % by weight / Mole percent	: Atmospheric air
	b. Solids at suction g/m ³	: As per ambient condition
	c. Relative humidity at suction %	: As per ambient condition
	d. Molecular weight	: As per ambient condition
	e. Specific weight at suction Kg/m ³	: As per ambient condition
	f. Capacity at suction Nm ³ / Hr	:
	g. Suction pressure KPa	: Bidder to Provide
	h. Discharge pressure mmWc	:
	i. Differential Pressure	: Bidder to confirm
	j. Suction temperature Deg C	: Ambient
	k. Discharge temperature Deg C	: <70
4.0	PERFORMANCE DATA	
	a. Capacity Nm ³ /Hr	: Bidder to Provide
	b. Static efficiency %	: Bidder to Provide
	c. BkW Normal / Maximum KW	: Bidder to Provide
	d. BkW at minimum suction temperature KW	: Bidder to Provide
	e. Motor rating KW	: Bidder to Provide
	f. Motor Speed rpm	: Bidder to Provide
	g. Discharge pressure static (inclusive of losses) mmWc	: Bidder to Provide
	h. Differential pressure (inclusive of losses) mmWc	: Bidder to Provide
	i. Speed Maximum/ Normal/Minimum	: Bidder to Provide



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	j. Noise level	:	Bidder to Provide
	k. Performance curve	:	Bidder to Provide
4.0	CONSTRUCTION DATA		
	a. Manufacturer	:	
	b. Model No.	:	Bidder to Provide
	c. Suction	:	Single
	d. Suction Rating / Size	:	Bidder to Provide
	e. Discharge Rating / Size	:	Bidder to Provide
	f. Type of rotor	:	Bidder to Provide
	g. Size of rotor Dia mm	:	Bidder to Provide
	h. Journal bearing: Type / Size:	:	Bidder to Provide
	i. Thrust bearing: Type / Size:	:	Bidder to Provide
	j. Bearing cooling required	:	Yes / No - Bidder to confirm
	k. Cooling water required	:	Bidder to confirm the quantity
	l. Type of drive	:	Direct / Belt & Pulley
	m. Shaft seal	:	Packing / Rubber seal
	n. Size / Code	:	Bidder to Provide
	o. Type of coupling	:	Bidder to Provide
	p. Service factor	:	Bidder to Provide
	q. GD ² at drive shaft end	:	Bidder to Provide
	r. Rotation viewed from coupling end	:	Clock wise / Counter clock wise
	s. Fluid Coupling	:	Yes / No - Bidder to confirm
	t. Fluid Coupling make	:	Bidder to Provide
	u. Fluid Coupling control	:	Bidder to Provide
	v. Suction filter	:	Required
	w. Degree of filtration	:	Bidder to Provide
	x. Base plate common to Blower. Inboard bearing housing and fluid coupling & Motor	:	Yes / No - Bidder to confirm
	y. Total weight kg	:	Bidder to Provide
	z. Maximum Erection weight kg	:	Bidder to Provide
5.0	MATERIALS		
	a. Casing	:	Bidder to Provide
	b. Rotor	:	Bidder to Provide
	c. Shaft	:	Bidder to Provide
	d. Packing Seal	:	Bidder to Provide
	e. Suction filter elements/ housing	:	Bidder to Provide
	f. Base frame	:	Bidder to Provide

Bidder shall submit completely filled datasheet.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI
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ANNEXURE – II

a) REFERENCE LIST FOR OXIDATION BLOWERS

Sl.No	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Yes/No	Type of blower	Model	Capa city	Head	Speed	Year of Com mg	Qty
						Nm ³ / hr.	mmWc	rpm		

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI
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ANNEXURE – III- LIST OF DEVIATIONS/ EXCEPTIONS TO THE ENQUIRY DOCUMENT

Enquiry No : _____; Project : _____

*We hereby fully accept to the technical Specification as per the subject enquiry

Or

*The following are the deviation to the enquiry document

Sl No	Clause No	Page No	Description of Deviation

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

*Strike out whichever is not applicable



**TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI
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ANNEXURE IV- SCHEDULE OF GUARANTEES

Enquiry No : _____; Project : _____

Sl. No	Description	Data
1.	Rated capacity of Blower Nm ³ /hr	:
2.	Discharge head at rated capacity mmWc	:
3.	Guaranteed power consumption at rated capacity and head kW	:
4.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor dB(A)	:
5.	Maximum vibration (peak to peak amplitude at site) microns	:
6.	Equipment Availability (%) for 120 days	:

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

ANNEXURE -V P&ID OF THE BLOWER SYSTEM

SYMBOLS FOR PIPING PARTS
& INSTRUMENT PARTS

SYMBOLS	NAME
	SUCTION FILTER
	SILENCER
	EXPANSION JOINT
	SIGHT GLASS
	REDUCER
	FLEXIBLE HOSE
	BLIND FLANGE
	DIFFERENTIAL PRESSURE INDICATOR (MECHANICAL)
	PRESSURE GAUGE
	FLOW TRANSMITTER
	PRESSURE TRANSMITTER
	TEMPERATURE GAUGE
	TEMPERATURE TRANSMITTER
	TEMPERATURE ELEMENT (RTD)
	VIBRATION TRANSMITTER
	TEMPERATURE INDICATOR

MACHINERY SYMBOLS

SYMBOLS	NAME
	FAN / BLOWER

INSTRUMENT SYMBOLS

SYMBOLS	NAME
	FOR DCS

INSTRUMENT VALVE SYMBOLS

SYMBOLS	NAME
	ACTUATED BY MOTOR
	ACTUATED BY PNEUMATIC (REGULATING)

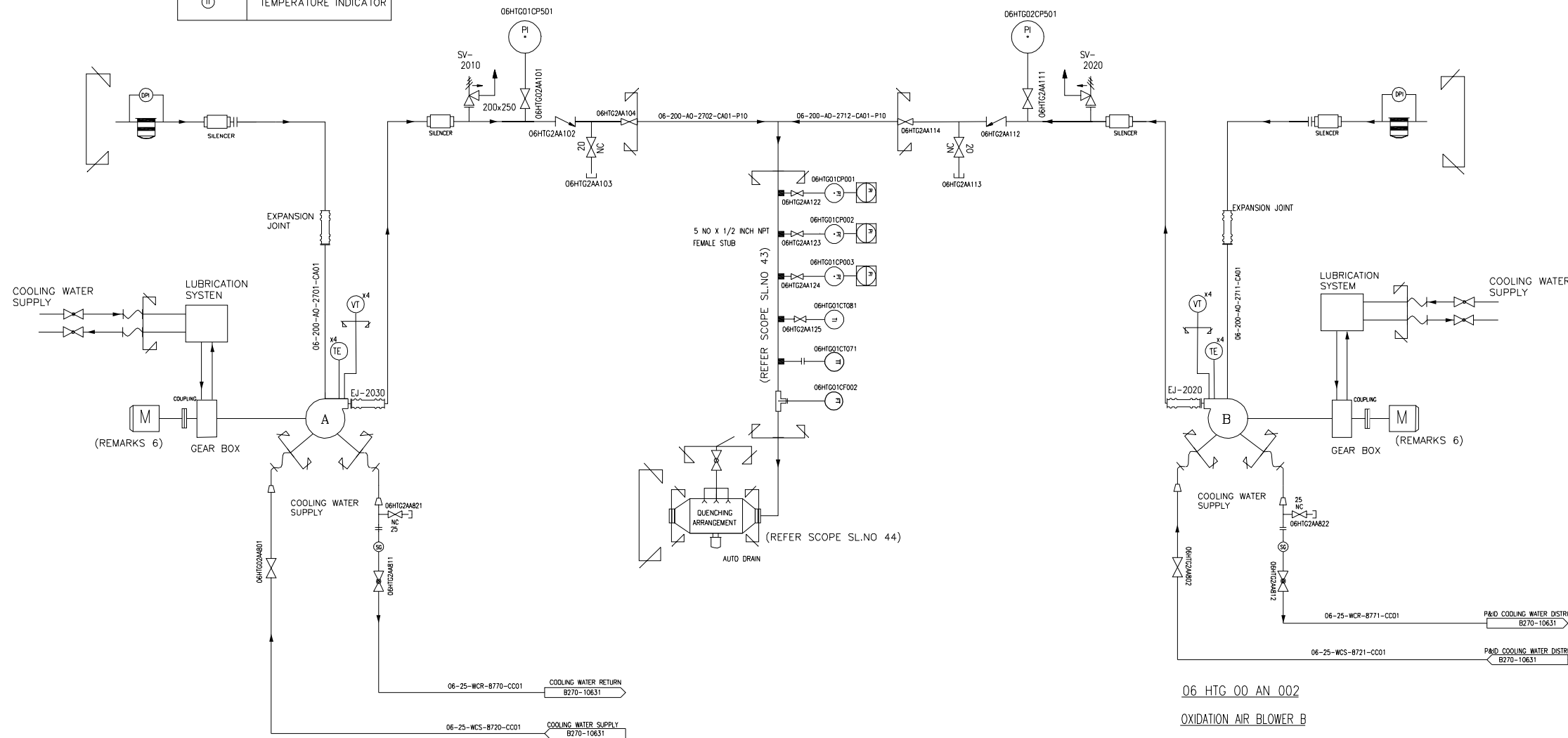
REMARKS

- 1) IN CASE THAT OXIDATION AIR TEMPERATURE IS MORE THAN 120 DEGREE CELSIUS, HEAT-RESISTANT GASKET (WITH EXFOLATED GRAPHITE OR TEFLON) IS REQUIRED.
- 2) QUENCHING ARRANGEMENT TO BE PROVIDED IF DISCHARGE TEMP>70 C
- 3) PIPE SIZE SHALL BE CHOSEN BY VENDOR SO THAT THE VELOCITY IS $\leq 20\text{M/S}$. SUGGESTED PIPE IS NB200 PIPE ALONG WITH ITS SUPPORTS AS PER THE BATTERY LIMITS SHOWN IN THE PID SHALL BE PROVIDED BY VENDOR.
- 4) COOLING WATER INLET & OUTLET TERMINATION SHALL BE FLANGED/THREADED. THIS WILL BE INFORMED DURING DETAIL ENGINEERING VENDOR TO ACCOMMODATE THE SAME.
- 5) GEARBOX ARRANGEMENT IS SHOWN IN THE PID. BELT PULLEY OR DIRECT DRIVEN BLOWERS ARE ALSO ACCEPTABLE.
- 6) MOTORS ABOVE 90KW SHALL BE PROVIDED WITH DUPLEX/ 2 NOS OF SIMPLEX FOR ALL BEARING & WINDING TEMPERATURE MEASUREMENT. MOTORS ABOVE 90KW SHALL BE PROVIDED WITH DUPLEX/ 2 NOS OF SIMPLEX FOR ALL BEARING & WINDING TEMPERATURE RTD'S FOR BEARING & WINDING TEMPERATURE MEASUREMENT.

PIPING VALVE SYMBOLS

SYMBOLS	NAME
	GATE VALVE (NOR.CLOSED)
	GLOBE VALVE (NOR.CLOSED)
	BUTTERFLY VALVE (NOR.CLOSED)
	CHECK VALVE
	PRESSURE RELIEF VALVE
	BALL VALVE

Sl. No	Scope of Supply for each Blower
1	Suction filter including silencer along with filter support structure and foundation/anchor bolts. Differential Pressure Indicator across suction filter.
2	Suction expansion joint.
3	Suction piping from filter up to blower suction nozzle
4	Air Blower (centrifugal/rotary/Positive Displacement type)
5	Suction throttler/IGV (in case of Centrifugal Blowers)
6	Blower Drive Motor
7	VFD shall be provided in case of Rotary or Positive Displacement Blower.
8	Gear Box (or) Belt & Pulley (If required). Direct Drive is also acceptable
9	Coupling between motor & gear box and Gear box & blower (as applicable)
10	Non sparking coupling guards (between motor & gear box and between gear box & Blower as applicable) Or Guards shall be provided for Belt & Pulley
11	Discharge expansion joint
12	Blow-off control valve with required accessories such as solenoid valve limit switches, positioner etc completely tubed and wired to junction box
13	Blow-off silencer along with support structure and foundation/anchor bolts.
14	Complete Blow-off piping
15	Discharge non return valve
16	Discharge Silencer along with support structure and foundation/anchor bolts.
17	Isolation valve (Gate valve) in discharge line
18	Common Base frame for Blower, gear box (as applicable) and motor
19	Discharge piping from Blower outlet up to isolation valve
20	Foundation bolts for complete blower and Motor frame.
21	Anti-vibration pad.
22	Complete Lube Oil System for blower and gear box (details to be provided by vendor)
23	Casing drain terminated at battery limit with drain valve and flange
24	Acoustic hood for the entire blower & Motor with ventilating fans.
25	Accessory Piping within the skid
26	Companion flanges with gaskets and fasteners at all terminal points
27	Pressure Indicator in the discharge line with root valve.
28	All Cabling up to junction boxes with double compression cable glands
29	Junction Boxes
30	Safety Valves required for the blower
31	Electrical items as required like lube oil pump motors, heaters etc are to be included in vendor scope
32	Instruments for the Blower: Adequate temperature detectors and indicators shall be provided for remote and local monitoring of the bearing metal temperatures of Blower. 2 Nos of RTDs for each bearing shall be provided for measuring the bearing temperature. All RTD type temperature elements shall be Pt-100 duplex, three-wire type. Provision for Mounting Vibrations sensors shall be provided in the blower.
33	Any other instruments required as per the standard practice or required for the completeness of the system shall also be provided.
34	Mechanical Running at shop with the job motor
35	Performance test at shop
36	Supervision of erection / commissioning - start-up and trial run of blower
37	Start-up & Commissioning spares as applicable to be included in base quote
38	O&M spares with price breakup
39	Special tools & Tackles as applicable
40	Painting as per approved painting schedule.
41	Packing & Forwarding
42	Power cabling is not in vendor scope. Power cable from Feeder to VFD panel and from VFD panel to the Motor will be provided by buyer.
43	However, vendor shall provide Double Compression Nickel Plated Brass Cable Glands for Motor and the VFD panel. Cable Size will be informed during detailed engineering. The Cable Glands shall match to the incoming feeder size.
44	Common Scope: For two Blower
45	Pressure Transmitter (3 Nos), Temperature Indicator(1no), Temperature Transmitter(1no) and Flow Transmitter(1no) in the common discharge line.
46	Discharge air piping for with required end connections for mounting the Flow Transmitter, pressure transmitter & temperature indicator and temperature transmitter. Edge preparation shall be done so that the Discharge Pipe will be welded to buyers pipe at site.
47	Quenching system to bring the discharge temperature to <70 deg.C. Bidder shall refer to the drawing in the Annexure for details of Quenching System. The Quenching System shall be flanged and required counter flanges shall be provided
48	Cooling water supply to Gearbox or Bearing and return will be provided at one point near battery limit. Further distribution is in vendor scope.
49	Instrument air supply will be provided at one point near battery limit. Further distribution is in vendor scope.
50	All the instruments/items, which have to be supplied by Blower vendor is indicated in the P&ID enclosed. Any other items / components not indicated in the P&ID, but required as per blower manufacturer's standard practice or required for the completeness of the System or required for the blower operation shall also be provided.



06 HTG 00 AN 001
OXIDATION AIR BLOWER A

06 HTG 00 AN 002
OXIDATION AIR BLOWER B

BHEL SCOPE

VENDOR SCOPE

BHEL SCOPE

CLIENT	 NATIONAL ALUMINIUM COMPANY LIMITED BHUBANESWAR, ODISHA				
CONSULTANT	 M. N. DASTUR & COMPANY (P) LTD CONSULTING ENGINEERS, KOLKATA				
PROJECT	INSTALLATION OF STEAM AND POWER PLANT FOR 5th STREAM ALUMINA REFINERY EXPANSION AT DAMANJODI, ODISHA UNDER PHASE-3 EXPANSION OF M&R COMPLEX				
 BHARAT HEAVY ELECTRICALS LTD. RANIPET	NAME	SIGN.	DATE	NO. OF VAR.	
	DRN. R YUVARAJ	-SD-	19.03.21		
FILE NO.	CHD. P NAVEEN	-SD-	19.03.21	-N.A.-	
	APPD. ACR	-SD-	19.03.21		
TITLE P&ID-OXIDATION AIR BLOWER SYSTEM	CARD CODE	BHEL DRG NO.		REV.	
	N.A.	CUST DRG NO.		00	
	SHT. No. 6	NO. OF SHT. 8			



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

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ANNEXURE- VI MOTOR SPECIFICATION AND DATASHEET

SPECIFICATION FOR GENERAL PURPOSE 415 V AC MOTORS (NOTE: TENDERER TO CONFIRM CLAUSE-WISE)

S1. No.	Description	Requirement	Confirmation by Tenderer
1.0	General	General Purpose 415V Motors, Energy efficient type, generally rated up to 180 KW, with robust industrial design, fully de-rated for the ambient and duty conditions specified and fully conforming to Indian standards for Design, Construction and Testing features	
2.0	Applicable Standards		
2.1	Flame proof enclosure for electrical apparatus	IEC: 60079-1, 2007	
2.2	Permissible limits of noise level by rotating electrical machines	IS: 12065, 1987 (2009)	
2.3	Mechanical vibration of rotating electrical machines	IS: 12075, 2008	
2.4	Dimensions of 3-phase foot/flange mounted induction motors / vertical shaft motors	IS: 1231 / IS: 2223 / IS: 2254	
2.5	Energy Efficient 3 phase squirrel cage induction motors.	IS: 12615, 2011	
2.6	Method of determination of Efficiency of rotating electrical machines	IS: 4889	
2.7	Designation of methods of cooling of rotating electrical machines	IS: 6362, 1995 (2017)	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

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Sl. No.	Description	Requirement	Confirmation by Tenderer
2.8	Rotating Electrical Machines - Rating & Performance	IS/IE:- 60034, Part-1 2004	
2.9	Degree of protection provided by enclosure for rotating electrical machinery.	IS/IEC: 60034, Part-5, 2000 (2007)	
2.10	Terminal marking and direction of rotation for electrical machines	IS/IEC: 60034, Part-8, 2002	
2.11	Methods of measuring temperature rise of electrical equipment	IS: 9678, 1980 (2009)	
2.12	Safety	Central Electricity Authority (CEA), I.E. Rules and guidelines of statutory authorities of Odisha State Government.	
3.0	Environment		
3.1	Voltage/System	415V $\pm$ 10%, Frequency 50 Hz $\pm$ 5%, 3 Phase, 4 wire System, solidly grounded neutral	
3.2	System Short circuit level	36 MVA	
3.3	Altitude/Temperature/RH	Less than 1000 m above MSL / 50 Deg C/ 100% RH	
3.4	Special requirements	Based on actual site requirements/ higher ambient where required	
3.5	Starting requirements for Direct On Line (DOL) starting	All DOL start motors shall be capable of starting and accelerating the coupled loads with 75% of the rated voltage at the motor terminals without injurious heating, within the rated hot thermal withstand time of the motor.	



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Sl. No.	Description	Requirement	Confirmation by Tenderer
3.6	Derating	The motor as well as its various components shall be suitably derated for satisfactory operation for specified altitude, ambient temperature, relative humidity, voltage and frequency variations, derating for special requirements stated above.	
4.0	Execution Options		
4.1	Adoption of type of motor		
4.1.1	Squirrel cage induction motors	For continuous duty applications for centrifugal fans/pumps and compressor drives	
4.1.2	Inverter grade motors	For satisfactorily working with IGBT transistor based inverter supplies	
4.2	Location	Indoor / Outdoor	
4.3	Speed (no of Poles)	To suit mechanical equipment supplier's requirement.	
4.4	Type of Mounting	IM 1001 / IM 1002 / other types to suit mechanical equipment supplier's requirement	
4.5	Method of cooling	IC 410 / IC 411 (as per IS 6362)	
4.6	Duty	Continuous duty S1 / other intermittent duties like S2 / S3 / S4 or any other duty to suit driven equipment's requirement / process requirement.	
4.7	Type of Starting / Controls	DOL Starting / IGBT based Inverter Circuit for variable speed drives	
4.8	Type of braking	Type to suit the driven equipment's requirement.	
4.9	No of starts for continuous duty motors	4 cold starts or 3 hot starts on an hourly basis	
4.10	Overload requirement	To suit driven equipment's requirement.	



