
TECHNICAL SPECIFICATION

FOR

OXIDATION BLOWER

CONFIDENTIAL

**CUSTOMER : Uttar Pradesh Rajya Vidyut Utpadan Nigam
(UPRVUNL)**

PROJECT : PANKI (1X660 MW)

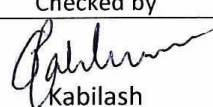
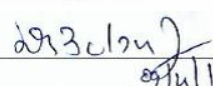
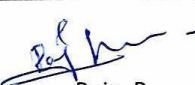
APPLICATION : FLUE GAS DESULPHURIZATION SYSTEM



BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT OF INDIA UNDERTAKING)
Flue Gas Desulphurization Group
Ranipet

	TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW
	PANKI:FGD:AOB:R00

TECHNICAL SPECIFICATION FOR OXIDATION BLOWERS

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COMMENTS : -----		

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1.0 PROJECT INFORMATION:

Panki Thermal Power Project (Coal Based) to be set up by UPRVUNL in Kanpur district of Uttar Pradesh State, India.

The capacity of the project is 660MW .

a.	Owner	UPRVUNL
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization

A) SITE CONDITIONS

Guarantee point

1.	Ambient Temperature and Relative Humidity		
	Ambient Temperature	:	27 deg C
	Relative Humidity	:	60 %

Design point

2.	Ambient Temperature and Relative Humidity		
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

Note:

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

B) PROJECT LOCATION AND APPROACH

The power project is proposed to be located in Panki, Kanpur district of Uttarpradesh,India.

a.	State/Division	Uttar pradesh
b.	District	kanpur



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2.0 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/Japanese) Standards. GB standards are not applicable.

3.0 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 of Panki 1x660MW project. The following points may be noted.

- a. This project is envisaged with one FGD system and it will be provided with 2 numbers of Oxidation Blower (1 working + 1 standby) which are located inside the Recirculation Pump & Oxidation Blower shed.
- b. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- c. The Bidder shall offer only proven design which meets the Provenness criteria indicated in **Annexure-I**. Necessary document evidences(end user performance certificate) for qualification shall be submitted along with the bid. If the Bidder doesn't meet the specified provenness criteria, then the Bidder will not be allowed to participate in the Tender.
- d. 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-IV**)".
- e. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.
- f. No deviation or exception shall be permitted without the written approval of the purchaser.
- g. 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.
- h. 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.
- i. 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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4.0 PROVENNESS CRITERIA:

The Bidders are required to meet the Qualification Requirement (QR) for Oxidation Blower as per **Annexure-I & submit the Annexure to qualification requirement along with necessary end user certificate/supporting documents. Bidder's offer will be rejected if the bidder fails to meet the Qualification criteria.**

5.0 TECHNICAL INFORMATION

Sl. No	Description	Requirement	
1.	Quantity	2 Nos (1 working + 1 standby). Total Quantity 2 Nos.	
2.	Parameters		
	Blower capacity	9000 Nm³/hr-wet	
	Discharge pressure	8700 mmwc	
	Efficiency required	55%(min)	
	Relative humidity	60%	
	Suction temperature	45.0° C (design), 27.0° C(guarantee)	
	Atmospheric pressure	997.4 hPa	
	Discharge temperature	<100° C	
	Type of Blower	Roots blower (Rotary, positive displacement type blower)	
	Duty	Continuous	
3.	Cooling water		
	Inlet temperature	38° C	
	Outlet temperature	<43° C	
	Pressure loss	0.15 MPa	
	Supply pressure	0.2 MPa	
4.	Air Composition (Wet)	Design point	Guarantee point
	H ₂ O	5.76 vol%	2.14%
	O ₂	19.79 vol%	20.55%
	N ₂	74.45%	77.31%
5.	Material of construction		
	Casing	Vendor to provide	
	Shaft	Vendor to provide	
	Impeller	Vendor to provide	
6.	Voltage level for Motors	a) Motor up to 200kw shall be 415v, 3 phase, 50HZ, AC b) Above 200 KW and up to 1500 KW- 3phase 3.3kV AC(MV) c) Above 1500KW-11 KV(HV) Distance between glade plate and terminal studs shall not be less than 500mm for MV/HV motors	
7.	Air filter filtering efficiency	Vendor to provide	



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Sl. No	Description	Requirement
8.	Blower Driver	Motor
9.	Cooling system for reducing the temperature of air at the blower outlet to <100 deg Celsius	Quenching/Cooling arrangement with water injection arrangement to be provided. Heat exchange should not be provided.
10.	Inspection & Testing	Testing will be done as per approved Quality plan.
11.	Service Engineer Site visit	There will be one visit per boiler. Vendor shall include No. of working days per visit in the offer.
12.	Guarantee & Warranty	• Vendor shall furnish Performance Guarantee for the design, manufacture, material, safe and trouble-free operation of the unit and its accessories. • The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1.5m above floor level in each elevation and 1.0 m horizontally from the base of any equipment.
13.	Defect Liability Period	• The Defect Liability Period shall be eighteen (18) months from the date of successful Completion of the Facilities or twelve (12) months from the date of Operational Acceptance of the Facilities.
14.	Vibration	The overall vibration level shall be as per ISO 10816-1. Balance quality requirement shall be G-6.3 confirming to ISO 1940 /1 vibration dampening pads if required, shall be provided.

5.1 WATER ANALYSIS (Process water)

The following water to be used for quenching the Oxidation air discharge temperature <100 deg C:

S.No	Constituents	Unit	Water quality
1.	Total Dissolved Solids	ppm	191.4
2.	Calcium as CaCO ₃	ppm	113.9
3.	Magnesium as CaCO ₃	ppm	40.0
4.	Sodium as CaCO ₃	ppm	37.2
5.	Potassium as CaCO ₃	ppm	
6.	Iron as Fe	ppm	0.3
7.	Fluoride as F	ppm	-
8.	Bicarbonate as CaCO ₃	ppm	97
9.	Chlorides as CaCO ₃	ppm	27.1



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S.No	Constituents	Unit	Water quality
10.	Sulphate as CaCO ₃	ppm	66.4
11.	Nitrate as NO ₃	ppm	0.5
12.	Silica