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Sl. No.	Description	Requirement	Confirmation by Tenderer
4.11	Over speed requirement	To suit driven equipment's requirement.	
4.12	Degree of protection	IP 54 for indoor. IP 55 for outdoor with additional removable canopy protection over the motor.	
4.13	Accessories	Brakes / Clutches /Geared Limit switches / encoders /Embedded temperature detectors etc., as may be required for individual application and control	
5.0	Construction details		
5.1	Frame Sizes	To conform to IS / IEC standard frame sizes.	
5.2	Energy Efficient motors for continuous duty applications	Shall conform to category, "IE2 for the VFD application and IE3 for other application as per IS: 12615.	
5.3	Ratings	Ratings shall be as per the preferred series and shall be based on design ambient temperature of 50 deg. C. The rating shall suit the driven equipment's requirement. Nevertheless, the rating of the motors including the over-load requirement selected shall be based on the class of duty and the load imposed by the equipment with a minimum reserve of 10% over the maximum load demand of the driven equipment at the design duty or any other duty that may arise during operation.	
5.4	Starting Current requirements	To be limited to 6 times the rated full load current in the case of squirrel cage motors when started directly on line.	
5.5	Starting Torque Requirements	To suit driven equipment's requirement and in conjunction with the selection of the speed – torque characteristics described in 5.6 below.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

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Sl. No.	Description	Requirement	Confirmation by Tenderer
5.6	Matching of Speed-Torque Characteristics	The speed-torque characteristics of the motor and its driven equipment shall be fully matched in order to obtain smooth acceleration without overheating of the motor and over-stressing of the mechanical parts of the driven equipment.	
5.7	Moment of Inertia	The motor inertia shall be taken into account along with that of the driven equipment to arrive at the starting time which shall be within the limit value set by the thermal withstand time (hot) specified for the motor.	
5.8	Pull out torque	Pull out torque as required by the driven equipment shall be considered. However, a minimum 200% at rated voltage and frequency for squirrel cage motors shall be considered.	
5.9	Construction aspects in brief		
5.9.1	Housing	Cast Iron / Fabricated steel	
5.9.2	Stator	Low loss, insulated CRGNO silicon steel	
5.9.3	Rotor	Die cast aluminium / copper bars	
5.9.4	Shaft	Carbon steel EN8 with open key ways as required	
5.9.5	End shield and bearing cover	Cast Iron	
5.9.6	Bearing and lubrication	Ball/roller bearing with Lithium complex based lubrication.	
5.9.7	Oil seal	Synthetic rubber	
5.9.8	Fan	Polypropylene / aluminum alloy, bi-directional and with aerodynamic design	
5.9.9	Fan cover	Deep drawn steel	
5.9.10	Motor feet	To be integrated cast with the stator to prevent breakage from vibrations.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

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Sl. No.	Description	Requirement	Confirmation by Tenderer
5.10	Windings and insulation for stator and rotor		
5.10.1	Windings	99.9% pure, electrolytic grade copper windings	
5.10.2	Insulation	Class F for DOL/RDOL application. Class H for VFD application.	
5.11	Temperature Rise	Limited to that of Class B.	
5.12	Terminal Boxes	The terminal boxes shall be of adequate size for terminating the required no. and size of XLPE insulated, armoured, stranded aluminium conductor cables. Adequate clearance shall be given between live terminals and covers. All six terminals shall be brought out in the terminal box for making star or delta connections as needed. Material: Pressed steel / Cast iron - Degree of Protection IP 55 and shall be possible to mount at top. Terminal Plate: DMC /Epoxy board with steel / brass studs. The orientation of the terminal boxes shall be changeable at site through rotation by 90 degrees.	
5.13	Number of shaft extensions	To suit driven equipment's requirement.	
5.14	Rating Plate / Lifting hooks/ lugs / drain holes with plugs / guards for free shaft ends and couplings	Standard arrangement to be provided.	
5.15	Anti-condensation Heaters	To be provided through separate terminal boxes. Indoor duty = 37 KW and above; Outdoor duty = 30 kW and above.	
5.16	Limits of vibration	The motor shall be dynamically balanced and shall satisfy the requirement specified in IS:12075.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
5.17	Limits of Noise level	The motor shall satisfy the requirement specified in IS: 12065 or lower values in specified cases / as per customer's requirement.	
5.18	Temperature Detectors	As required the motors shall have duplex type, two nos. per phase for winding temperature and two nos. for each bearing temperature, one for driven end & one for non driven end.	
5.19	Special Requirement for Inverter grade Motors for satisfactory working in conjunction with IGBT Transistor based Inverters.		
5.19.1	Increased insulation levels	For stator windings - turn to turn insulation, phase to phase insulation and ground insulation. (Insulation shall withstand a peak value of not less than 1600 V at the motor terminals)	
5.19.2	Formed coils	For higher frame sizes / kW ratings in place of wound coils	
5.19.3	Derating	Thermal derating due to reduced ventilation obtained in lower speeds for motors with IC 411 cooling. As an alternative, suitable separately powered cooling blowers mounted on the motor may be considered	
5.20	Painting	As per IS 5, Finish coat shall confirm to shade 632 for outdoor equipment and shade 631 for indoor equipment	
6.0	Safety features		
6.1	Earthing	The Motor body shall be provided with two (2) separate earthing terminals for earthing in compliance with I.E. Rules.	
6.2	Canopy for motor	To be provided for all outdoor installed motors.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
7.0	Documents		
7.1	Performance Curves	Tenderer to furnish the following Performance Curves 1) Matched speed-torque curves of the motors superimposed with those of the driven load. 2) Performance curves for Starting Current, Starting Time, Efficiency & Power Factor for each motor 3) Thermal withstand curves for both Hot and Cold condition.	
7.2	Calculation / data sheets supplied by drive manufacturer	Tenderer to furnish required data sheets for the Motor. Tenderer shall also furnish calculation for Motor Sizing.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 M W

NALCO:DM N.JDI:FGD: OAB:R00

LT M OTOR FOR NALCO DAM ANJODI PROJECT

ENERGY EFFICIENT	IE3
SUPPLY	Supply: 415V + 10%, 3 Phase, 50 Hz, +3% & -5%. System fault level of 50kA rms for 1s
STARTING CURRENT	As per IS 12615
RATIO OF LOCKED ROTOR KVA TO KW	
i) Below 110KW	11
ii) 110KW to 200KW	9
M IN. SPACING BETWEEN GLAND PLATE AND CENTER STUD(IN M M)	
upto 3KW	As per manufacturer's practice
above 3KW and upto 7KW	85
above 7KW and upto 13KW	115
above 13KW and upto 24KW	167
above 24KW and upto 37KW	196
above 37KW and upto 55KW	249
above 55kw and upto 90KW	277
above 90KW and upto 125KW	331
above 125KW and upto 200KW	203
PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE(IN M M) IN TERM INAL BOX	
upto 110	10
above 110kw and upto 150KW	12.5
above 150KW	19
ADDITIONAL DATA TO BE INCLUDED IN DATASHEET	
GRADE OF BALANCING OF MOTOR	
STANDARD CONTINUOUS RATING AT 40DEG.C AMBIENT	
DERATED RATING OF MOTOR AT 50DEG.C(DSIGN POINT)	
NO LOAD CURRENT OF MOTOR AT RATED VOLTAGE AND FREQUENCY	
STARTING TORQUE VALUE IN KGM	
LOCKED ROTOR KVA @ RATED KW	
POWER FACTOR AND EFFICIENCY AT 75% LOAD	
POWER FACTOR AND EFFICIENCY AT 50% LOAD	
SPACE HEATER TERM INAL	Separate terminal box shall be provided
PAINTING	Will be informed during datasheet approval.
a) LT Motor is applicable for < 180kW rated motors. Voltage: 415V +/-10%, Frequency: 50hz +/- 5% , 3Phase - 4wire ; b) HT Motor is applicable For > 185kW rated motors. Voltage: 6.6kV +/-10%, Frequency: 50hz +/- 3% , 3Phase - 3wire ;	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM NJDI:FGD: OAB:R00

ANNEXURE- VII VFD SPECIFICATION AND DATASHEET

SPECIFICATION FOR VECTOR CONTROLLED VARIABLE SPEED DRIVES

(NOTE: TENDERER TO CONFIRM CLAUSE-WISE)

Sl. No.	Description	Requirement	Confirmation by Tenderer
1.0	General	Industrial type, floor mounted, dust and vermin proof, cubicle type, vector controlled variable speed drives panel comprising latest generation Integrated Gate Bi-polar Transistor based circuitry for feeding controlling induction motors rated upto 185 KW. Bypass DOL starters also to be provided.	
2.0	Applicable Standards		
2.1	Dry type Power Transformers	IS: 11171	
2.2	Current Transformers	IS: 2705	
2.3	Voltage transformers	IS: 3156	
2.4	Copper strips for electrical purposes	IS: 1897	
2.5	Wrought aluminium and aluminium alloy bars, rods etc for electrical purposes	IS: 5082	
2.6	Guide for Marking of insulated conductors / Guide for Uniform system of marking and identification of conductor and apparatus terminals	IS: 5578, IS: 11353	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM N.JDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
2.7	LV Fuses	IS: 13703	
2.8	LV switchgear & control gear assemblies- requirements	IS: 8623	
2.9	LV switchgear and control gear	IS/IEC: 60947	
2.10	Meters and Instruments	IS: 1248	
2.11	Reactors/chokes	IS: 5553	
2.12	Degree of protection provided by enclosures of electrical equipment	IS/IEC: 60529	
2.13	Safety	Central Electricity Authority (CEA), I.E. Rules and guidelines of Statutory Authorities of the Odisha State Government.	
3.0	Environment (Review for actual location/system)		
3.1	Voltage/System		
3.1.1	LV system	415V +/- 10% Frequency 50 Hz +/- 5%, 3 Phase, 4 wire system with solidly grounded neutral	
3.2	System Short circuit level	System short circuit level shall be taken as 36MVA at 415V. Minimum short circuit level to be considered 36MVA at 415V	
3.3	Altitude/Temperature/RH	Less than 1000 m above MSL / 50 Deg C / 100% RH	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM NJDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
3.4	Special requirements	Based on actual site requirements	
3.5	Derating	The AC Drives Panel as well as the various components shall be suitably derated for satisfactory operation for specified altitude, ambient temperature, relative humidity, voltage and frequency variations, derating for enclosure and other special requirements stated above.	
4.0	Execution Options		
4.1	Incoming Section	Incoming load break isolator, HRC fuses, line contactor for rating upto 400A or Manually operated drawout type ACB with release for rating above 400A and commutating reactors in each of the phases R, Y & B	
4.2	Converter Section		
4.2.1	Type	Individual converter section catering into each drive.	
4.2.2	Configuration	Three phase Full wave diode bridge (comprising 6 nos. diodes)/ semi-controlled rectifier bridge comprising 3 nos. diodes and 3 nos. thyristors/Fully controlled thyristor bridge comprising 6 nos. thyristors along with required circuits for surge protection on the line side, abnormal dv/dt and abnormal di/dt protection	
4.2.3	Overload capability	To suit driven equipment's requirement with minimum 150 % for 60 seconds for the incoming, converter and inverter sections.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
4.3	Inverter Section	See 5.16 below	
4.4	Cable entry	Bottom	
4.5	Degree of protection	IP 41	
4.6	Bus bar material	Aluminum for Power and Copper for Control bus bars.	
4.7	Busbar rating	Current rating and short time rating as specified.	
4.8	Bus bar covering	PVC sleeved for Power and Control Bus bars; Separate chamber for control bus bars.	
5.0	Construction details		
5.1	Enclosure Material	CRCA sheet steel 2.0 mm for load-bearing members, 1.6 mm for door and non-load bearing members and 3.0 mm for gland plates	
5.2	Enclosure Base frame	Panels should be supported on a base frame of 3.0 mm thick CRCA sheet painted black all around suitable for bolting / welding/grouting on to foundation.	
5.3	Gaskets	Doors and Interpanel gaskets of neoprene rubber	
5.4	Busbar supports	Non hygroscopic, fire retardant self extinguishing materials (FRP for barriers, SMC/DMC for moulded insulators and supports)	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMN.JDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
5.5	Painting/Colour	As per IS 5, Finish coat shall confirm to shade 631 for indoor equipment	
5.6	Cubicle doors	Hinged with interlocking with switch/module position for safety	
5.7	Bus bar covers	Bolted and provided with danger plates	
5.8	Cable chamber doors	Hinged on one side and bolted on the other side.	
5.9	Electronic circuit boards	Shall be based on SMT technology and mounted on standard DIN racks.	
5.10	Accessibility of devices	Easy accessibility from the front and rear through doors provided at the front and rear.	
5.11	EMI Compliance	Shall conform to latest EMI directives and fitted with suitable EMI filters/shields	
5.12	Converter Section		
5.13	Normal operation	Capable of operation normally on a continuous basis under the specified AC incoming voltage and frequency variations.	
5.13.1	Momentary dips	Designed to withstand momentary dips lasting minimum of half cycle to maximum of two cycles in supply voltage without incurring damage to the thyristor devices and blowing of fuses.	
5.14	DC link Bus section	To comprise DC Link capacitor, reactors as well as over voltage protection devices.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
5.15	Dynamic Braking section	To be provided through a set of adequately rated air cooled resistors controlled through braking chopper circuits, in the event of braking through regeneration is not adapted.	
5.16	<i>Inverter Section</i>		
5.16.1	Surge Protection Devices	Externally or internally provided surge protection device	
5.16.2	IGBT devices	Latest generation IGBT devices with minimum loss and capable of high speed switching. Junction temperature of the IGBT devices not to exceed 125 deg. C	
5.16.3	Semi-conductor fuses	Each IGBT transistor shall be provided with an individual semi-conductor fuse with trip indication.	
5.16.4	Protection from transients for the IGBT devices	To include necessary line reactors and capacitor circuits, snubber circuits and free wheeling diode circuits for protection from transients.	
5.16.5	Temperature monitoring of heat sinks	To be provided for the heat sink of the transistors.	
5.16.6	Filters and Reactors	To be provided on the output side of the inverter to mitigate the motor overvoltage as well as surges.	
5.16.7	Output section contactor	Output side contactor (latching type) to be provided for isolation of the motor during maintenance. In case the emergency OFF (lockable) PB near the drive is operated, with the drive in operation, latching output contactor shall hold till the drives speed drops to zero and their after open (de-latch) the out put side contactor.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM N.JDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
5.17	Regulation and control system	Micro-processor based fully digital controls with suitable interfaces (Modbus RTU) with the plant level automation and field level instruments as needed. Selection shall be provided for choosing either vector controlled drive operation or sensorless speed control system.	
5.18	Functions of the regulation and control system	To perform all functions including triggering, protection, self-diagnostics and operator interface.	
5.19	Speed control range	Better than 1:100 for open loop controls and better than 1:1000 for drives with pulse encoder feedback.	
5.20	Speed control accuracy	Better than +/- 0.2% accuracy for open loop systems and better than +/- 0.02% accuracy for drives with pulse encoder feedback.	
5.21	Operator interface	Through door mounted console unit with display unit for indication of faults, alarms, drive parameterisation and diagnostic messages in clear text.	
5.22	Programming and debugging unit	To be provided apart from the operator interface mentioned above - shall be lap-top type, IBM compatible PC with requisite software for loading debugging measurement, trouble shooting and maintenance functions.	
5.23	<i>Basic control features</i>		
5.23.1	Adjustable frequency	Adjustable PWM frequency to be provided	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
5.23.2	Switch over option	Switch over option from closed loop (vector control) to sensorless speed control or to open loop control as may be required at site.	
5.23.3	Torque capability	100% torque at zero speed; adjustable torque boost while starting.	
5.23.4	Output frequency range	0.1 to 100 Hz.	
5.23.5	Current limit	Adjustable	
5.23.6	Speed profile	To be provided with adjustable acceleration/deceleration ramp.	
5.23.7	Prevention of resonance	Operator selectable skip frequencies to avoid mechanical resonance	
5.23.8	Standard software Functions Library	Library of standard functions as required for various applications for configuring the drive shall be provided.	
5.23.10	Auto tuning	Facility for auto-tuning sequence to match the machine characteristic with those of the inverter.	
5.23.11	Communication	Suitable interfaces for networking of the inverters, operation in conjunction with other PLC or DCS controls though built hardware and communication interface modules to suit protocols like Modbus RTU.	
5.23.12	Modular construction	To be provided for ease of expandability at site for future requirements.	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DMNJDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
5.23.13	Power ride through	The inverter shall withstand condition of momentary power loss (upto 2 sec duration) without tripping and shall continue to operate the drives without user intervention (resetting or restarting) when the power supply is resumed.	
5.23.14	Diagnostic functions	Self-diagnostic functions both for hardware/software	
5.23.15	Storage	Capacity to store and play-back faults during break-downs	
5.24	<i>Basic protective features</i>		
5.24.1	Incoming Section	AC Mains failure / Over voltage & under voltage protection / phase loss & single phasing prevention/transient over-voltage protection for both mains borne and unit generated / Earth fault protection.	
5.24.2	Converter Section	Short circuit protection through semi-conductor fuses, abnormal dv/dt and di/dt protection/provision of free wheeling diodes for absorption of back-emf/Temperature monitoring of semi-conductor devices	
5.24.3	DC link Bus section	Overvoltage protection	
5.24.4	Inverter Section	Short circuit protection through semi-conductor fuses, abnormal dv/dt and di/dt protection / provision of free wheeling diodes for absorption of back-emf/ Temperature monitoring of semi-conductor devices	
5.24.5	Outgoing section	Motor overcurrent / overload / earth fault / stall / protections	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM N.JDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
5.25	<i>Basic annunciation features</i>		
5.25.1	Incoming sections	For all the protections called for in the incoming section as given above	
5.25.2	Converter and Inverter sections	For all the protections called for in the converter/inverter sections as given above and in addition, CPU Error and other hardware faults/Thyristor/diode/IGBT devices over temperature /Semi-conductor fuses blown/Feed back loss/Control system power failure/IGBT triggering circuit failure/Failure of ventilation system, etc.,	
5.25.3	Outgoing section	For all the protections called for in the outgoing section as given above.	
5.26	<i>Wiring</i>		
5.26.1	Power Wiring	1.1 KV grade, heavy duty, single core, stranded copper conductor, PVC insulated cables or suitable sized, PVC sleeved aluminium or copper bus bars as required for 415 V motors and Raychem sleeved (heat shrinking type and with appropriate voltage grading) bus bars for high voltage motors.	
5.26.2	Control Wiring	1.1 kV grade, PVC insulated copper wires of cross section 1.5 sq.mm for all control connections within a module. Wires of 2.5 sq.mm cross section for Control bus and CT wiring. All control wiring shall be ferruled.	
5.26.3	Segregation of power and control wiring	To ensure increased safety and to avoid problems associated with EMI	



TECHNICAL SPECIFICATION OF OXIDATION AIR BLOWER FOR NALCO DAM ANJODI 18.5 MW

NALCO:DM NJDI:FGD: OAB:R00

S1. No.	Description	Requirement	Confirmation by Tenderer
5.26.4	Control wiring Duct	Separate control wiring duct shall be provided for routing intra-panel control wiring and interconnections.	
5.27	Control Voltage Supply	Through dual control transformers with suitable manual change-over switch. Control transformers shall be sized such that no devices malfunction due to the in-rush current of the largest rated contactor's coil. Control transformers shall be housed in separate modules. Plus/Minus 2.5%, 5% taps shall be provided on the primary together with non-magnetic shielding between primary and secondary windings. DC Control power supply, if required, shall be provided through separate transformer-rectifier system with suitable filter on the output side.	
5.28	Motor heaters	Integral circuits for space heaters for motors shall be provided in the drives panels and terminated as per requirements	
5.29	Indicating lamps	All indicating lamps shall be of cluster LED type	
5.30	Panel lamps	Panel lamp with door switch shall be provided in the cable alley of each vertical panel of the MCC with a 220V, 1 phase, 5A socket outlet for use during maintenance.	
5.31	Feeder identification	Identification labels shall be provided on each module indicated the feeder designation, rating and circuit no. as per SLD.	
5.32	Operating height	No operating handles/components should be located above 1800 mm and below 400 mm from floor level	



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NALCO:DM NJDI:FGD: OAB:R00

Sl. No.	Description	Requirement	Confirmation by Tenderer
5.33	Maintenance access	Adequate access shall be provided for maintenance/removal of components and bus bars/insulating supports.	
5.34	Cable Terminals and Glands	Double compression cable glands for the outgoing cables as required with the necessary quantity of power and control terminal lugs as loose supply along with the panel.	
6.0	Safety features		
6.1	Earth bus	An aluminium earth bus bar of minimum size 50 x 6 mm cross-section shall be provided at bottom of panel with provision on either side to connect earth strips. All metallic enclosures including module doors and draw out module frames shall be connected positively to earth by scraping contacts/flexible copper connections (first to make and last to break type) to ensure electrical safety. The earthing shall be effective from Service to Test Position in the case of draw-out modules.	
6.2	Cubicle doors	Doors shall be interlocked to prevent opening when Isolator/breaker is ON and (drawout) module is in service position. The interlock shall be defeatable by authorised personnel.	
6.3	Safety during maintenance	Isolator/ACB operating handles shall have provision for padlocking in OFF position for safety.	
6.4	Bus bar connections	Bus chambers shall be shrouded using bolted plates. Sliding shutters shall be provided to prevent accidental contact with bus tapplings in draw-out modules	

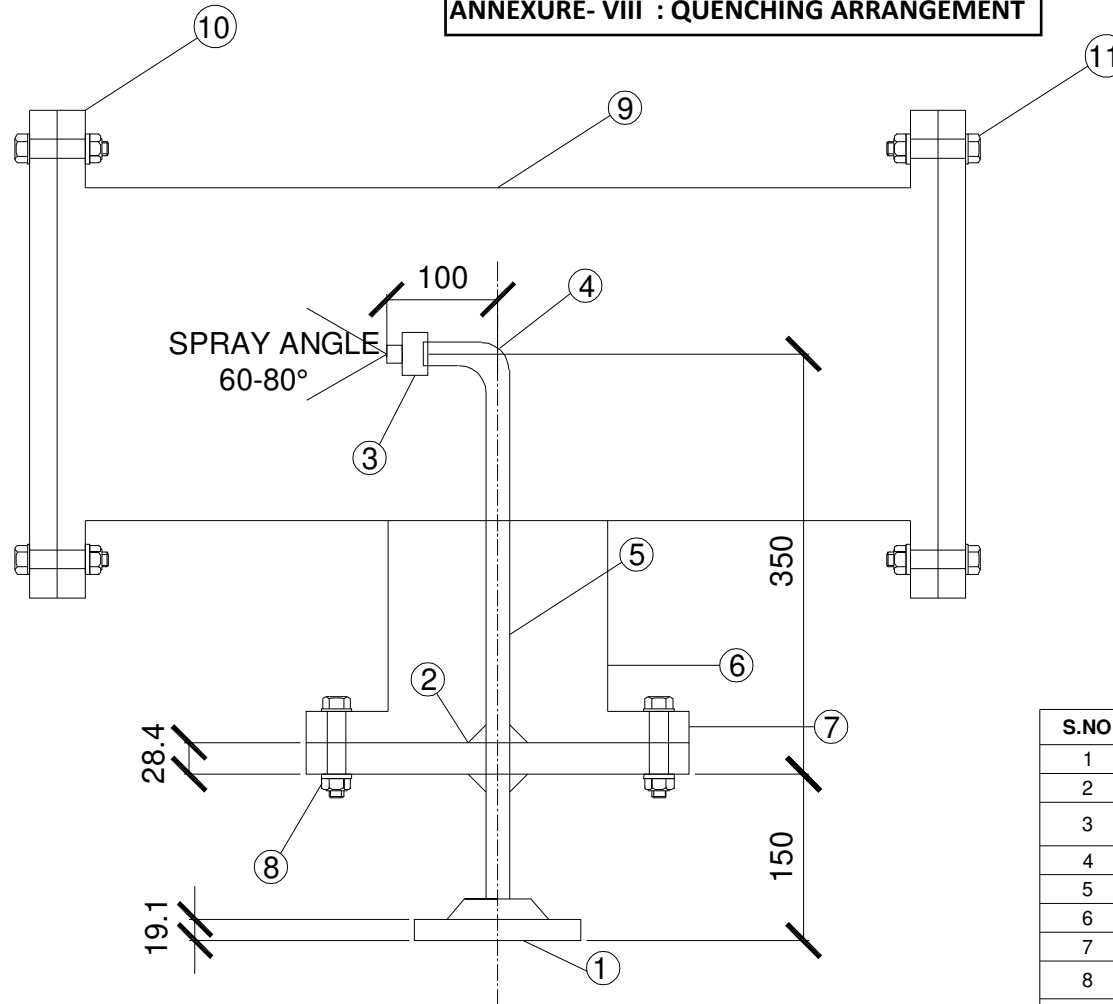


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Sl. No.	Description	Requirement	Confirmation by Tenderer
6.5	Terminals in cable chambers	Power terminals shall be shrouded. Control terminal blocks shall offer protection against accidental contact with live terminals.	
6.6	Danger plates	Appropriate danger boards/labels shall be fixed on the panels/shroud plates as per safety regulations.	

ANNEXURE- VIII : QUENCHING ARRANGEMENT



NOTE: DRILLING SHALL BE AS PER ANSI B16.5

S.NO	DESCRIPTION	MATERIAL
1	REDUCED FLANGE	SS304
2	BLIND FLANGE	SS304
3	SPRAY NOZZLE R 1/2 " (Female NPT)	SS304
4	90°BEND LR	SS304
5	PIPE 15NB SCH 20	SS304
6	PIPE	CS
7	FLANGE	CS
8	FASTENERS NUT & BOLT	CS
9	PIPE 200NB SCH 20	CS(SA 106 GRADE B)
10	FLANGE	CS
11	COUNTER FLANGE WITH CONNECTING BOLT & NUTS	CS

PROJECT: NALCO DAMANJODI 18.5 MW

REMARKS:

- VENDOR SHALL DECIDE THE SPRAY NOZZLE SIZE & OTHER SIZES AS PER THEIR REQUIREMENT.
- FEED PRESSURE AT THE INLET FLANGE OF THE QUENCHING NOZZLE WILL BE 2 BAR. PRESSURE DROP ACROSS THE SPRAY NOZZLE SHALL BE 1 BAR.

Annexure-2-C (cont'd)

Sl. No.	Item	List of Vendors
C.	<u>MOTORS</u>	
1	HT AC Motor (1000 kW and above)	: KEC/BHEL/CGL/MARATHON/ABB/SIEMENS
2	HT AC Motor (200 kW – 1000 kW)	: SIEMENS/CGL/KEC/BHEL/MARATHON/ABB
3	Synchronous & Sq. Cage Motors above 3000 kW	: BHEL/SIEMENS/ABB
4	LT AC Sq-cage induction Motor (General purpose)	: SIEMENS/CGL/ABB/ MARATHON/ BBL/BHEL/ KIRLOSKAR
5	LT AC Motor (Flame proof)	: KIRLOKAR (KEC)/CGL/SIEMENS / BBL /MARATHON/ABB
6	L.T. Geared Motor	: KIRLOSKAR (KEC)/POWER BUILD/ IC/BB/SEW/FIMET/REMI/WEG/ ABB/SIEMENS
7	DC Motors	: CGL/MARATHON/KIRLOSKAR/ BHEL /ABB/SIEMENS
D.	<u>DRIVES AND CONTROL EQUIPMENT</u>	
1	Converter duty cast resin transformer (6.6 kV)	: BHEL/ABB/KEC/VOLTAMP/RPG RAYCHEM
2	Thyristor Converter Unit	: BHEL/SIEMENS/ROCKWELL / SCHNEIDER/ABB/SCHNEIDER / NELCO/KEC/L&T/KELTRON
3	VVVF Drive	: SIEMENS/ABB/ROCKWELL / SCHNEIDER/L&T/BHEL/CGL/GE-POWER
4	VVVF Drive (Flux Vector Control) – 2 level & 3 level Controller	: ABB/SIEMENS/SCHNEIDER / HITACHI/ROCKWELL
5	Isolator	: SIEMENS/L&T/SCHNEIDER/ABB
6	HRC Fuses	: SIEMENS/SCHNEIDER/ABB/L&T/ GE POWER/BUSSMAN



C FIELD INSTRUMENTS

- | | |
|-----------------------------|--|
| 1. Pressure Gauge | : GIC/H.GURU/WAREE/INDUSTRIAL
INSTRUMENTATION / WIKA/GENERAL
INSTRUMENTS/GOA INSTRUMENTS/AN
INSTRUMENTS |
| 2. Draught gauge & DP gauge | : SWITZER /GIC/H.GURU/ WAREE/
WIKI |



Annexure-2-D (cont'd)

Sl. No.	Item	List of Vendors
3.	SMART Transmitters	: YOKOGAWA/HONEYWELL/ ABB/ SIEMENS/ EMERSON/E&H/FUJI
4.	Pressure/DP/temperature & Flow Switches	SWITZER / H. GURU INDUSTRIES/ DANFOSS/ VARMA-TRAFAG/GENERAL INSTRUMENT/GEORGIN
5.	Temperature Gauge	: WIKA/GIC/H.GURU/WAARE/ INDUSTRIAL INSTRUMENTATION/ GENERAL INSTRUMENTS/GOA INSTRUMENTS/AN INSTRUMENTS
6.	Temperature Elements (RTD & T/C)	: NAGMAN/TEMPSENS/ TOSHNIWAL INDUSTRIES/PYROELECTRIC/ GIC/ GOA INSTRUMENTS/ALTOP/FUJI
7.	Temperature transmitters	: HONEYWELL/EMERSON/ YOKOGAWA /E&H/ABB/FUJI
8.	Temperature Switch	: SWITZER / INDFOS/ HONEYWELL/ VERMA TRAFAG /P& F / H. GURU INDUSTRIES/GEORGIN
9.	Level gauges and float type level switches	: GIC//LEVCON/V. AUTOMAT/PLACKA/ TECKTROL/KHRONE/CHEMTROL (VEGA)/SWITZER/S.B. ELECTROMECHANICAL/ V.AUTOMAT/EIP/NIVELCO/EUREKA /V. AUTOMAT/Hi-TECH
10.	Level Switches (Conductivity/capacitance/Resonance)	: LEVCON/ENDRESS-HAUSER/ EIP/S.B. ELECTROMECHANICAL / SAPCON/ NIVO/ABB
11.	Nucleonic Level Gauge	: CONCORD (BERTHOLD) / EMERSON (K.RAY)/ECIL/ CHEMTROL (VEGA) /ENDRESS HAUSER
12.	Ultrasonic/Radar type Level (Guided wave RADAR (SILO) etc) transmitter	: TOSHBRO (MILTRONICS)/ ENDRESS- HAUSER/SIEMENS/ VEGA /EMERSON (SAAB)/SBEM/ABB
13.	Rotameter	: IEPL/EMERSON(BROOKS) / EUREKA/ AL FLOW/KROHNE MARSHALL/PLACKA /ROTA/ABB



Annexure-2-D (cont'd)

Sl. No.	Item	List of Vendors
14.	Vortex Flow Meter	: ENDRESS HAUSER/ YOKOGAWA / KHRONE/EMERSON/ABB/ ROSEMOUNT/SIEMENS
15.	Mass Flow Meter	: EMERSON/ ABB/ ENDRESS HAUSER/ YOGOKAWA/ KHRONE/SIEMENS
16.	Pollution Control & Stack Monitoring System	: HONEYWELL/EMERSON/FORBE MARSHALL/ABB/CHEMTROL /AMETEK/SICK & LAND
17.	SWAS & other water analysers/meters	: FORBES MARSHALL /ABB ANALYTICAL /YOGOKAWA / EMERSON/ STEAM EQUIPMENTS/HACH
18.	RF Capacitance (Hopper)	: EIP / EIP ENVIRO/ABB/MAGNETROL
19.	Flow Elements (Orifice Plate, Flow Nozzle, Venturi Tube etc)	: ENGG. SPL/MICRO PRECISION/IL/ BALIGA/GI/ STAR MECH/MECHANICAL ENGINEERS/GENERAL INSTRUMENT / STARMACH/EMERSON
20.	Control Valves /On-Off Valves	: IL/ FISHER-XOMOX/ FORBES MARSHALL/MIL/ABB/KOSO/ EMERSON PROCESS MANAGEMENT/ SEVERN GLOCON INDIA PVT LTD/SPX-FLOW/FLOW SERVE/ IMI-CCI
21.	Motorised/Electric Actuators	: AUMA/ IL / LIMITORQUE/ ROTORK/ DANFOSS
22.	Pneumatic Actuators (Cylinder or Rotary/Rack and Pinion Type etc)	: ELOMATIC/KROMBACK/MECCAIR/ NUCON/PRIMA/AUDCO/FISHER/ VIGRO/NORGREN/ASCO NUMATIC/ JANATICS/SMC/ROTEX/ SCHRADDER
23.	Air filter Regulator	: PLACA/SHAVO NORGREN/ ABB/ CONTROL AIR/BELLS CONTROLS/ FAIR CHILD
24.	I/P Convertor	: HONEYWELL/EMERSON/FORBE MARSHALL/ABB/CHEMTROL /AMETEK/FAIR CHILD/WATSON-SMITH



Annexure-2-D (cont'd)

S1. No.	Item	List of Vendors
25.	Terminal Block	: CONNECTWELL/ELMEX/WAGO/ PHOENIX/WEIDMULLER/BECKHOFF/ ABB
26.	Solenoid Valves	: ROTEX/ASCO/VICKERS/SMC/ NORGREN/SCHRADER BELLOW
27.	Magnetic Flow meter/Ultrasonic Flow meter	: ENCDRESS-HAUSER/KHRONE/ABB/ INVENSYS (FOXBORO)/EMERSON/ YOKOGAWA/SIEMENS
28.	Positive Displacement Flow meter	: TOSH. HYD(BOPP & FEUTHER) /ROCKWIN/ABB/SWITZER/ KRAL
29.	Encoder	: P & F / ROCKWELL / HUBNER/MTL/ PHOENIX/SIEMENS
30.	Vibration Monitoring Systems	: BENTLEY-NEVADA/FROBESMARSHALL (SHINKAWA)/ROCKWELL AUTOMATION /ABB
31.	UPS	: EMERSON/HI-REL/APC/NUMERIC/ ABB
32.	Limit switches	: ABB/JAY BALAJI/ ELECTROMAG/ KAKKU/ SIEMENS/HONEYWELL/ TELE-MECHANIQUE/ ALLEN- BRADLEY/GO-SWITCH (EMERSON)/ SCHINDER
33.	Ultrasonic Level Switch (Measurement- Liquid/Solid)	: ENDRESS-HAUSER/KHRONE/ EMERSON/SIEMENS/VEGA/ ABB
34.	Microwave Solid/Liquid Level Measurement	: ENDRESS-HAUSER/KHRONE/ EMERSON/MILLITRONICS/VEGA/ SIEMENS/ABB
35.	Control Valve with Diaphragm Actuator (Critical Application)	: MIL/KOSO/FISHER/DRESSER/IMI-CCI /EMERSON PROCESS MANAGEMENT/ SPX-FLOW/ SEVERN GLOCON INDIA PVT LTD/ IL
36.	Pull Chord/Belt sway/Zero Speed & Proximity Switches	: JAYSHREE/JAI BALAJI/AG SYSTEM/ ROCKWELL/SCHNEIDER- TELEMECANIQUE/ SIEMENS



Annexure-2-D (cont'd)

Sl. No.	Item	List of Vendors
37.	Voltage/Power/Frequency/Current/Energy Transducers	: ABB/SIEMENS/ALSTOM/SCHINDER
38.	Humidity Sensor	: SIEMENS/HONEYWELL/ FOXBORO
39.	HART CONFIGURATOR (UNIVERSAL)	: ROSEMOUNT/ABB/YOKOGAWA
40.	PVC coated copper Tubes/Copper Tubes	: REPUTED AS PER OEM STANDARD
41.	Tank Level Indicator	: NIVO/LEVCON/SWITZER/MEGNETROL
42.	Annubar	: SWITZER/EMERSON/ ENGG.SPL
43.	Water Meter	: KAYCEE/RAJKAMAL/CAPSTAN
44.	Flow meters	: E & H / KHRONE / ROSEMOUNT / YOKOGAWA/ABB
D SPECIAL INSTRUMENTS		
1.	Electronic Weighing System	: ABB/SCHENCK/SARTORIOUS MECHATRONICS/TRANSWEIGH/METTLER-TOLEDO/NOVA WEIGH /IPA /KLISTER -MORSE/STOCK REDLER/MERRIC INDUSTRIES/SIEMENS
2.	Gas Analysers/Meters (CO,CO ₂ ,O ₂ etc.,)	: EMERSON /ABB ANALYTICAL /SIEMENS/YOKOGAWA/ FORBE MARSHALL/ HONEYWELL (TELEDYNE) /CHEMTROL/POTENCE/SICK/FUJI & LAND/METTLER TOLEDO
3.	Water Analysers/Meters (SWAS etc.,)	: FORBES MARSHALL /ABB ANALYTICAL /YOGOKAWA /HACH/ION EXCHANGE / CHEMTROL/POTENCE/EMERSON
4.	Ph,DO and Conductivity Meter	: EMERSON / YOKOAGAWA/ FORBESMARSHALL / INVENSYS (FOXBORO/ TOSHBRO CONTROLS\ION EXCHANGE/ POLYMETRON /HONEYWELL/ HACH/ABB

VOLUME IIB

**TECHNICAL SPECIFICATION
FOR
SEAWORTHY PACKING FOR EXPORT JOBS**

SPECIFICATION NO. PE-TS-888-100-A001



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI, INDIA**

	TITLE TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS	SPECIFICATION NO. PE-TS-888-100-A001	
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1.0 Purpose

The purpose of this specification is to describe minimum packing requirements for the different items/equipment for all export Project and also to define marking and shipping requirements during transportation by ship, road and air for all export jobs.

2.0 SCOPE

For export jobs, sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required. Workmanship and materials used shall be of high standard meeting the technical requirements and in accordance with best commercial export packing practices. Vendor shall be responsible for sea worthy export packing, however it shall meet the minimum requirements specified herein. Equivalent or better packing methods may be deployed subject to approval of the BHEL/Purchaser. Vendor shall submit the packing procedure for its equivalent for purchaser's approval during detailed engineering.

The scope this specification is to define VENDOR's responsibilities in terms of:

- Preservation of the GOODS/items/equipments before packing.
- Packing of the GOODS for road, rail, sea and/or air transportation to desired destination i.e. project site
- Making cases/crates
- Chemical Treatment/Fumigation before packing to prevent fungus, damage due to termite, borer, rats, etc.
- Marking of cases/crates.
- Other Services required.

3.0 Application

This specification is applicable to all the goods to be transported to project site and requires to be in transit for longer duration. *However, for "Misc cable erection items", "Fire sealing system" & "Exothermic welding material", the packing requirements shall be as per the procurement specification.*

4.0 Definitions

- "BHEL" : Main EPC vendor
- "OWNER" : Customer for a particular export project.
- "VENDOR" : Company(ies)/VENDOR(s) to whom the BHEL has placed Purchase Order for GOODS/ items/system/package.
- "GOODS": means all or part of the articles, material, equipment supplies including technical documentation, as described in the Purchase Order, to be supplied by VENDOR.
- "PACKER": Packaging Company to whom VENDOR intends to sub-contract the packing in case they do not have own packing capability/facilities .
- "FREIGHT FORWARDER" : Means the Company responsible for performing freight forwarding activities.

5. General Information

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The following requirements are intended as minimum requirements, and compliance to these requirements in no way absolves or relieves **VENDOR** of any responsibility or obligation outlined in the Purchase Order. In all circumstances, the packing will be designed and constructed in order to support **GOODS** during transportation as well as to prevent the Goods from damage due to impact, extreme climatic conditions, sun and rain. It must be ensured that the delivery of the **GOODS** to the jobsite by sea, road or air, in good condition.

GOODS shall be export packed in compliance with the best-established practices for international projects, in accordance with the following instructions. In the event of any conflict between these specified requirement and the established practices, specification requirement shall govern.

Due to climatic conditions and the complex transport operation(s), it is essential that protection and packing is of the highest standard. Packing means to efficiently protect the **GOODS** during the total transport operation; from the moment they leave the factory until they are delivered to the jobsite, including handling operations (loading/unloading) and storage.

When **VENDOR** do not have packing capabilities/facilities of their own and therefore intends to sub-contract, **VENDOR** have to inform **BHEL/Purchaser** of the name and address of proposed **PACKER(s)** for approval.

6.0 Criteria for Selection of Packaging

Packages are to be made according to categories, described in articles 8.1 to 8.5, depending on the type of materials, their fragility and size.

These categories have been established for the protection of equipment and material during multi-mode transports, i.e.: combination of overland and sea transport; containerization, air transportation.

In a general manner, the **GOODS** have to be packed in such a way that crates, bundles, pallets can be stored into General Purpose containers, wherever possible.

If **VENDOR** has any doubt about the correct method of protection or packing, he should contact **BHEL/Purchaser** in order to mutually agree on the adequate type of packing to be used.

Materials can be classified in following categories

- Hazardous Material
- Non-Hazardous Material
-

Further to above categorisation, non-hazardous materials can be sub- categorised for selection of packing.

6.1 Hazardous Materials

Though handling of hazardous material may is not applicable in the scope of this specification. All hazardous material must be packed in adherence to the detailed requirement relating to packing, marking and labelling set out in the most recent report of the Board's Standard Advisory Committee on the Carriage of Dangerous Goods in Ships for sea freight, and the Restricted Articles Regulations, laid down by the International Air Transport Association for airfreight.

6.2 Non-Hazardous GOODS

The scope of this specification is to provide necessary guidelines for packing for power plant equipment, components, Pipings & Valves, Fittings, other structural items, electrical items, spare parts and erection materials. The procedure is defined in subsequent paragraphs in details in clause no. 8.0.

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7.0 Marking Instructions & Despatch details, Storage Code

7.1 Marking Instructions & despatch details

Packages and crates will be marked with indelible black paint, resistant to seawater. Marking must be perfectly legible.

The shipping marks, which will be as per fig-13, shall be stencilled on two sides and one end in clear characters at least 5 centimetres high (where crate size permits, otherwise use optimum size for each package dimension).

When the GOODS are to be shipped in containers then marking may be stencilled on one end only. However, packages must be stowed in a manner that shows these marks.

Crates containing fragile articles must be packed with special precaution against risk of breakage and must be stencilled on all sides "FRAGILE - HANDLE WITH CARE". Where crates are not to be overturned, VENDOR must show on the crates, clear and readily visible identification as per fig-12, to ensure they are kept in the correct position.

Packages/equipment of 2,000 kg or more must be marked with slinging points on all sides, in addition to the centre of gravity marks.

Number packages consecutively i.e. 1 of 10, 2 of 10, etc. Do not duplicate package numbers. VENDOR is responsible for any loss or damage caused by incorrect marking.

All cases/crates shall also be marked with the appropriate international standard graphic symbols for handling as shown in Fig 12.

As a minimum, all cases/crates are to be marked clearly on all four sides with:

- "HANDLE WITH CARE"
- "RIGHT SIDE UP"
- "KEEP DRY"

In the case of packages with a single gross weight totalling 2,000 kg and/or a height of more than 1m, the centre of gravity shall be clearly marked with the symbol on two adjoining sides. For all items of equipment with an eccentric centre of gravity this symbol shall be marked at the bottom, side and top of the package.

The slinging and lashing points shall be marked with a chain symbol.

When packing in cases/crates, these packages shall also have metal corners at the slinging points. (Fig-11)

External front and rear sides of the boxes to be planed for writing instructions.

Dispatch details such as consigner/consignee address, contract and case details, country of origin, port of delivery, stacking instructions shall be written on one side of the boxes. An anodized aluminum plate as per details and specifications given in fig-13 shall be provided on one side of the boxes.

One copy of packing slip wrapped in polyethylene bag covered with aluminum packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag is to be kept inside the box at the pertinent place.

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7.2 Storage Code

The type of storage required is required to be specified, it will be shown on each packaging in **RED colour**.

- X Crates or packages to be stored outdoor without covers
- XX Crates or packages to be stored under tarpaulin
- XXX Crates or packages to be stored in covered or enclosed premises
- XXXX Crates or packages which must be stored in air-conditioned premises

8.0 GUIDELINES FOR PACKING GOODS

8.1 In the subsequent paragraphs details of different types of packings for different types of GOODS are defined. Vendor shall make packing details/procedure based on the guidelines and submit for approval.

8.1.1 Packing for Pipe, Fittings, Flanges and Valves, Structural Steel

Particular attention should be brought to pipe, fittings, flanges, valves and structural steel. Packing categories for piping and fittings will differ according to the diameter and wall thickness of these products. VENDOR shall comply with the following established practice.

IMPORTANT NOTE:

Depending on the project schedule and availability of ocean vessels, the piping and structural steel may be shipped in containers. In this event, VENDOR has to arrange the packages in such a way it allows the stuffing into Open Top in gauge containers.

8.1.2 Pipe

Where practicable, pipe lengths shall be limited to 11.8 meters.

All pipes 2" included and below shall be packed in crates. All pipes to be capped and ends sealed with waterproof tape.

Pipes over 2" up to 6", shall be bundled and banded in bundles of uniform length. Bundling is carried out with U-IRON or traversal planks, joined with threaded connecting rods with locknuts. Quantities and strapping positions depend on the lengths, with a 120 cm spacing to prevent distortion. Bundle weight shall not exceed 2,000 kg. All pipes are to be capped and ends sealed with waterproof tape (tape is not necessary if end caps are of the pre-shrunk or self-sealing type).

Pipes larger than 6" shall be shipped as single lengths with the ends capped. End caps are to be of the recessed type to enable the use of soft faced hooks, but still completely sealing the end and also protecting the weld.

All stainless steel piping must be packed separately in wooden crates. Any banding of bundles is to be with the same material.

8.1.3 Pipe Fittings, Flanges and Valves

All pipe fittings, flanges and valves up to 6", are to be packed in cases/crates. For items over 6", these may be fixed securely to a pallet base and enclosed in a crate, for protection. Where valves have actuators attached, rigidity must be ensured for the valve and actuator. The vulnerable parts of the actuator are to be completely protected within a wooden crate.

All stainless steel fittings, flanges and valves of all sizes, must be packed separately in wooden crates. Any strapping is to be with the same material.

8.1.4 Structural Steel

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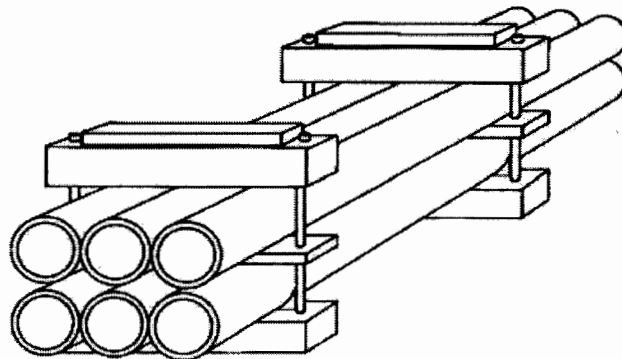
Structural Steel, reinforcing rods, bars, etc., should be packed in bundles of uniform length. Refer to articles 8.1.2, for strapping requirements. Bundle weight not normally to exceed 2,000 kg. Fabricated structures and structural steelwork, etc, should be bundled and packed using wooden beams and long bolting to secure the load.

8.2 Bundling – Packing Category I

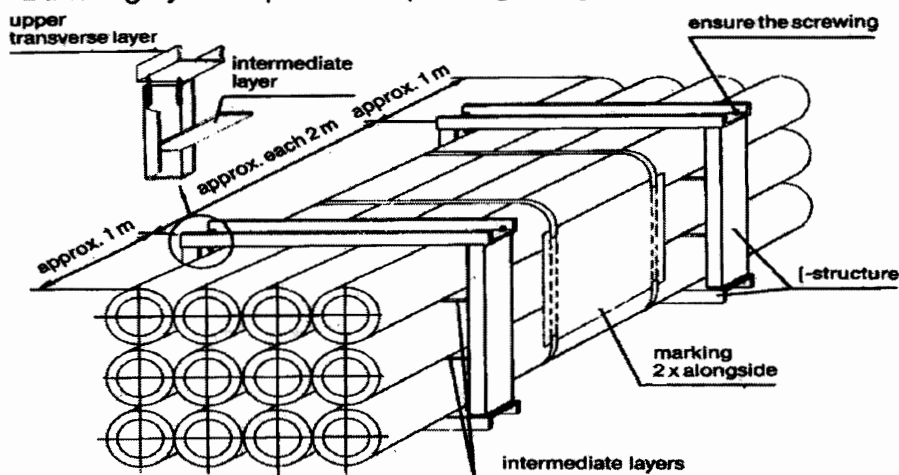
8.2.1 Type of Equipment

Equipment which is not subject to damage by corrosion or mechanical effect, i.e. pipes, piping, structural steel.

Packing category I



Bundling by U-shaped iron – packing category I A



8.2.2 Type of Construction

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- Bundling has to be effected
- By squared timber and threaded rods.
- With an intermediate layer (threaded on tightening bolts) according to the weight of the package.
- Wedge-shaped timbers must be added at the outer points of lower layer.
- Between the bolts a spacer must be nailed.
- The bolts must be secured (e.g. by locking nut).
- If single parts could protrude, an appropriate protection must be installed (flat iron or plates).
- Bundling with steel straps or PVC straps is not accepted.

8.3 Skids, Square Timber Constructions, Casings – Packing (Category II)

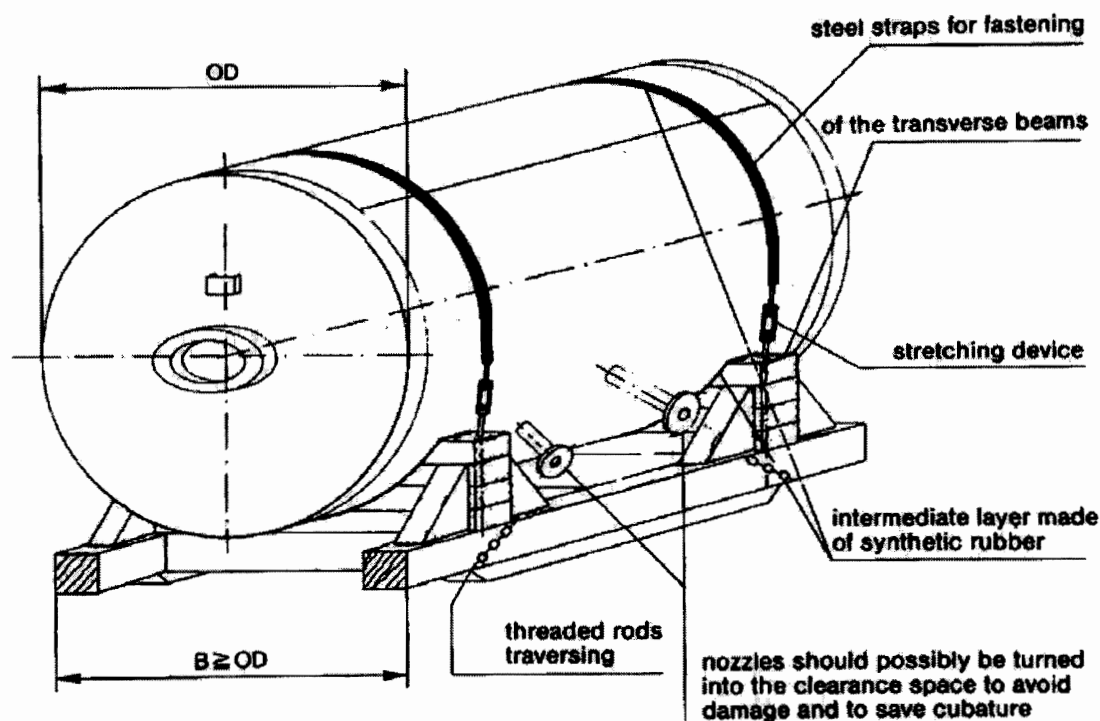
8.3.1 Type of Equipment

Voluminous apparatus, tanks and/or heavy pieces those are not vulnerable to mechanical or corrosive effects.

8.3.2 Type of Construction

- The construction skid can be made of wood or of metal.
- The fastening of the packages on the skid will be made by steel straps (flat iron) which have to be elastically lined, non-slip and securely bolted onto the skids.
- Flange openings have to be closed with gaskets and blind flanges or, if necessary, provided with cover.
- Skid constructions may not be less than the dimensions of the package in length or in width.
- Tanks and apparatus with their own support cradles must be supplied with an anti-slip lining.

PACKING CATEGORY-II



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8.4 Packing of GOODS in Wooden Crates/Cases/Boxes

The construction of wooden crate/cases/boxes shall be as per the details indicated in clause 9.0 & Fig 1 to 11. Details indicated in the sketches for different categories Packing crates/boxes are only for a typical equipment considered for illustration.

8.4.1 Packing Category III

8.4.1.1 Type of Equipment

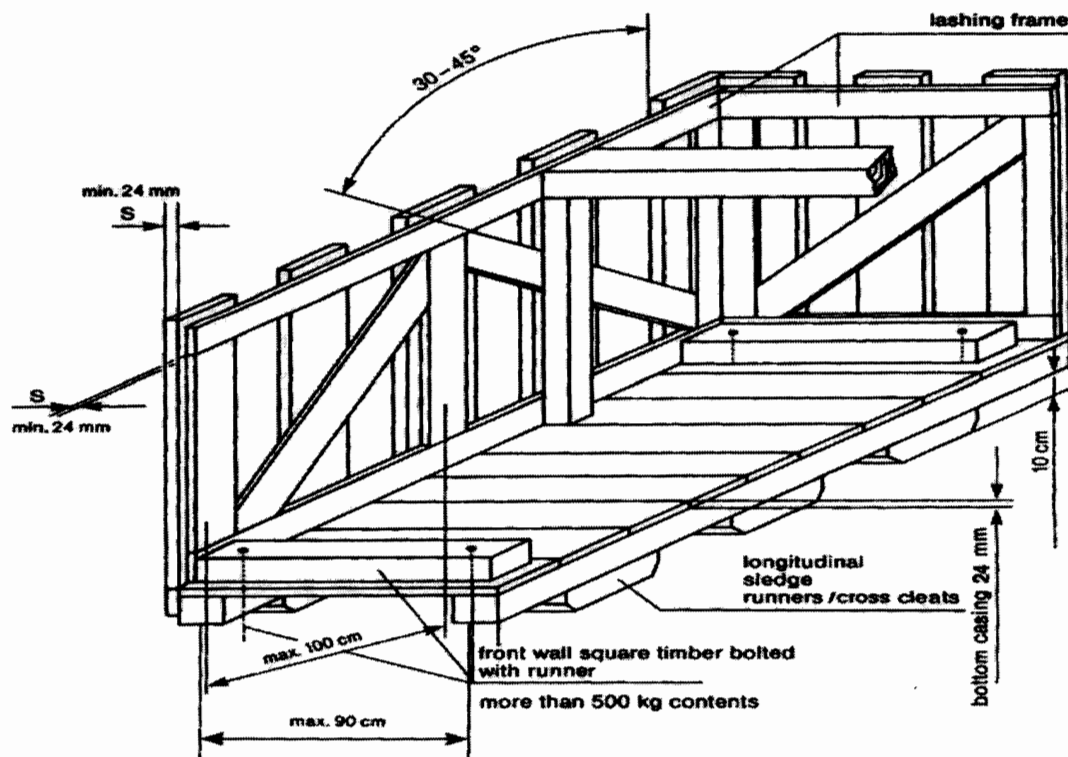
Fabricated equipment, which cannot be transported on cradles; frame-works, prefabricated piping and fittings, mechanical and electrical assemblies. *This type of packing is recommended where many parts of the equipment/component/assembly are not protruding out.*

8.4.1.2 Type of Construction

The equipment must be safely fastened to the bottom with bolts, possibly by the runners or to be spread in such a manner that no protruding parts are possible. For parts, sensitive to rainwater and/or debris, a protection has to be made by a foil cap.

If it is possible that single part could protrude through the front/back side wall, they shall be closed completely. The marking of the package shall be done on plywood plates at the prescribed sides.

Packing Category III



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8.4.2 Cases with Lining – Packing Category IV

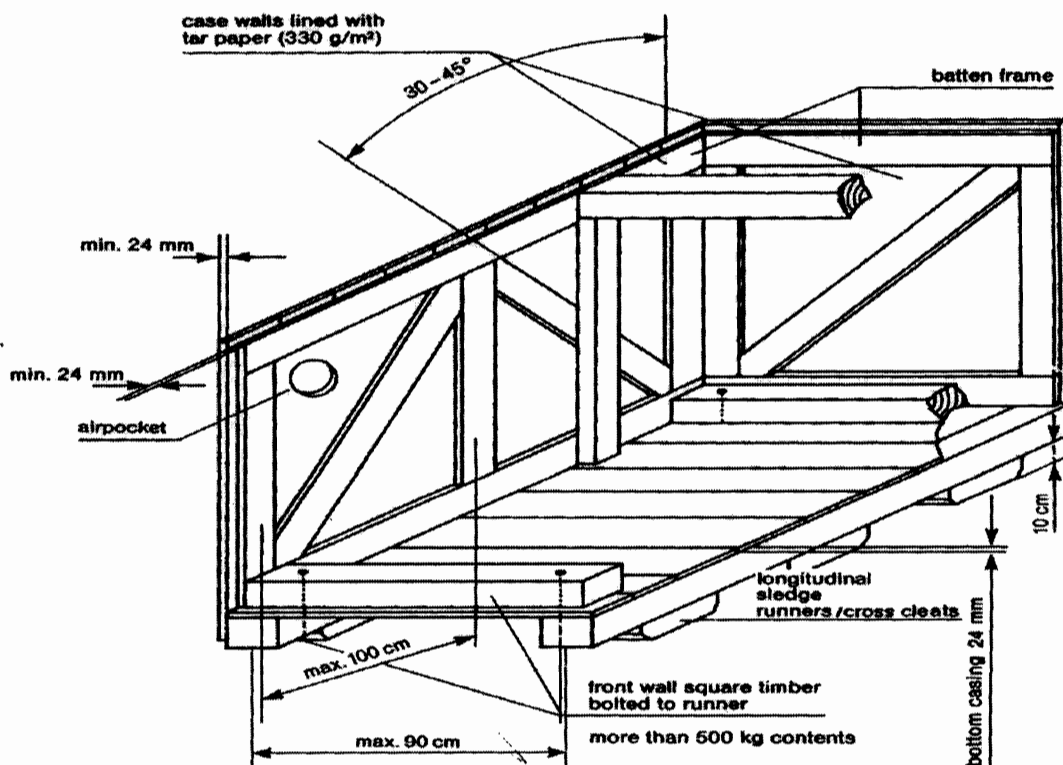
8.4.2.1 Type of Equipment

Recommended for equipment and mechanical parts Equipment sensitive to mechanical damage or parts and components that are particularly at risk of theft or loss; pumps, elbows, flanges, fittings, tools, erection materials, etc.

8.4.2.2 Type of Construction

The same type of construction as article 8.4.1.2, but with all sides completely boarded without space between the boards. Sides to be provided with waterproof lining; fabric-reinforced waterproof tar paper or polyethylene-foils resistant to ultraviolet rays can be used. Polyethylene-foil shall be fixed under the lid cover to avoid penetration of water. At weights of more than 500 kg the longitudinal runner must be bolted to the front all square timber. For ventilation inside the case, an opening in the waterproof lining must be placed between the diagonal battens and diagonal joists.

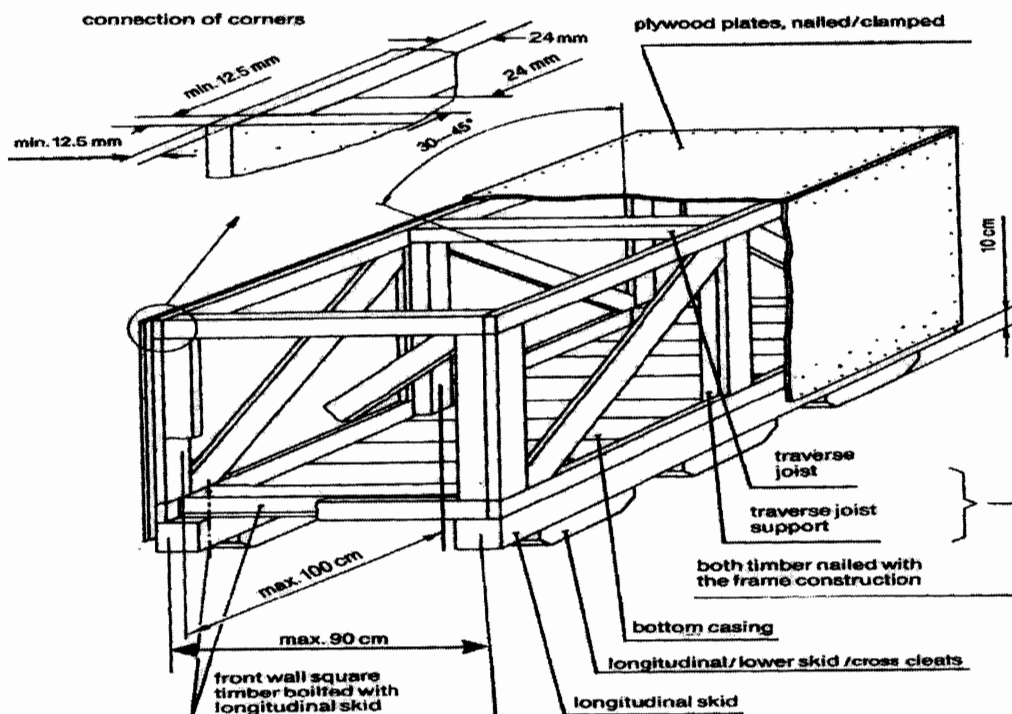
Packing Category IV



8.4.3 Cases with Alternative Surface Materials

8.4.3.1 Plywood Box – Packing Category IV A

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Case constructed of 5 layers of watertight, glued plywood with a total thickness of 12.5 mm. The frame must be constructed from minimum 24 mm timber or as per guide lines given above against clause 8.0, Fig 1 to 11 and must be suitable for the weight and nature of the parts to be packed. Planed square timber must be bolted with longitudinal skid and covered with diagonal joists. If applicable, construction of the cover and sides is to include diagonal bracing. Covers consisting of several layers of plywood are to be sealed with durable elastic putty or additional water-resistant sheets to be fixed.

8.4.4 Case with Barrier Material – Polyethylene Foil – Packing Category V

8.4.4.1 Type of Equipment

Sensitive equipment, simple electrical equipment, insulation materials, fire-resistant materials, with non-corrosion- guarantee for a period up to twelve (12) months.

8.4.4.2 Type of Construction

Preservation by welding in polyethylene-foil with addition of desiccants and if necessary, application of non-corrosive contact agents, otherwise, type of construction as indicated in article 8.4.2.2.

Additional marking:

- Case with desiccants.

8.4.5 Case with Barrier Material – Aluminium Compound Foil – Packing Category VI

8.4.5.1 Type of Equipment

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Electrical equipment such as, switchboards, electric motors, sensitive equipment, with non-corrosion guarantee, for a period up to twelve (12) months.

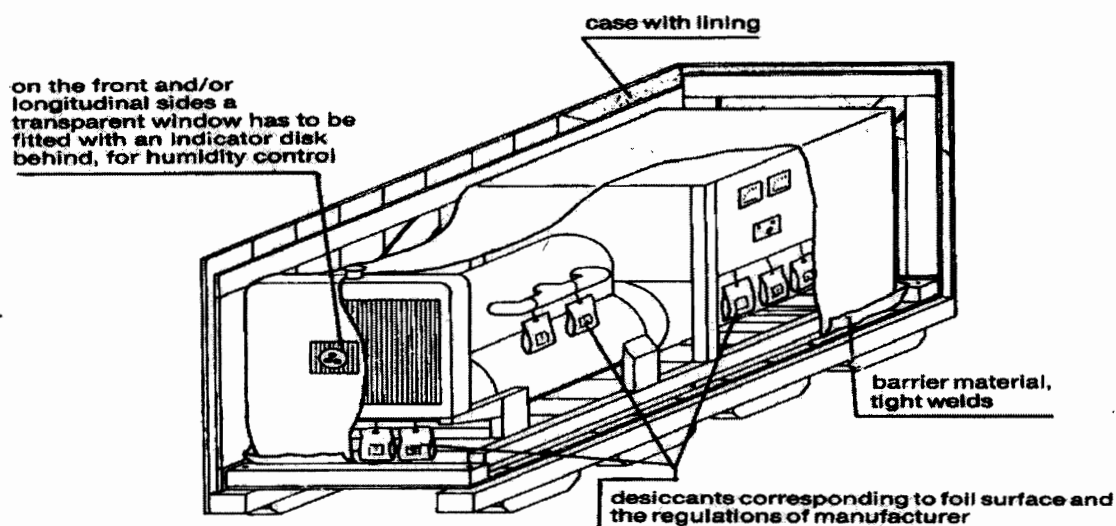
8.4.5.2 Type of Construction

Type of construction as indicated in article 8.4.2.2. Preservation by sealing an aluminium compound foil, with the addition of desiccants. Humidity indicators, if required and installed in the barrier wrapping, shall allow easy control from the outside.

Additional marking:

- Case with desiccants.

Packing Category V/VI



8.4.6 Double Case – Packing Category VII

8.4.6.1 Type of Equipment

GOODS which are of high sensitivity to shock, impact and vibration, for instance, special electrical equipment like computers, switchboards, laboratory instruments

8.4.6.2 Type of Construction

Case construction as indicated in article 8.4.2.2, with additional floating inner packing (case-in-case principle), padding corresponding to weight and sensitiveness. Preservation by sealing in aluminium compound foil with the addition of desiccants. The inner case has to be made of plywood or equivalent material with a thickness of 8-12 mm, depending on the weight of the GOODS to be packed. The inner buckles and/or frame borders have to be dimensioned so that the full stability of the inside case will be reached and no twisting is possible. The inner sides of the inside case will be lined with bituminous kraft paper on all sides (except bottom).

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8.4.7 Cable Drum – Packing Category VIII

8.4.7.1 Type of Equipment

All type of cables, wires, ropes, hoses.

8.4.7.2 Type of Construction

For all type of cables refer clause no. 11.1. For other items (wires, ropes, hoses) new or practically new drums are to be used. Planking of the e drums by use of boards, thickness minimum 20 mm, with additional double steel strapping, nailed, and carefully preserved/protected cable ends prior to packing.

8.4.8 Hazardous Materials – Packing Category IX

8.4.8.1 Type of Equipment

Hazardous materials according to the law are explosives, compressed gases, liquefied gases dissolved under pressure or deeply refrigerated, flammable liquids, flammable solids: substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases, oxidizing substances, organic peroxides, poisonous (toxic) and infectious substances; radioactive materials, corrosives, miscellaneous dangerous goods.

8.4.8.2 Type of Construction

Hazardous materials shall always be packed and documented separately from any other material. Selection of packaging materials, execution of packing and marking as well as documentation shall always be in compliance with the applicable laws and regulations. Any certificates required for transportation or for authorities to be supplied before shipment of the GOODS.

8.4.9 Wooden Floor as a Transport Support – Packing Category X

8.4.9.1 Type of Equipment

Any materials to be stuffed in containers or on flat racks and that are not stowed on standard pallets or otherwise suitably packed

8.4.9.2 Type of Construction

- Longitudinal internal square timbers bolted to the front wall runners, longitudinal skid.
- Maximum distance between longitudinal runners 90 cm (middle to middle of the runner).
- Full boarding of the floor.
- Attaching of lifting lugs and/or iron ropes for lifting/pulling the units off the transport equipment.
- If applicable, preservation of the equipment by sealing in polyethylene-foil or aluminium compound foil and the addition of desiccants.

8.5 Air Transport Packing

8.5.1 General

Certain types of material may have to be shipped by air from their country of origin. This means of transport will be exceptional, and will be used only:

- For GOODS, which are highly sensitive to shock or vibrations, such as computers, electronic instruments, or those of small dimensions and weight.
- For GOODS urgently required at the module yard(s) and/or jobsite.

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8.5.2 Type of Packing

Depending on the goods to be packed, VENDOR may use one of the following types:

- A triple-corrugated cardboard container made with waterproofed glue and a barrier layer of polyethylene on the outsides to keep out humidity.
- Wooden/cardboard packing cases: the wood being used for the framework and base of the cases, waterproofed triple-corrugated cardboard being used for the sides and top. These cases are of the "Bell" type, and used for material of small or medium dimensions.
- For larger dimensions, plywood cases are acceptable. The timber characteristics, cross-sections and thickness will be systematically determined by the nature of the loads to be packed.

8.5.3 Dimensions

In order to optimize the existing transport facilities (passenger or cargo aircraft), the dimensions of:

- Triple-corrugated containers.
 - Wooden/cardboard packing cases.
 - Plywood cases.
- Are to be adapted to pallets used for air transportation.

9.0 Detailed specification for Wooden Crates/Boxes/Cases and other packing materials

9.1 Technical specification for wood

The wood shall be Fir, Chir, Silver Oak (Gravillea Robusta), chemically treated mango and Pinewood with moisture content not exceeding 50%. The wood shall have flexural and compressive strength, stiffness, shock absorption and nail retention properties. The wood shall be free from common defects such as warp, bone, twist, knot, cracks, splits, end splits, bend, visible sign of infection and any kind of decay caused by insects or fungus, etc. Surface cracks with maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

9.2 Chemical Treatment of Wood:

The wood shall be chemically treated to provide protection against deterioration due to fungi and attack by termites, borers, marine organism and any other kind of infection. It shall be treated only after final processing like cutting, planning, joint grooving, etc.

9.3 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES:

9.3.1 PACKING OF EQUIPMENTS

Various mechanical, electrical and C&I equipment e.g. Pumps, motors, equipment skids, heat exchangers, control panels, switch gears, transformers, etc. shall be wrapped in weather proof packing and then secured in wooden packing cases. The construction of wooden packing cases/crates shall be as per details given below and also given in figure 1 to 11.

9.3.1.1 Bottom Frame

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The construction of bottom frame shall be as per Fig-2. The No. of slides/runners for bottom frames shall be selected depending upon the weight and overall dimensions of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt and nuts etc. to bottom frame of the wooden packing cases/crates. The equipment not provided with base frame/plate like cylindrical vessels, etc to be secured to the bottom frame of the wooden cases with "C" clamps fabricated from steel channels/ angle iron.

9.3.1.2 TOP FRAME

The construction of top frame shall be as per fig-3.

9.3.1.3 END PANELS

The dimension of the end and lateral panels shall be calculated according to overall dimensions of the items to be packed. Diagonal braces shall be used for packing cases having height exceeding 500mm. Details of bracings shall be as per fig 5 to 9.

9.3.1.4 Sling Plate

To facilitate lifting of cases, longitudinal under slide boards shall be fixed. To avoid damage to the box while lifting sling plates shall be provided. Refer fig-11.

9.3.1.5 Angle Iron Cleats

Angle iron cleats shall be used for strengthening the joints as indicated in fig-10

9.3.1.6 Other Requirements

- The thickness of planks for top, bottom, side and end panels shall be at least 25mm. Planks used for this purpose shall be joined with each other by tongue and groove joint. The groove dimension shall be such that tongue fits tightly into groove to make the joint.
- Runners/slides, traverse bars, etc shall be of single length i.e. without any joint. Planks for sheathing, diagonal bracing etc shall also be of single length up to 2400mm, proper jointing is permitted for planks for sheathing and diagonal bracings.
- Each equipment to be individually covered with double polyethylene petticoat. Sheet thickness of polythene sheet shall not be less than 0.175 mm (175 microns). The sealing shall be such so as not to allow moisture inside.
- The inner surface of 4 sides of shooks shall be nailed with bituminized water proof craft paper. Wherever 2 pieces of kraft paper are used, joint shall have an overlap of minimum 20 mm.
- All the inner sides of the box shall be nailed with bitumen coated HESSIAN POLYTHYLENE KRAFT PAPER. For top frame it shall project on all sides by 100mm and shall be nailed on sides. Wherever 2 pieces of kraft paper are used, joint shall have an overlap of minimum 20 mm.
- For delicate equipment like control panels and switchgears, lighting panels and lighting transformers, suitable cushioning material like rubberised coir (min. 50 mm thick and 100 mm wide) shall be provided on their bottom support and the gap between the panel and casing

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shall be filled with rubberized coir with distance between consecutive supports less than 500 mm (ref fig15). For other equipment suitable support from sides of the casing shall be provided.

- Switchgear cubicles, control panels and control desks shall be packed and shipped in separate convenient sections. The components e.g. circuit breakers relays and instruments etc. which are removed from panels for shipping purpose and shall be separately packed and shipped as per packing instructions in clause 10.4.
- Packing case for control panels and switchgear panels shall be finally covered with GI sheet of minimum thickness of 0.4mm.
- Packing cases shall be bound at edges by nailing MS clamps/brackets at sufficient intervals. Further heavier boxes shall be strapped with C clamps (ref fig-4) fabricated from steel channels/angles and lighter boxes shall be strapped with hoop iron strips.
- Silica gel is used for this purpose to protect contents over sufficiently long time from corrosion. Silica gel shall be indicating type confirming to IS-304 (1979) packed in cotton bags placed at different positions inside the packing for absorbing moisture and shall not come into directly contact with equipment/material inside the package. The quantity of silica gel shall be adequate for storage period of one year, however it shall not be less than 4 gm. per ltr. Volume of case subject to minimum 400 gm. Per case.



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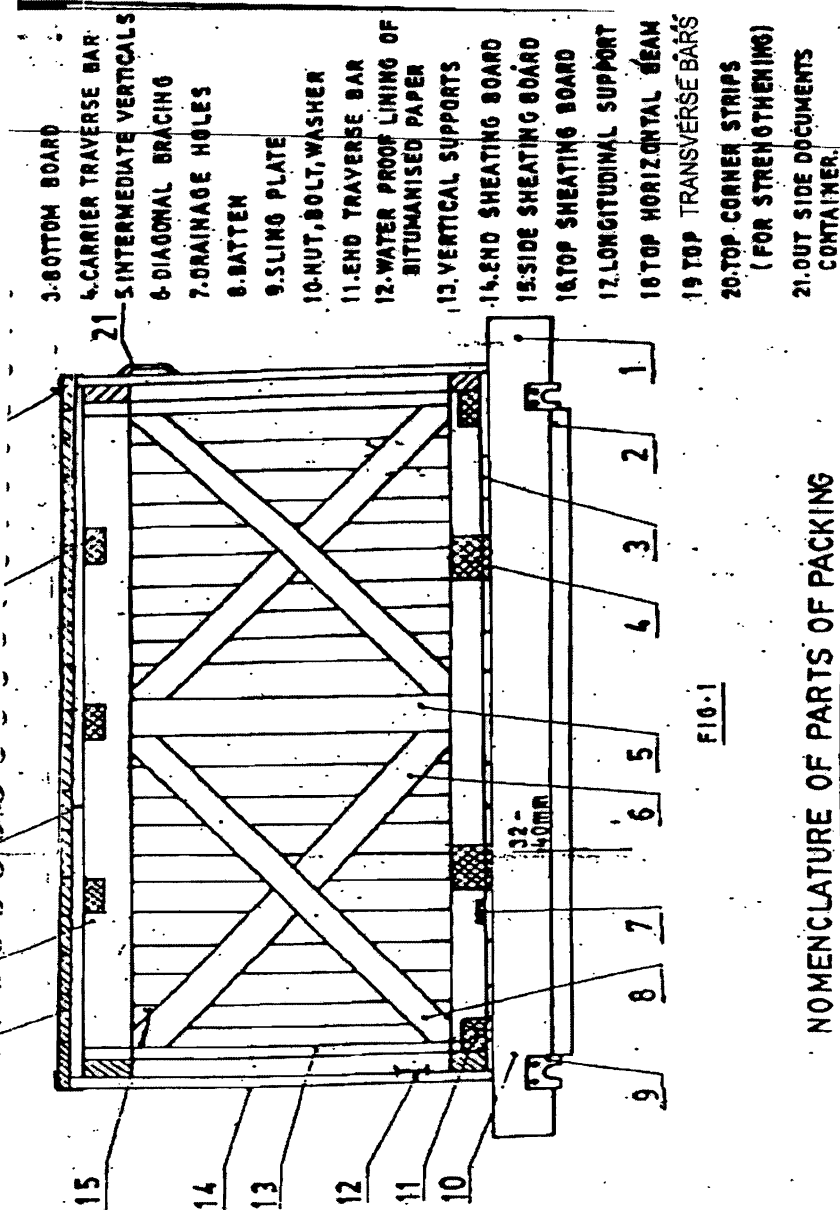


FIG-1

NOMENCLATURE OF PARTS OF PACKING

CASES

- 1 SLIDE
- 2 UNDER SLIDE BOARD

FIG-1

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BOTTOM FRAME ARRANGEMENTS

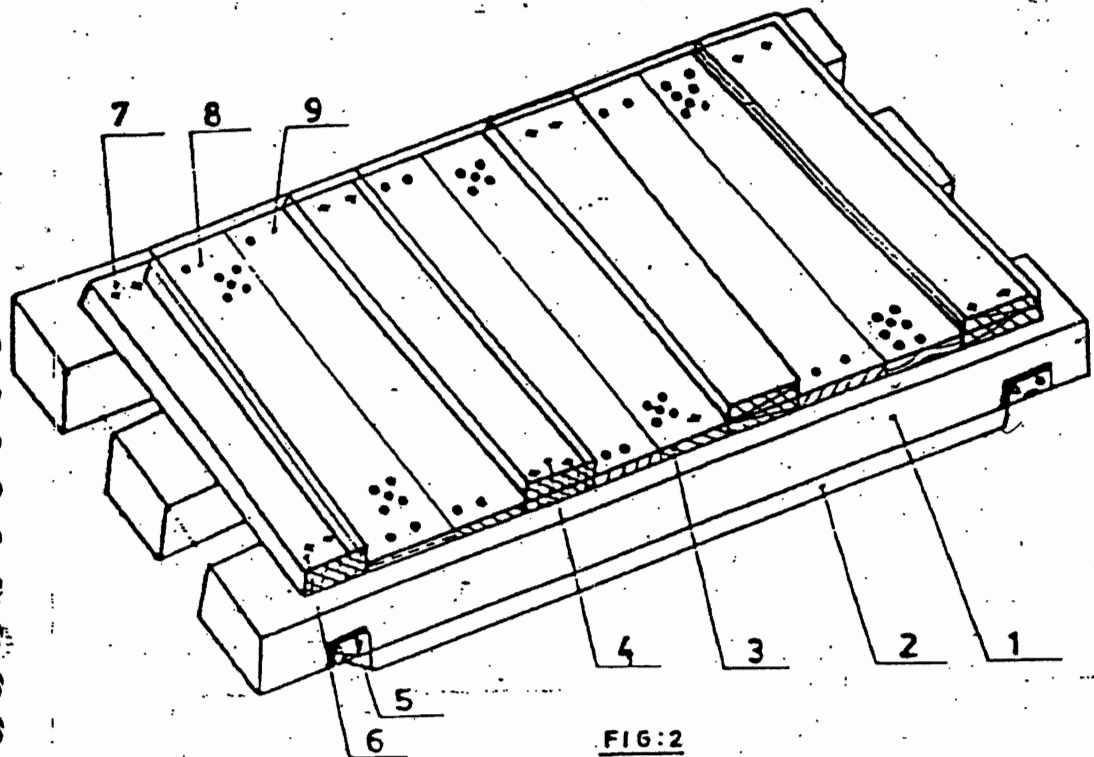


FIG:2

Nos. of slides: Minimum 2 Nos.
For length more than 1800 mm or
load more than 1000kg, Nos. of
slides shall be minimum 3 Nos.
For dimensions of slides, refer Table 1
Cross section of end traverse bar; 100 x 100 mm.
(minimum)

1. SLIDE
2. UNDER SLIDE BOARD
3. BOTTOM BOARD
4. CARRIER TRAVERSE BAR
5. SLING PLATE
6. TRAVERSE BAR
7. BOLT, NUT & WASHER
8. DRAINAGE HOLES
9. NAILS

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TOP FRAME ARRANGEMENT

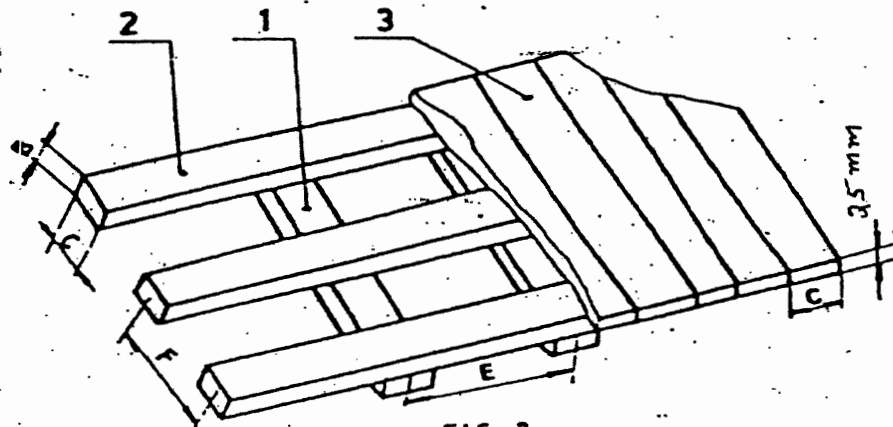
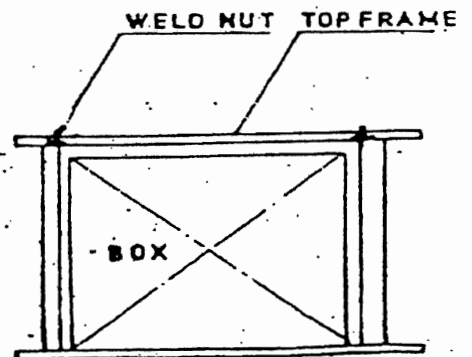
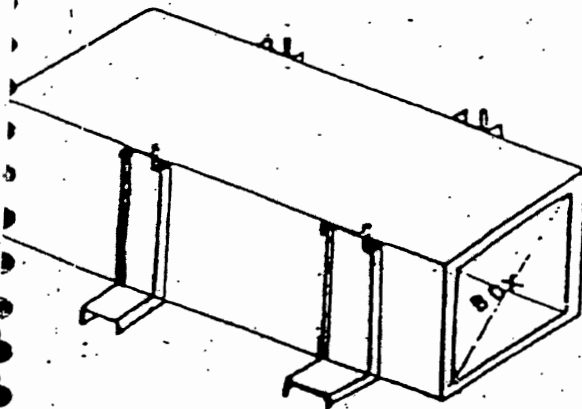


FIG-3

F : 700 to 1000 mm
E : 500 to 900 mm
30 x 100 mm.

- 1 - Traverse Bars
- 2 - Horizontal Soans
- 3 - Top Board

ARRANGEMENT OF C-CLAMPS AROUND CASES



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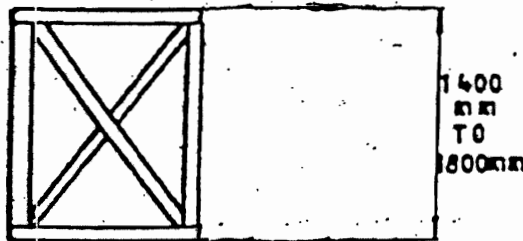
**ARRANGEMENT OF DIAGONAL BRACING AND
HORIZONTAL SUPPORT**

FIG: 6

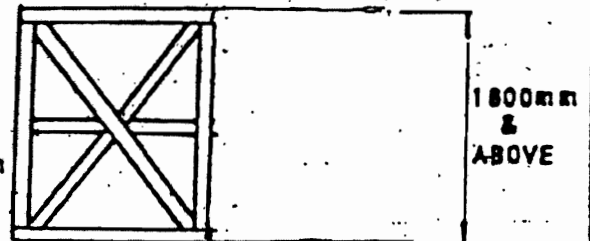


FIG: 8

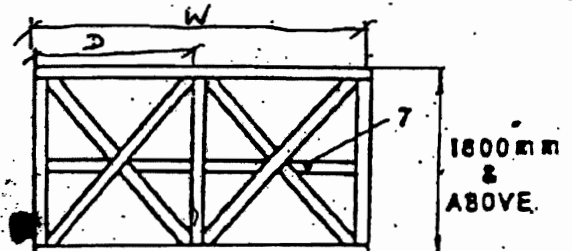


FIG: 7

7- Middle Horizontal Support

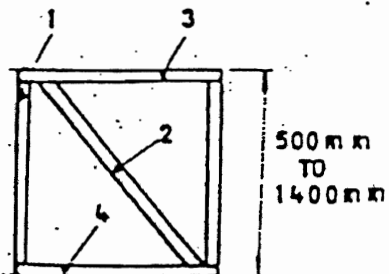


FIG: 5

1- Vertical Support

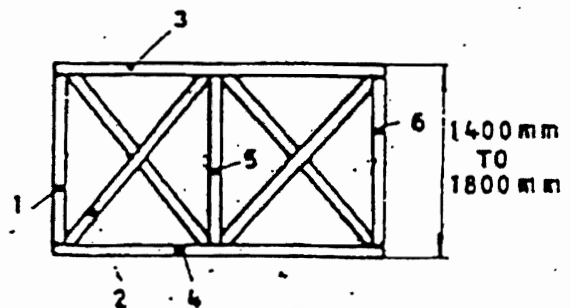


FIG: 7

1, 5, 6 - Vertical Support

**TITLE**

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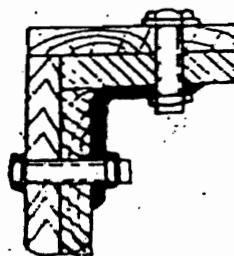
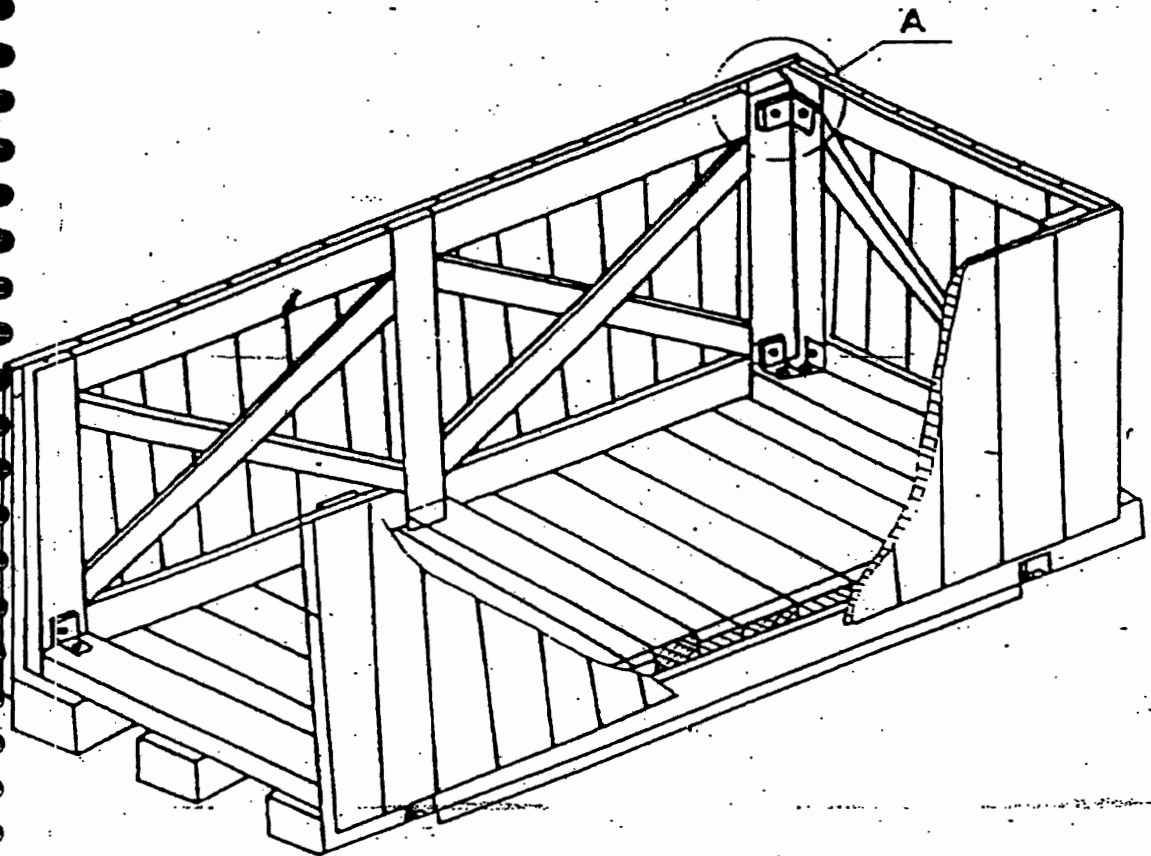
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ARRANGEMENT OF PACKING CASE



DETAIL-A

HOLE DIAMETER
MUST CONFORM
TO BOLT DIA

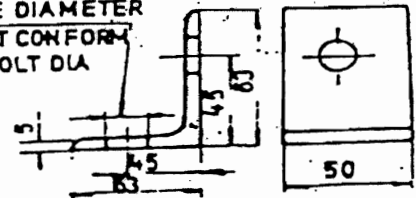


FIG:10

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FOR EXPORT JOBS**

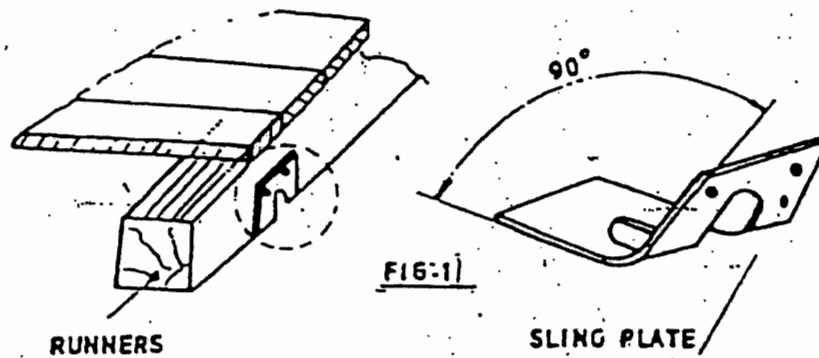
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**ARRANGEMENT OF SLING & PLATE ON
CASES**

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TABLE-1

LOADS	LENGTHS OF SLIDES						
	600	800	1000	1200	1300	1500	2000
	Cross section b x c				c b		
500	50 X 100	50 X 100	50 X 100	50 X 100	75 X 100	75 X 100	100 X 100
800	50 X 100	50 X 100	75 X 100	75 X 100	75 X 100	75 X 100	100 X 100
1000	75 X 100	75 X 100	75 X 100	100 X 100	100 X 100	100 X 110	100 X 150
1500	75 X 100	75 X 100	100 X 100	100 X 100	100 X 100	100 X 150	100 X 150
2000	75 X 100	100 X 100	100 X 100	100 X 150	100 X 150	100 X 150	150 X 150
2500	75 X 100	100 X 100	100 X 150	100 X 150	100 X 150	150 X 150	150 X 150
3000	100 X 100	100 X 150	150 X 150	150 X 150	150 X 150	150 X 150	150 X 150

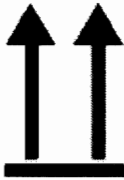
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Table-2

End and side panels	Width of the panel "W"	Distance between longitudinal support (Dimension "D")						
		600	800	1000	1200	1400	1600	1800
		Cross section b x c				Item 1 to 7		
Fig- 5 to Fig-9	600 to 1200	30	30	30	30	30	30	30
		X	X	X	X	X	X	X
	1201 to 1600	100	100	100	130	130	130	130
		30	30	30	30	30	30	30
	1601 to 2000	X	X	X	X	X	X	X
		130	130	130	130	130	130	130
	2001 to 3000	30	30	30	30	30	30	40
		X	X	X	X	X	X	X
	3001 to 4000	130	130	130	130	130	130	150
		40	40	40	40	40	40	40
		X	X	X	X	X	X	X
		150	150	150	150	150	150	150

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INDICATION MARKS ON CASES/BOXES/CRATES

Designation	Symbol	Explanation
Fragile, Handle with care		The symbol should be applied to easily broken cargoes. Cargoes marked with this symbol should be handled carefully and should never be tipped over or slung.
Use no hooks		Any other kind of point load should also be avoided with cargoes marked with this symbol. The symbol does not automatically prohibit the use of the plate hooks used for handling bagged cargo.
Top		The package must always be transported, handled and stored in such a way that the arrows always point upwards. Rolling, swinging, severe tipping or tumbling or other such handling must be avoided.
Keep away from heat (solar radiation)		Compliance with the symbol is best achieved if the cargo is kept under the coolest possible conditions. In any event, it must be kept away from additional sources of heat. It may be appropriate to enquire whether prevailing or anticipated temperatures may be harmful.
Protect from heat and radioactive sources		Stowage as for the preceding symbol. The cargo must additionally be protected from radioactivity.
Sling here		The symbol indicates merely where the cargo should be slung, but not the method of lifting. If the symbols are applied equidistant from the middle or center of gravity, the package will hang level if the slings are of identical length. If this is not the case, the slinging equipment must be shortened on one side.
Keep dry		Cargo bearing this symbol must be protected from excessive humidity and must accordingly be stored under cover. If particularly large or bulky packages cannot be stored in warehouses or sheds, they must be carefully covered with tarpaulins.

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Center of gravity		This symbol is intended to provide a clear indication of the position of the center of gravity. To be meaningful, this symbol should only be used where the center of gravity is not central. The meaning is unambiguous if the symbol is applied onto two upright surfaces at right angles to each other.
No hand truck here		The absence of this symbol on packages amounts to permission to use a hand truck on them.
Stacking limitation		The maximum stacking load must be stated as "... kg max.". Since such marking is sensible only on packages with little loading capacity, cargo bearing this symbol should be stowed in the uppermost layer.
Clamp here		Stating that the package may be clamped at the indicated point is logically equivalent to a prohibition of clamping anywhere else.
Temperature limitations		According to regulations, the symbol should either be provided with the suffix "...°C" for a specific temperature or, in the case of a temperature range, with an upper ("...°C max.") and lower ("...°C min.") temperature limit. The corresponding temperatures or temperature limits should also be noted on the consignment note.
Do not use forklift truck here		This symbol should only be applied to the sides where the forklift truck cannot be used. Absence of the symbol on other sides of the package amounts to permission to use forklift trucks on these sides.
Electrostatic sensitive device		Contact with packages bearing this symbol should be avoided at low levels of relative humidity, especially if insulating footwear is being worn or the ground/floor is nonconductive. Low levels of relative humidity must in particular be expected on hot, dry summer days and very cold winter days.

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Do not destroy barrier		A barrier layer which is (virtually) impermeable to water vapor and contains desiccants for corrosion protection is located beneath the outer packaging. This protection will be ineffective if the barrier layer is damaged. Since the symbol has not yet been approved by the ISO, puncturing of the outer shell must in particular be avoided for any packages bearing the words "Packed with desiccants".
Tear off here		This symbol is intended only for the receiver.

FIG-12

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BHEL-PEM-DELHI-INDIA	
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

FIG-13: MARKING PLATE



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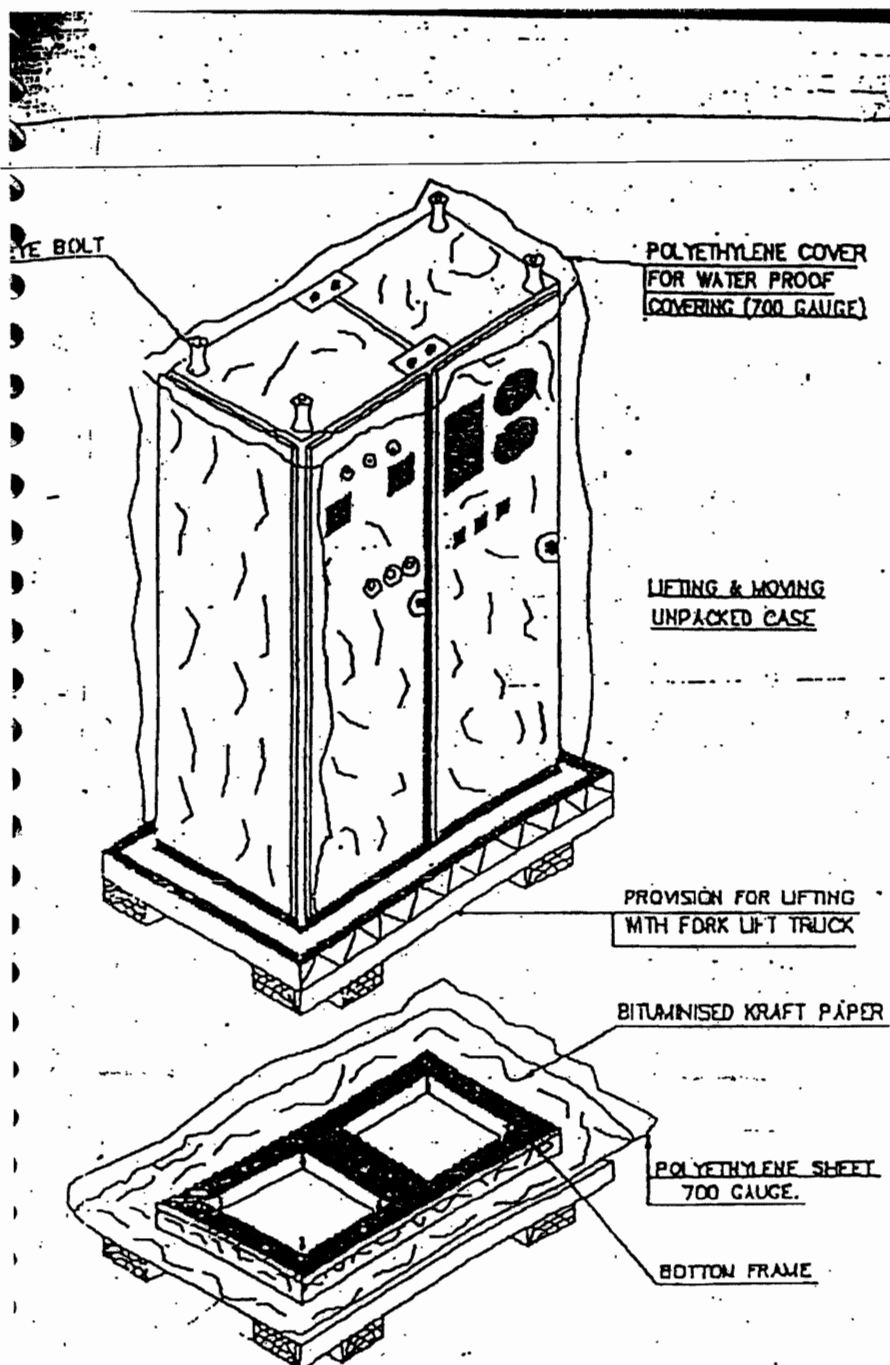


FIGURE-14



TITLE

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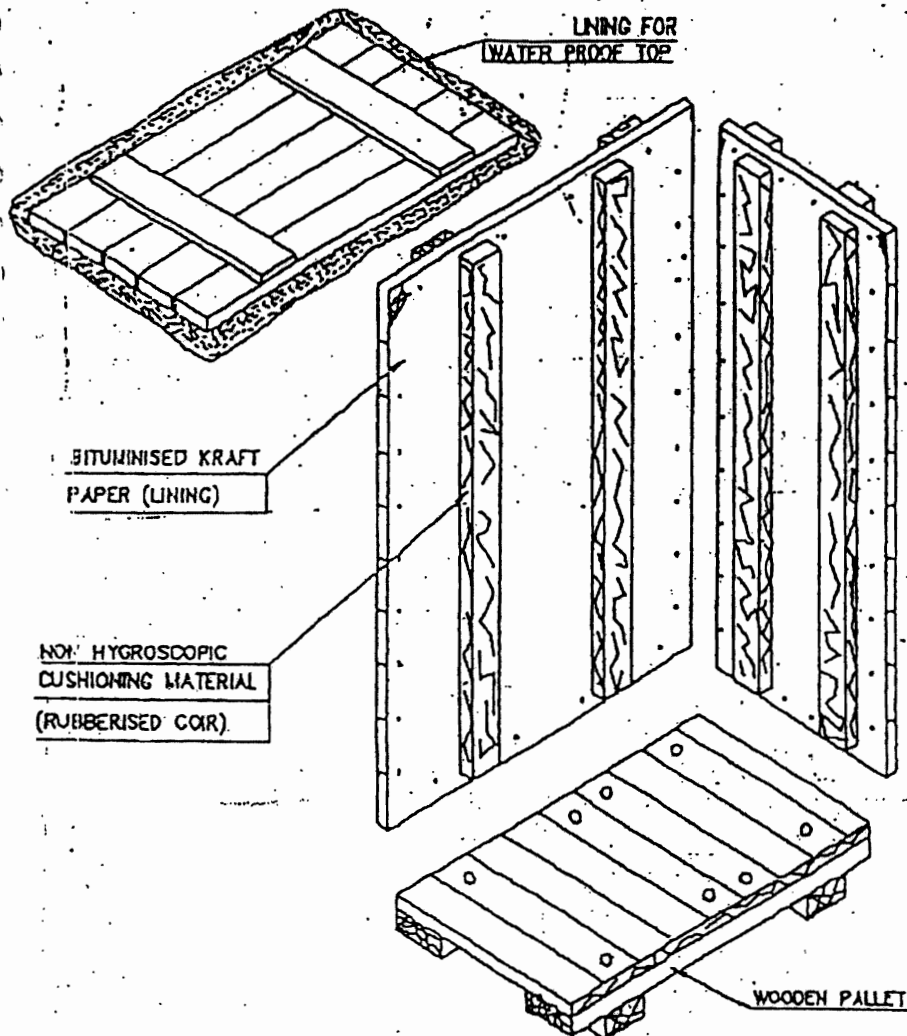
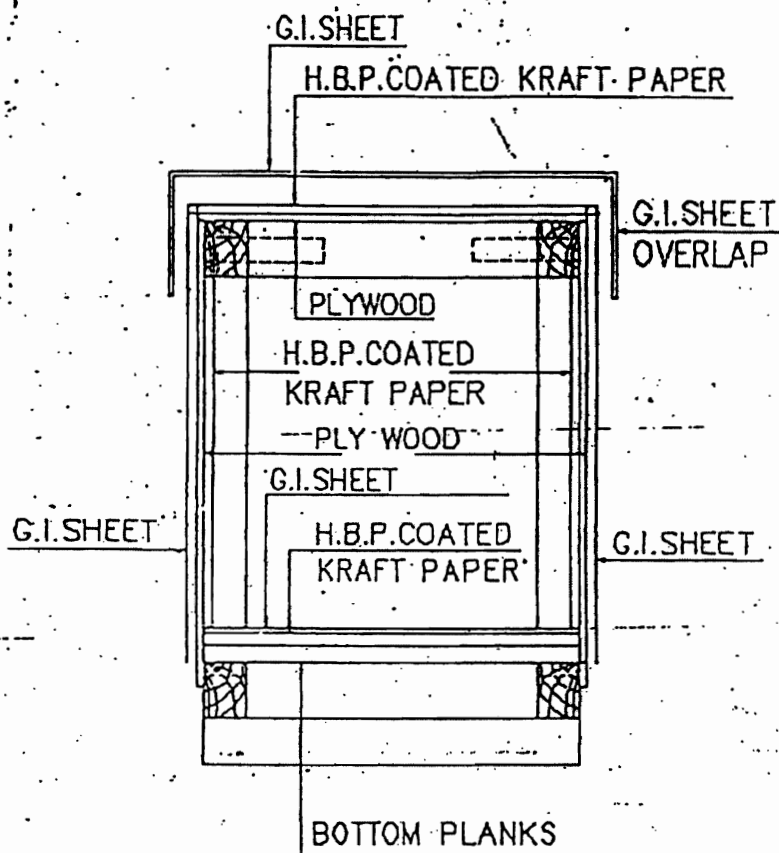


FIGURE-15

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**FIG-16 : CLOSED PACKING CASE WITH G.I.SHEET
SHOWING LAYERS OF PACKING MATERIALS.**

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10.0 TYPICAL PACKING DETAILS/PROCEDURE FOR MECHANICAL ITEMS

10.1 INSULATION MATERIAL (MINERAL WOOL MATTRESSES)

This specification covers the requirements of seaworthy packing and marking for bonded mineral (rock) wool mattresses having metallic hexagonal wire netting as facing on one or both sides.

10.1.1 TYPE OF CONSTRUCTION

Mattress shall be packed in Polythene (of 0.2 mm thickness) all around and sealed to prevent moisture absorption during transit and storage. Further it shall be wrapped with Bitumen coated Polythene bonded/lined Hessian and stitched and then packed in 5 ply DFC carton box.

Silica gel is used for this purpose to protect contents over sufficiently long time from corrosion. Silica gel shall be of indicating type conforming to IS:304-1979 packed in cotton bags placed at different positions inside the packing for absorbing moisture and shall not come into direct contact with the material inside the package. The quantity of silica gel shall be enough for storage period of one year. However, it shall not be less than 4 gms per litre volume of case subject to minimum of 400 gms per case.

Each mattress as well as the packages shall be serial numbered. Also, printed sheets indicating the nominal thickness, density and wire netting details (i.e. material and size) shall be placed below the wire netting.

Following details shall be legibly written on the packages. The details shall also be typed on a sheet of paper & kept in a sealed Polythene cover, inside the packages

- a) Project Name
- b) Purchase Order No.
- c) Sl. No. of package
- d) Size of mattress (Thickness x Length x Width)
- e) Density
- f) Wire netting material and size
- g) Weight of the package

10.2 INSULATION MATERIAL (ALUMINIUM COIL)

Heavy Gauge Aluminium Coil Packaging are done by Eye-to-Sky packaging or by Eye to eye packaging as per the proven practice being followed by manufacturer of Aluminium sheets.

10.2.1 Type of construction for Eye to Sky packaging

- a. Strapping of coil with polyester strap around circumference at one place.
- b. Putting paper I. D. Edge protector.
- c. Wrapping the coil with VCI stretch film after putting silica gel bags (4 nos.) Inside the coil.
- d. Wrapping the coil with HDPE film.
- e. Covering the coil including its build up & bore with masonite / particle board.
- f. Putting metallic I. D on coil.
- g. Putting O.D edge protector (paper) on coil.

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- h. Putting circumferential polyester strap (3 nos.) & eye polyester strap (4 nos.).
- i. After placing the coil on coil tilter ply wood (10mm thick) of suitable size along with wooden pallet is to be put at the bottom side of the coil.
- j. Coil is to be tilted to eye-to-sky position.
- k. Final strapping with metallic strap to unit coil and skid at 2 places with top cover of plywood.
- l. Fixing the coil with wooden blocks at 4 corners.
- m. Labeling 2 nos.(one metallic & one adhesivetype) For specification, net wt. & gross wt.

10.2.2 Type of construction for Eye to Eye packaging

- a. Strapping of coil with polyester strap around circumference at one place.
 - b. Putting paper I. D. Edge protector.
 - c. Wrapping the coil with VCI stretch film after putting silica gel bags (4 nos.) Inside the coil.
 - d. Wrapping the coil with HDPE film.
 - e. Covering the coil including its build up & bore with masonite / particle board.
 - f. Putting metallic I. D on coil.
 - g. Putting O.D edge protector (paper) on coil.
 - h. Putting circumferential polyester strap (3 nos.) & eye polyester strap (4 nos.).
 - i. Placing of coil on wooden skid Coil is to be tilted to eye-to-sky position.
 - j. Final strapping of coil and skid at 2 places with steel strap. Fixing the coil with wooden blocks at 4 corners.
- Labeling 2 nos.(one metallic & one adhesive type) For specification net wt. & gross wt.

10.3 Packing Procedure for Online Tube Cleaning System and accessories

This procedure is applicable for the shipment of Onload Tube Cleaning System and accessories by sea.

10.3.1 Packing details:

- The Packing case shall be made of treated rubber wood. The design of the case shall be as per Annexure IIIA & IIIB.
- The Equipments shall be placed on the wooden base of the Packing case and fastened if required to arrest the movement of the same.
- Equipment shall be covered by Polythene sheet and inside wall surfaces of the wooden cases also shall be covered by polythene sheet.
- All Nozzles shall be closed with plywood dummies.
- All electrical components assembled or loose shall be covered with polythene sheets along with silica gel pack.
- Silica gel desiccants shall be kept inside each case in sufficient quantities in order to absorb the moisture.

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- Thermocol packing shall be made for glass items like Ball vessel sight glass, Vpiece
- sight glass & pressure gauge.
- Silica gel desiccants shall be kept inside of each case to absorb the moisture.
- A Packing list covered in a polythene envelope shall be fixed inside and outside of each packing case.
- Shipping marks and consignee address shall be painted on the outer surface of the case.
- All handling instruction required for the case like top, sling, rain, handle with care etc, shall be marked on the case as per the symbol attached.
- Machined surface will be applied with Anti rust oil and covered by polyurethane sheet to protect from external oxidation.
- All valves will be closed with dummies to protect the internals and placed in the wooden case which will covered by polyurethane sheet.



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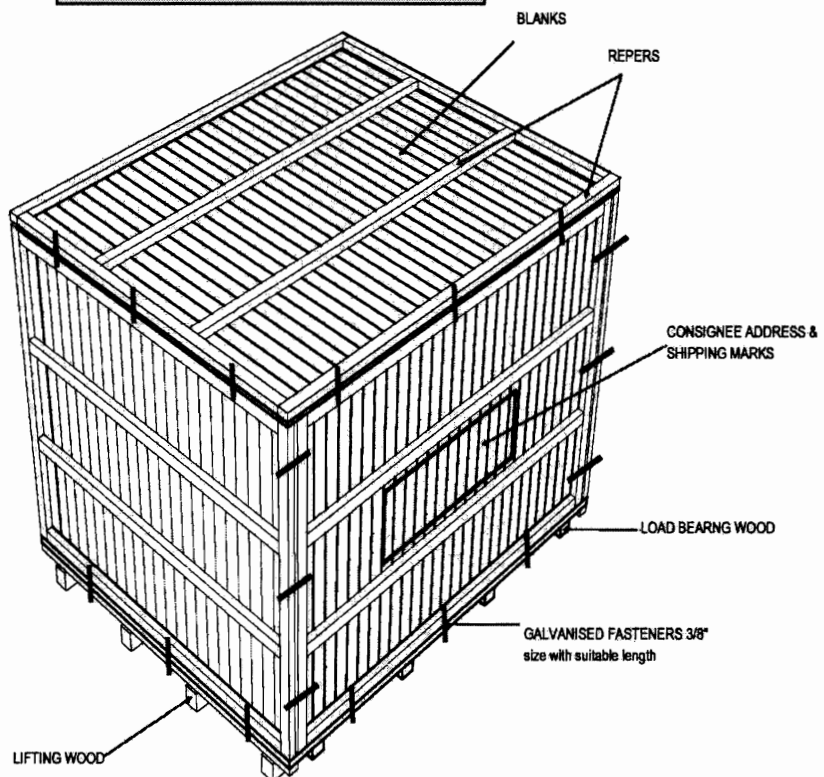
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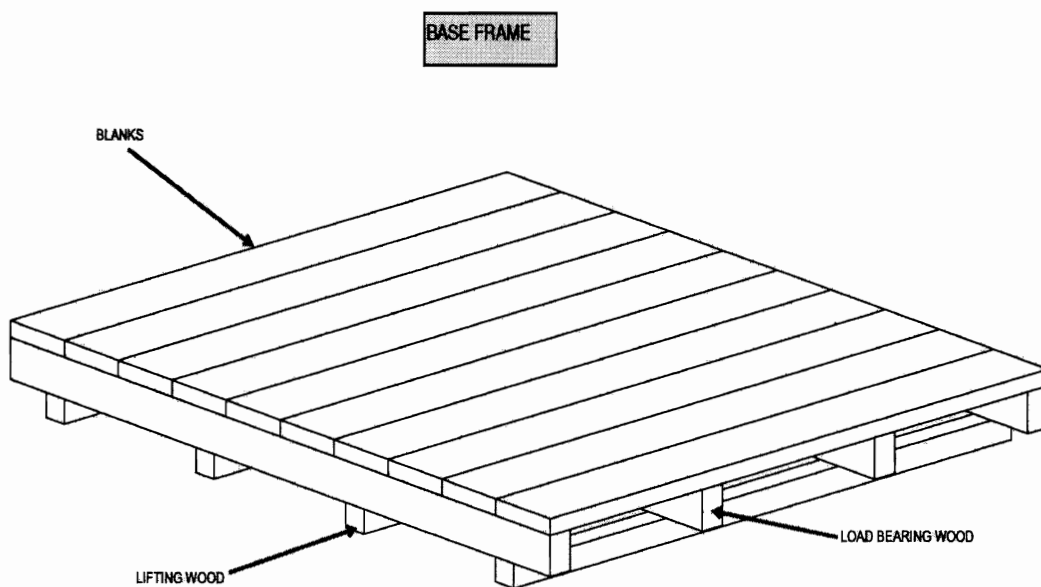
MODEL: FASTNERS TYPE (BASE, SIDE & TOP
ATTACHED WITH BOLT, NUT & WASHER)

This Type of case to be used for
following items:

1. BALL SEPERATOR
2. BALL COLECTOR SKID



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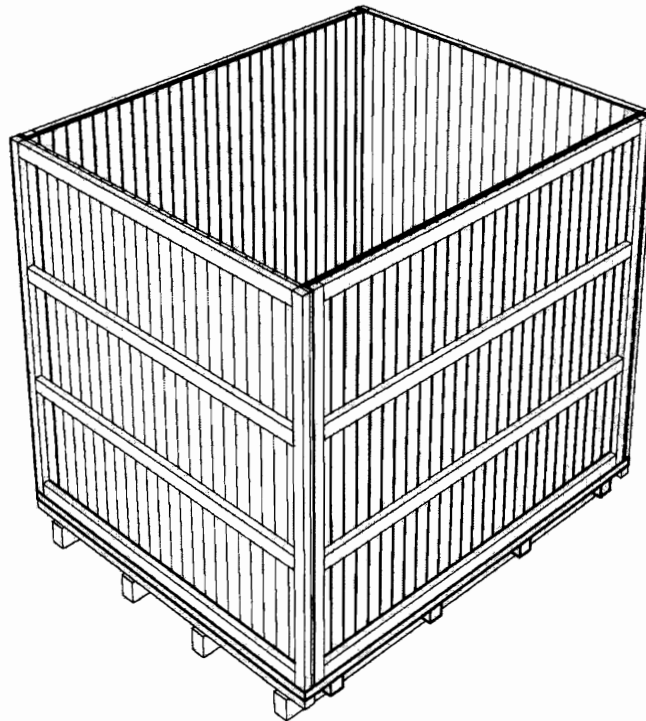
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MODEL: FASTNERS TYPE - WITHOUT TOP





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MODEL: NAILING TYPE
(FRAME & INSIDE REEFER NAILED)

- THIS TYPE OF CASE TO BE USED FOR THE FOLLOWING ITEMS:
1. PUMP SKID
 2. CONTROL PANEL
 3. LOOSE ITEMS, TOOLS & TACKLES
 4. DPMS, BRM
 5. SPARES
 6. CLEANING BALLS
 7. CABLES & ACCESSORIES

Shipping marks & Consignee
Address

BLANKS

LIFTING WOOD

BLANKS

REEPERS

BLANKS

REEPERS

LOAD BEARING WOOD

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TITLE

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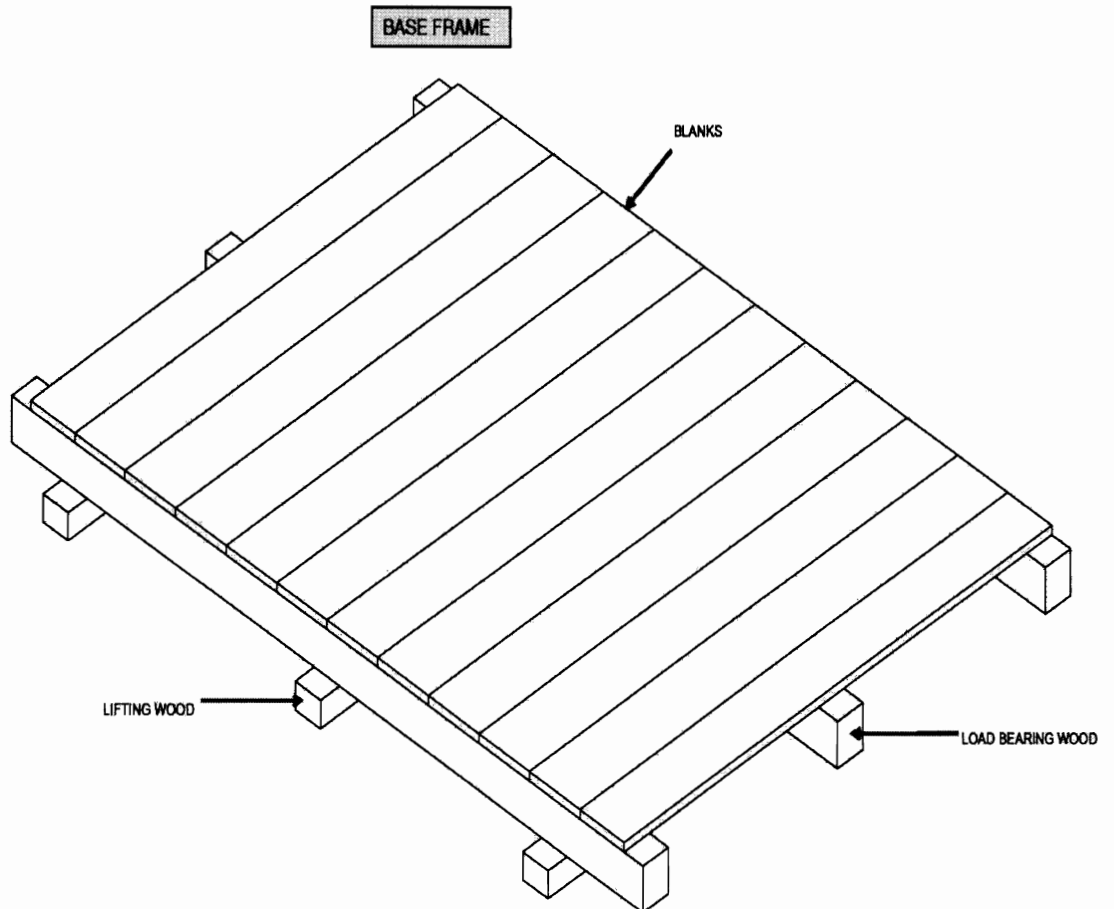
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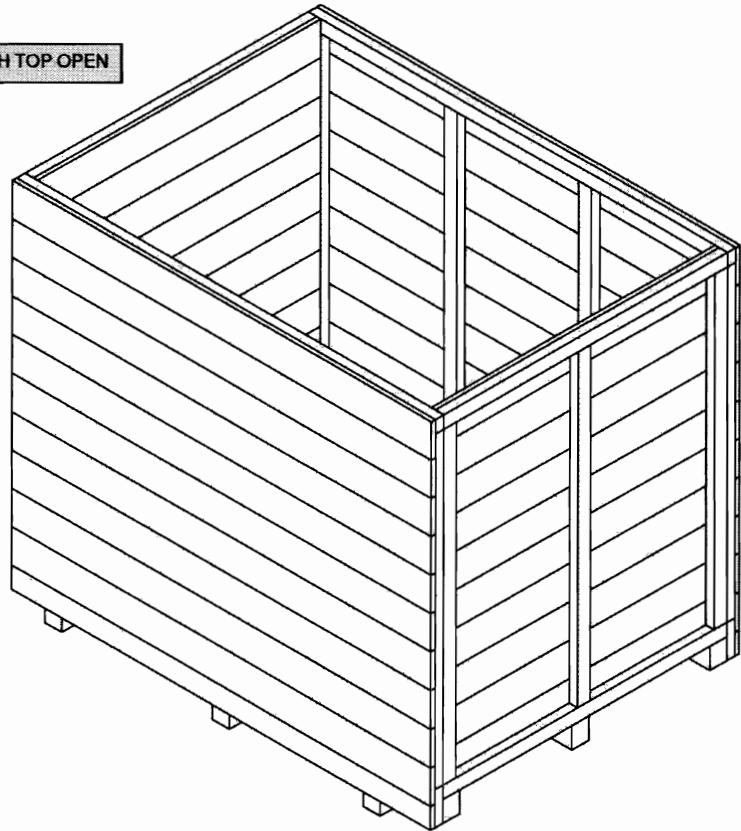
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NAILING TYPE MODEL WITH TOP OPEN



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10.4 PACKING OF LOOSE ITEMS

Loose mechanical, electrical and C&I items e.g. valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/ thermocol sheets/air bubble sheets depending upon the items and then packed in wooden boxes. The left out spaces and top of the boxes shall be filled with rubberized coir to get proper cushioning effect, Special attention shall be paid to relays, instruments etc for arresting the movements of their operating mechanism during transportation.

The construction of wooden packing cases shall be as per clause 9.3.1 retaining its all features concerning strength of the box. The construction of wooden packing case for electrical and C&I items shall be as per fig-16.

Inner surface of 6 sides of the box shall be lined with bitumen coated hessian polyethylene kraft paper. Rubberized coir of min. 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the boxes.

11.0 PACKING OF ELECTRICAL ITEMS

11.1 CABLES

11.1.1 Type of Equipment
All type of cables..

11.1.2 Type of Construction

New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. Cable drum can be put in wooden crates for ease in transportation and handling. (Wooden cable drum is also acceptable, however vendor to furnish constructional details for approval).



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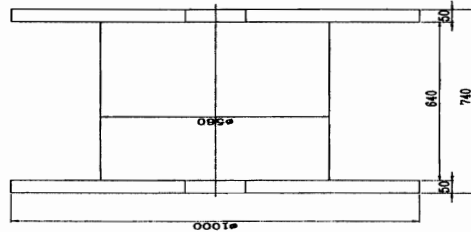
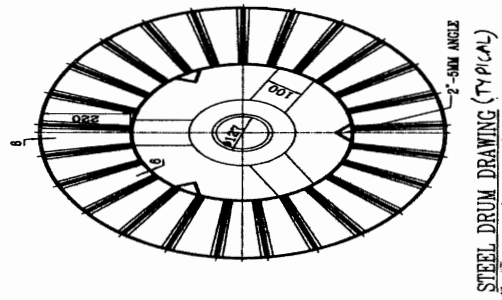
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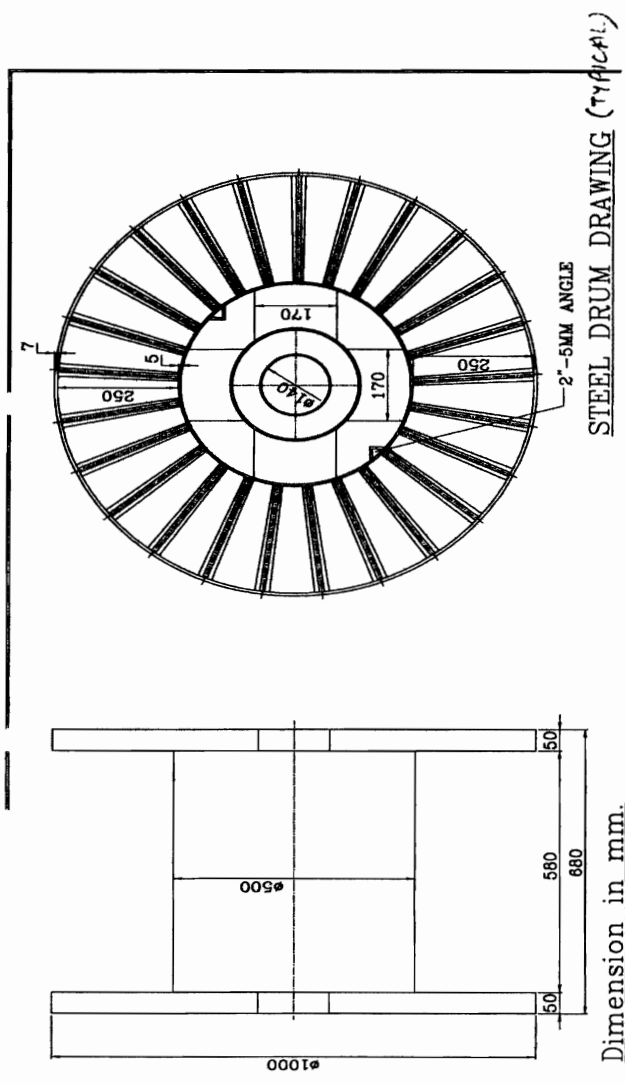
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Dimension in mm.

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11.2 PACKING OF CABLE TRAYS & ACCESSORIES AND CABLE TRAY SUPPORT MATERIAL

11.2.1 Cable trays can be packed in wooden boxes as per fig 1 to 11 or in steel boxes. Details of steel box construction is as indicated below.

- 1) All Dimensions are in "mm" unless otherwise stated.
- 2) Packing Box shall be fabricated using 50x50x6mm MS Angle, 50x3mm Flat, 2.5 mm thick C Channel, 1mm & 1.6mm Thick sheet.
- 3) Finish of Packing Box Shall be Galvanized.
- 4) Angle & Channel Section forming part of the Main frame shall be welded thoroughly with each other to give a rigid structure.
- 5) Sheet Section and Flat section shall be bolted/ Riveted/ Welded suitably to the Main frame stated in '4' above.

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- 6) Welding Portion on galvanized surfaces shall be painted with Zinc Rich Paint.
- 7) Dispatch details such as consignor/consignee address, contract and case details, 'country of origin, port of delivery, stacking instructions shall be written on one of the side of boxes. An anodized aluminium plate as per details and specifications given in page 3 of 5 shall be provided on the boxes
- 8) One copy of packing slip wrapped in polythylene bag covered with suitable aluminium .packing slip holder to be nailed on the external surface of the box. One more copy 9f the packing Slip wrapped in polythylene bag to be kept inside the box at the prominent place.
- 9) **INDICATION MARKS ON THE BOXES:** Markings shall be provided on the boxes indicating position of Boxes for handling, storage and nature of consignment. For guidelines referred page 4 of 5. The ink issued for this purpose as well as for marking dispatch instruction shall be indelible/non-washable marking ink.
- 10) Each item as mentioned in BOQ shall be packed & supplied as a set comprising of required numbers of associated fasteners & hardware etc

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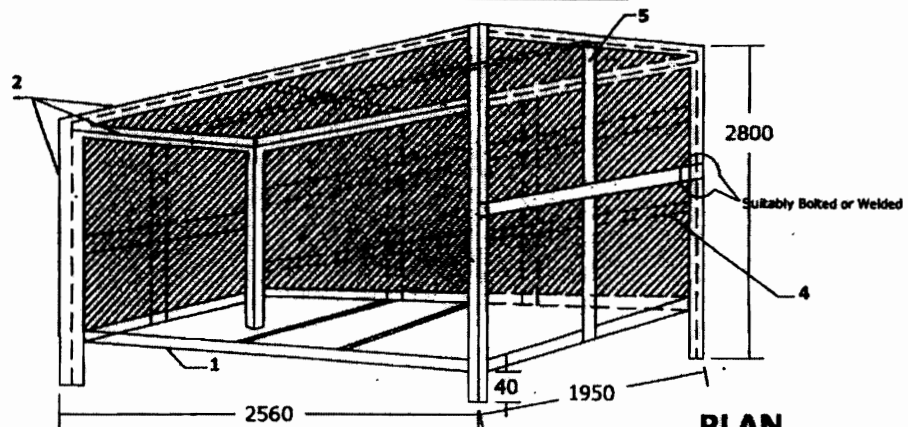
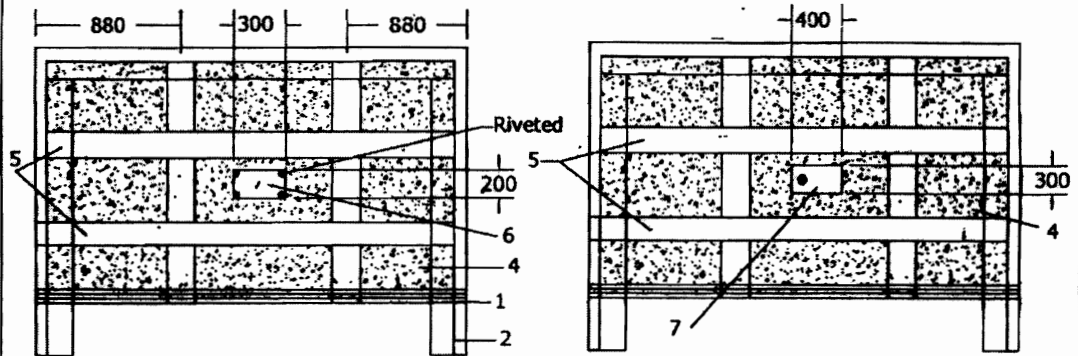
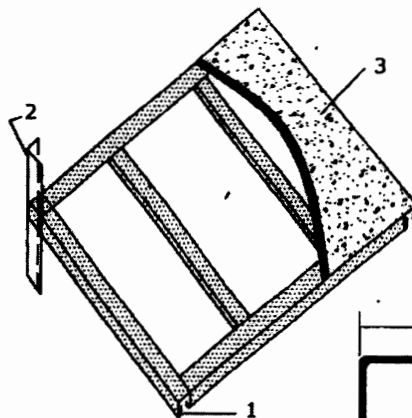
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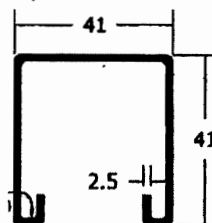
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STEEL PACKING (TYPICAL DETAILS)**PLAN****FRONT SIDE OF BOX****BACK SIDE OF BOX****BOTTOM FRAME ARRANGEMENT****Note:**

1. "C" Channel to be used on Bottom Frame.
2. 50x50x6 Angle to be used Vertically on four sides of the Box and Horizontally on four sides on the top Frame.
3. 1.6mm thick sheet (plain) on Bottom Plate.
4. 1.0mm thick sheet to cover top & four sides of BOX.
5. 50x3 Flat as additional cross members to be used Horizontally & Vertically on top & Four Sides of Box.
6. Anodised Aluminium Plate for Marking.
7. Hinged Inspection Window.

**DETAILS OF "C" CHANNEL**

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11.3 PACKING FOR STATION LIGHTING SYSTEM

Aspects of packing specific to equipments / items of station lighting system are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

11.3.1 For LIGHTING TRANSFORMER, DISTRIBUTION BOARDS, LIGHTING PANELS,

- Construction of packing case for LIGHTING DISTRIBUTION BOARDS, LIGHTING PANELS, TRANSFORMER . shall be EITHER as per FIGURE 1,2,3,5,6,7,8,9,10,11 OR FIGURE 14,15,16.
- Each Panel/Transformer shall be individually covered with double polythene sheet of thickness 175 microns minimum.
- All the 6 inner surfaces of packing shall be nailed with bitumen coated hessian polythene craft paper. Wherever 2 pieces of craft paper are used, the joint shall have minimum overlap of 20mm.

For the top frame it shall be project on all sides by 100mm and shall be nailed on sides .

- The gap between the panels and packing case shall be filled with rubberized coir of thickness 50mm minimum and width 100mm. The distance between two consecutive supports of rubberized coir shall be less than 500mm.
- Silica get packed in cotton bags shall be placed at different positions inside the packing.
- Packing case shall be finally covered with GI sheet of thickness 0.4mm minimum.

11.3.2 For LUMINARIES, RECEPTACLES. EMERGENCY LIGHT, 240/24V TRANSFORMER, CEILING FAN, SWITCH BOARDS, FLEXIBLE CONDUIT, WIRES, EARTH WIRE. JUNCTION BOXES, ERECTION COMMISSIONING SPARES, RECOMMENDED SPARES , ERECTION MATERIAL AND CONSUMABLES

- Construction of packing case for THE ABOVE MATERIAL shall be as per FIGURE 1to11.
- Items placed inside the case shall be covered with double polythene sheet of thickness 175 microns minimum.
- All the 6 inner surfaces of packing shall be nailed with bitumen coated hessian craft paper. wherever 2 pieces of craft paper are used, the joint shall have minimum overlap of 20mm. For the top frame it shall be project on all sides by 100mm and shall be nailed on sides.
- Silica get packed in cotton bags shall be placed at different positions inside the packing.

11.3.3 For CONDUIT PIPE

As per international practice pipes are shipped in open bundles with metal strapping. Packing as per attached figure A shall be provided which is described as following:

- Each bundle shall be wrapped with 2 layers of 175 microns thick polythene sheet.
- Then bundle will be wrapped with bitumen coated hessian craft paper.
- Bundle shall be strapped with steel straps.
- An anodized aluminium packing description plate as per Figure No. 13 shall be provided.

11.3.4 For POLES

Poles will be wrapped with 2 layers of minimum 175 microns thick polythene sheet and then with bitumen coated hessian craft paper, packed as per Figure – C i.e. bundling.

11.3.5 For STRUCTURAL STEEL

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Structural steel will be different sizes and shapes. Hence it will be packed as per Figure No. B and described as following :

- a) Each bundle shall be wrapped with 2 layers of 175 microns thick polythene sheet.
- b) Then bundle will be wrapped with bitumen coated hessian craft paper.
- c) Bundle shall be strapped with steel straps.
- d) An anodized aluminium packing description plate as per Figure No. 13 shall be provided.

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PACKING PROCEDURE FOR CONDUIT PIPE

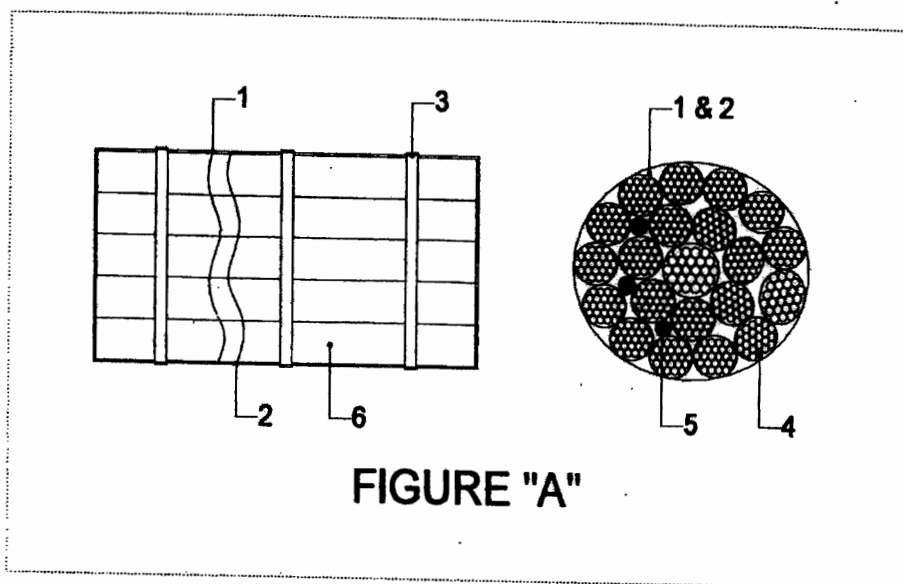


FIGURE "A"

- 1) LAYER OF BITUMEN COATED HESSIAN KRAFT PAPER.
- 2) LAYER OF POLYTHENE SHEET.
- 3) METAL STRAPPING.
- 4) CONDUIT PIPES.
- 5) SILICA GEL POUCHES.
- 6) BUNDLES OF CONDUIT PIPES.

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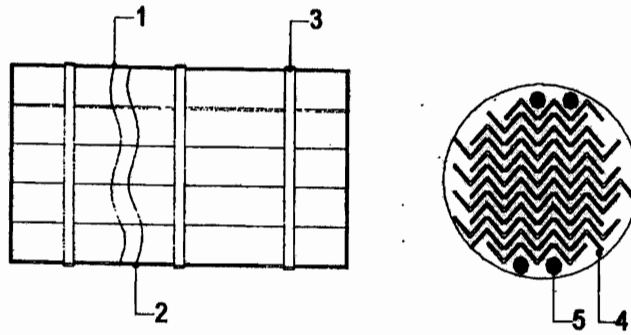
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PACKING PROCEDURE FOR STRUCTURAL STEEL**FIGURE "B"**

- 1) LAYER OF BITUMEN COATED HESSIAN KRAFT PAPER.
- 2) LAYER OF POLYTHENE SHEET.
- 3) METAL STRAPPING.
- 4) STRUCTURAL STEEL.
- 5) SILICA GEL POUCHES.



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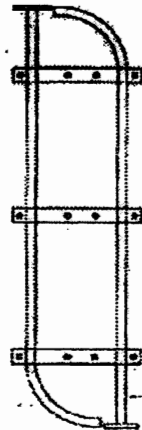
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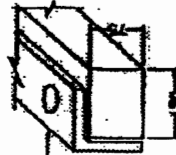
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packing procedure for poles



POLES WRAPPED WITH POLYTHENE SHEET &
EXTRUDING COATED HESSIAN CLOTH



TOP WOODEN BATTEN TO BE
FIXED WITH 150x80x6 MM ON TOP
OF IT FOR TIEING THE ROD
25 MM DIA



BOTTOM WOODEN BATTEN TO BE
FIXED ON 150x80x6 MM ANGLE

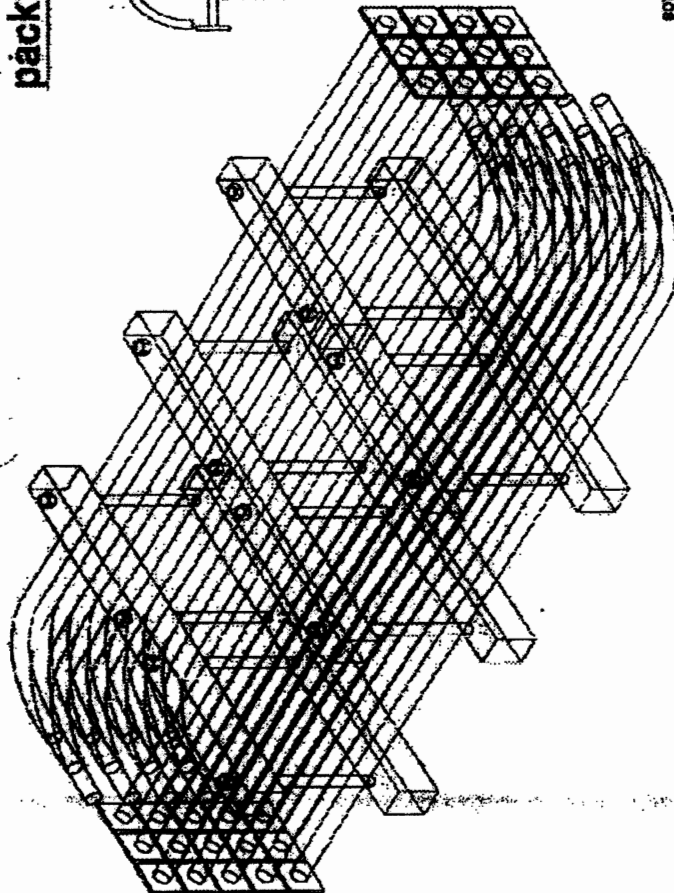


FIGURE "C"

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11.4 PACKING FOR DC BATTERY

The packing procedure for seaworthy packing of DC Battery is defined below, which is capable of withstanding impacts, compression, vibration, toppling, sea water spray, prevention against rust, temperature and extreme atmospheric conditions. Aspects of packing specific to equipments / items of DC Battery are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

The packing procedure consists of various stages namely primary packing, cushioning, securing, desiccant, outside packing box, Runners/ sliders/ transverse bars of plywood, etc., provided for each movement.

- a) The packing boxes shall be made up of plywood boxes (thickness 9mm min.) with blocks at the bottom of the box for provision for handling the boxes using the forklift. The packing boxes sizes are generally standardized to half-euro size (capable of handling equipment's weight).
- b) Rubberized coir of 25mm thickness shall be provided as cushioning material at the bottom and thermocole of 20mm shall be provided inside on all four sides. Other than this polyethylene film wrap or cover also will be provided. Left out spaces to be filled with rubberized coir/ thermocol to get cushioning effect.
- c) Silica gel in dust free air permeable cotton/paper bag shall be placed in the packing boxes for storage period of 1 year as per IS 304 (1979)
- d) While packing the cells, transit caps (polypropylene) of red and blue shall be used for big size cells for ensuring that cells does not get damaged during the transport due to vibrations etc.
- e) The battery accessories shall be packed with suitable precautions as follows:
 - i) Copper connectors shall be packed after making bunches with lead wire seals to avoid misplacement.
 - ii) Hardware items shall be packed in polyethylene bags (Thickness $\geq 0.175\text{mm}$) with item slip
 - iii) Battery rack shall be packed in dismantled condition, wrapped with polyethylene sheet
 - iv) For Ni-Cd type battery, electrolyte in solid form for dry cells shall be packed in cans with KOH, LiOH being packed separately.
 - f) Galvanized Steel straps are provided for binding the packing box sides.
 - g) The handling instructions shall be marked in indelible/ non-washable ink, indicating the upright position.

11.5 PACKING OF SERVICE TRANSFORMERS(OIL FILLED) & ACCESSORIES

This instruction is applicable for packing of transformers (oil filled), its accessories and components so as to ensure safe delivery to end user. Aspects of packing specific to equipments / items of transformers(oil filled) are given here. All other instructions / aspects as per the main specification of export packing which are not covered here shall also be applicable.

11.5.01 PACKING DETAILS :

- a) Items shall be packed in case / crates as per the shipping list.
- b) All fragile items and small items shall be packed in cases and to be marked as "Fragile, handle with care Fragile items".
- c) Fragile accessories are to be first packed in their original boxes (VENDOR's packing). Very

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- d small / delicate items such as glass thermometer, door keys shall be packed in separate box.
- d In case original box is found damaged, suitable alternate box or packing method using felt or foam sheet and polythene wrap to be used.
- e These boxes are then placed in identified wooden boxes. Inside of such boxes are lined with a layer of polythene sheet, packing wool / grass and another layer of polythene sheet before placing the boxes. All boxes are then wrapped with this polythene sheet before closing the box. Fragile items shall not be placed loose, one above the other inside the case.
- f All wiring cables, connection flats of non-ferrous materials, CTs, valves bellows shall also be packed.
- g Items like CTs, Oil communicating bushings, insulators, wired equipments and housings such as RTCC Panel, M. Box, Drive Mechanism, thermometers, gauges shall be wrapped in polythene from all around.
- h Buchholz relay and OSR relay openings will be blanked using covers, before putting them in the box
- i Items shall be carefully lowered and arranged inside the crate / case and each item shall be locked from all sides in such a way to avoid its movement in any way. Wooden stoppers and separators shall be provided for this and nailed to the crate / case wood.
- j Wooden planks and batons in contact with fragile items shall be provided with kit foam at the locations of contact.
- k Oil communication bushings shall be packed in separate case on V or U shape wooden felted supports, as in case of condenser bushings.
- l While placing and arranging the items inside the crates / cases, these shall be verified for correctness and then the packing note shall be signed. The cover top of the crate / case shall then be closed.
- m The main equipment like transformer tank shall be packed suitably to prevent any damage during transit / storage. Support structures like frame, header supports etc. shall be crated. Conservator headers shall also be crated. Radiators pipe work and other instruments & components shall be packed in cases. All the cases shall be lined with polythene from inside.

11.6 ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCH GEARS

For Control and switch gear panels, construction of wooden packing cases may be provided as per fig 14 & 15 and as detailed below.

Thickness of planks for all sides, binding and jointing battens shall be at least 25 mm. Width of the plank shall be at least 125mm and that of binding and jointing planks shall be at least 100mm.

Top frame shall be suitable so that it does not collapse due to sandwiching between slings while lifting. Longitudinal and traverse bars for the bottom wooden pallet to be suitably selected.

Diagonal bracings shall be as per cl 9.3.1.3 and all other requirements shall be as per clauses 9.3.1.4 to 9.3.1.6.

12.0 Containerization

As required by BHEL, the VENDOR shall stuff the GOODS into 20 or 40 foot containers (dry, open top, flat racks, etc.).

The maximum inside dimensions of containers are to be considered:

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- 40 foot containers: 11.80 m x 2.20 m x 2.05 m
- 20 foot containers: 5.80 m x 2.20 m x 2.05m
-

The present definition of containerization is valid for sea containers only. Vendor to check the size of containers before start of packing of equipment.

12.1 Protection of Cases/Crates

Since shipping containers are in general not water tight, packing in contact with the floor of the container shall be raised in order to prevent it from being damaged by the accumulation of water.

12.2 Mechanical Constraints

The mechanical constraints for "general use" closed containers are of a different nature (height of "stacking" being limited inside the containers), the packing for the GOODS may be of a lighter structure. However, it is necessary that the packing be appropriate so as to protect the GOODS on site during the storage period, as required after discharging of the GOOD'S from the containers.

Note:

It is the responsibility of the VENDOR to ensure that the cases/crates are stowed, secured and fastened inside the container. The VENDOR will take all necessary precautions to conform to the maximum weight allowed and the centre of gravity of the container. The securing and fastening of the cases/ crates can be carried out by nailing timbers on the bottom or on the vertical sides of the container.

13.0 Other Services to be provided by Vendor

In addition to the packing and shipping documents, VENDOR must also carry out the following services, which shall be included in his quotation:

Carriage of VENDOR's sub-contracted equipment and material, which must be re-grouped in VENDOR's or PACKER's workshops, whilst waiting for packaging.

BHEL reserves the right to postpone the shipping of the GOODS. In this event, any storage and insurance costs during the first ninety (90) days shall be borne by the VENDOR.

Loading, including lifting, securing, lashing, and stowing, of all cases, crates, or packages onto means of transportation such as, but not limited to, trailers, containers, etc.

14.0 Responsibilities and Guarantees

VENDOR is responsible for the choice of category for packing according to the transport facilities used, and on the basis of the present document. In case of doubt or disagreement regarding the choice, VENDOR must inform BHEL prior to packing and await BHEL's approval. All phases of packaging, marking, loading, etc. will be subject to BHEL inspection.

BHEL reserves the right to reject the packing when the packing does not conform to these instructions and/or when the packing does not ensure perfect protection of the GOODS. VENDOR is responsible for the weights and dimensions declared, and the marking of the packages.

The documents must be in strict conformity with the packing contents.

The packing specified in these "Packing, Marking and Shipping Instructions" is guaranteed for a twelve (12) months storage period after delivery on site.

VENDOR is responsible for providing storage recommendation adapted to the GOODS. According to this guarantee, VENDOR is held responsible in the event of goods becoming

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useless, damaged or broken, as a result of poor packing and/or stowing, or due to corrosion, subsequent to insufficient or inadequate protection. All direct or indirect costs resulting thereof, will be back-charged to VENDOR.

To,

Shri. S Shanmuga Sundaram, DM/Engg

NALCO: FGD: OXB: 170

Dt. 23-04-2021

Indent No: RFW01149 - RFW01150. Dt:15.04.2021	Project : Nalco Damanjodi 18.5MW
Item: Oxidation Blower	PGMA : FW230
Tech Spec:	NALCO:DMNJDI:FGD:OAB: R00, Dt:15.04.2021

Following are Quality recommendation

1. Inspection Categorization Plan yet to be approved by Customer, therefore considering Critical item this item shall be inspected at Manufacturer works as per Customer approved QP. QP shall be submitted to Customer after review by BHEL.
2. Applicable Vendor shall be obtained from Commercial project coordinator. Qualified vendor accepted by engineering is accepted by Quality also.
3. Inspection and testing shall be done as per approved Quality Plan /Approved Drawing/Approved datasheet and Technical Specification.
4. Panting shall be as per customer approved painting schedule.
5. Arrange acceptance on our QP from Qualified vendor for taking up with customer for their review and approval. Find herewith our QP (QP No. NKPI: 703, Rev: 02 DT: 04.02.2021). This MQP contains minimum check with nil deviation applicable and actual quantum of check / stage may differ based on project / customer requirement.
6. Packing of items shall be as per BHEL Engg Approved Packing Drawing/Packing Specifications.
7. BHEL Authorized representatives shall have the right to witness the necessary inspection and testing of goods mentioned in the PO. The supplier shall inform BHEL in advance about the readiness of the goods for inspection and testing. Inspection / Inspection wavier / approval by BHEL does not absolve Supplier's responsibility for conformity of the specification as per the terms of PO. Material Test Certificates shall be submitted to BHEL.
8. Annexure 'Q' and BOI details shall be part of enquiry File and shall be filled by Supplier with their duly sign and seal.
9. Supplier should be manufacturer not a trader/Agent. (If the OEM/Principal engaging the services of an agent to participate on their behalf, vendor will be acceptable with respect to Quality requirement provided acceptance on Point No 2, 3, 7 and 10 shall be accepted to supplier)

10. General Inspection Notes:

- a. Latest version of standards & Specification shall be applied.
- b. Materials shall be procured in compliance to Functional Technical specification.
- c. Gauges and measuring instruments with valid calibration only shall be used.
- d. Inspection / Inspection wavier / approval by BHEL does not absolve Supplier's responsibility for conformity of the specification as per the terms of PO.
- e. BHEL /BHEL Authorized representatives shall have the right to witness the necessary inspection and testing of goods mentioned in the PO.
- f. In case of Vendor Drawing & Datasheet, it needs approval by BHEL Engineering.
- g. This QP shall be read along with relevant PO, BHEL Specification / Approved Drawing/ Datasheet.

This is for your information and further necessary action at your end please.


Prepared by.
Rakesh Kr Madhu (Dy.Mgr/QA)

Reviewed & Approved by.
K Renjith(Mgr/QA)

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MANUFACTURING QUALITY PLAN											PROJECT: PACKAGE: FGD PACKAGE CUST No: Main Contractor- BHEL NTPC DRG No:			
Manufacturer Name and Address M/s.					ITEM: OXIDATION BLOWER									
					QP NO: NKPI:703,REV:02 DT: 04.02.2021									
					Page 1 of 3									
SL. NO.	COMPONENT & OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTAN CE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1	2	3	4	5	6		7	8	9	D*	10			11

1.0	RAW MATERIALS													
1.1	Castings, Shaft, Impeller/rotor.	Chem. & Mech. Properties.	MA	Review of MTC	1/Heat		Material Spec. / NTPC Approved. Datasheet / Drawing		TC	√	P	V	V	
1.2	Shaft	UT	MA	NDT Testing	100%	100%	ASME Section - V	Tech. Spec. / Manufacturer UT Procedure	UT Report	√	P	V	V	Dia≥ 40 mm shall be UT tested.
2.0	BOUGHT OUT ITEMS (Bearings)													
2.1	Bearings	COC	MA	Verification	100%	100%	Drg. & PO.	Applicable Standards	TC	√	P	V	V	
2.2		Dimensions	MA	Measureme nt & Visual	100%	100%	Drg. & PO.	Applicable Standards	coc/ IR	-	P	-	-	
3.0	IN PROCESS INSPECTION													
3.1	Welding Qualifications	WPS & PQR	MA	Verification	100%	100%	ASME Sec. IX		IR	√	P	V	V	Recent qualified WPS, PQR and WPQ shall be submitted for review during inspection.
3.2	Welder Qualifications	WPQ	MA	Verification	100%	100%	ASME Sec. IX		IR	√	P	V	V	
3.3	NDE Persons	Qualified Certificates	MA	Verification	100%	100%	SNT-TC-1A:2016		IR	√	P	V	-	
3.4	Casing	Dimensions, Surface Defects	MA	Measureme nt & Visual	100%	100%	Approved. Drawing.		IR		P	-	-	
3.5	Pressure test	Air leak tightness	MA	Pneumatic	100%	100%	Appd. Drg/Datash eet.	No leakage	IR	√	P	V	V	
3.6	Machining Dimensions of Shafts, Impeller	Dimensions	MA	Measureme nt	100%	100%	Approved Drawing.		IR	-	P	-	-	

MANUFACTURER SIGN & STAMP	LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. UT: ULTRASONIC TESTING M: MANUFACTURE/SUB SUPPLIER, C: MAIN CONTRACTOR (BHEL/BHEL AIA), N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION / REVIEW OF RECORDS MTC: MATERIAL TEST CERTIFICATE, TC: TEST CERTIFICATE, MA: MAJOR, MI: MINOR, COC: CERTIFICATE OF CONFORMANCE, IR: INSPECTION REPORT. AIA: AUTHORISED INSPECTION AGENCY.	Rakesh Kr Madhu(Dy.Mgr/QA)	K Renjith (Mgr/QA)	R Arunachalam(DGM/QA)
		PREPARED BY	REVIEWED BY	APPROVED BY

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		MANUFACTURING QUALITY PLAN						PROJECT: PACKAGE: FGD PACKAGE CUST No: Main Contractor- BHEL NTPC DRG No:								
		Manufacturer Name and Address M/s.			ITEM: OXIDATION BLOWER											
					QP NO: NKPI:703, REV:02 DT: 04.02.2021											
					Page 2 of 3											
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS		
1	2	3	4	5	M	C/N	6	7	8	9	D*	M	C	N	10	11

3.7	Surface Defects	MT/PT at machined area	MA	Measurement/ Visual	100%	100%	ASME Sec. V	Relevant Standard	IR	√	P	V	V	
3.8	Gear wheel	Heat treatment	MA	Measurement	100%	100%	Approved Data Sheet / Drawing		COC/IR	√	P	V	-	
3.9		Dimensions, Hardness	MA	Measurement	100%	100%	Approved Data Sheet / Drawing			√	P	V	V	
3.10	Coupling	Manufacturer TC with Balancing Report	MA	Measurement Visual	100%	100%	Appd. Drawing. / ISO 21940 Gr 2.5		IR	√	P	V	-	
3.11	Gear & Pinion	UT	MA	NDT Check	100%	100%	ASME Sec. V	Relevant Standard	IR	√	P	V	V	After finish machined.
3.12	Valve with Pneumatic Actuator	Functional Check	MA	Measurement / Visual	100%	100%	Manufacturer Internal Procedure		IR	√	P	V	V	
3.13	Rotor Assembly	Dynamic balance test	MA	Measurement	100%	100%	ISO 1940 Gr.2.5.		IR	√	P	V	W	
4.0	FINAL INSPECTION													
4.1	Final Assembly	Dimensions, Completeness	MA	Measurement Visual	100%	100%	NTPC Approve Drawing		IR	√	P	W	W	
4.2	Performance Test	Capacity, efficiency, head & power Consumption.	MA	Measurement	100%	100%	NTPC Approved Data Sheet / Approved Drawing		IR	√	P	W	W	
		Noise & vibration	MA	Measurement	100%	100%			IR	√	P	W	W	
		Oil temperate rise,	MA	Measurement	100%	100%			IR	√	P	W	W	
		Leakage of Oil from Gear Box.	MA	Visual	100%	100%	No Oil Leakage		IR	√	P	W	W	

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		PREPARED BY	REVIEWED BY	APPROVED BY

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	MANUFACTURING QUALITY PLAN						PROJECT: PACKAGE: FGD PACKAGE CUST No: Main Contractor- BHEL NTPC DRG No:							
	Manufacturer Name and Address M/s.			ITEM: OXIDATION BLOWER										
				QP NO:NKPI:703,REV:02 DT: 04.02.2021										
				Page 3 of 3										
SL. NO.	COMPONENT & OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTAN CE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
M	C/N	M	C	N										
1	2	3	4	5	6		7	8	9	D*	10			11

PROJECT:
PACKAGE: FGD PACKAGE
CUST No:
Main Contractor- BHEL
NTPC DRG No:

5.0	SURFACE PREPARATION, PAINTING & PACKING												
5.1	Painting	Painting Finish	MI	Visual	100%	100%	NTPC Approved Painting Procedure.	IR	√	P	V	-	
5.2	Packing	Size, appearance & firmness	MI	Visual	100%	100%	Specification / Packing Procedure.	IR	-	P	-	-	
5.3	Identification	Work Order, Project Details	MI	Visual	100%	100%	Specification / Packing Procedure.	IR	-	P	-	-	

Note:

1. This QP is applicable for Mandatory Spare supply also.
2. All other minor items, which are not cover under this QP, shall be manufactured inspected as per OEM (Original equipment Manufacturer)/BHEL standard practice and relevant standard. Relevant TC/COC will be submitted to NTPC for inspection Clearance.
3. Refer Separate MQP for Electric Motor.

RECORD OF REVISION

REV NO	DATE	DESCRIPTION
00	09.11.2020	Original Issue – First submission
01	10.01.2021	Revised based on Customer comments
02	04.02.2021	Revised based on Customer comments

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Annexure Q		
	Indent No:	Enquiry no:
Sl.No	BHEL / Customer Requirements	##Specific confirmations by the manufacture(Acceptable/Not acceptable)
1	Quality Plan Requirement: (If SQP is not given & Vendor QP applicable)	
	(i) MQP (Manufacturing Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Our SQP/Typical MQP/ MQP Format is attached for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw material Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during preaward / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP/ SQP (In case BHEL SQP is provided) is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standards to BHEL/Customer/Consultant.	
	Important Notes shall be included in MQP : (a) Latest revision of Standards & Specification shall apply. Only International Standards are applicable. (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
2	Domestic / Inland Inspection will be carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable).	
3	Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Foreign Sources: (1) Any one of the following Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself. (2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own, then these charges non claimable by the bidder. List of TPIA 1.M/s Bureau Veritas 2.M/s TUV-Nord 3.M/s TUV-SUD 4.M/s TUV Rheinland 5.M/s Lloyds Register 6.M/s SGS 7.M/s Germanischer Lloyd 8.M/s QUEST 9.M/s Certification Engineers International 10.M/s Intertek 11.M/s IR Class Systems and Solutions 12.M/s DNV 13. M/s Fichtner 14. M/s ABS Inspection Services	

Sl.No	BHEL / Customer Requirements	##Specific confirmations by the manufacture(Acceptable/Not acceptable)
4	Stage Inspection during manufacturing Process : Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review, verification and clearance for further processing. This inspection call shall be given well in advance (atleast 2 weeks before for Indian and 45 days for foreign) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	
5	Inspection before despatch for domestic supplier : Inspection before despatch at supplier's works shall be carried out by Bidder appointed Inspection agency(As in SI no.3.) Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet .	
6	Inspection at Foreign Source/Supplier: (a) As in SI no: 3. shall be ensured without fail (b) No material / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by Bidder appointed Third Party Inspection Agency (As per SI no.3) / Customer/Customer Appointed Inspection Agency/Consulate. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). Inspection before despatch for Foreign supplier : Inspection before despatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in SI no: 03 at supplier's cost.	
7	Painting shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in advance before proceeding including the BOI being procured for assembly / skid like motors etc	
8	Specific confirmation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechanical + HT + NDT etc (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Built Drawings with actual make / rating used with BHEL/customer approved drawings.	
9	Packing / Seaworthy Packing shall be as per BHEL Packing schedule / approved drawing / sketch. This shall be ensured to take care of transit / handling / transshipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
10	Outsourcing of test facilities: Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accredited third party lab / Govt / Govt Lab for major testing such as NDT, Electrical & Mechanical testing.	
11	Important Note: No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidences in the offer itself.	
12	## Necessarily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	
13	If the OEM/Principal engaging the services of an agent to participate on their behalf, Then mention OEM / vendor Name & address as well as agent details with their sign and seal.	
VENDOR SIGN AND STAMP:		Vendor Name & Address:

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Details of BOI's/ Sub Systems with respect to Main Items

SI No.	Item/ Sub system Name	Quantity	Supplier Name	Place of Manufacturing
OEM (ORIGINAL EQUIPMENT MANUFACTURER) SEAL AND SIGN.				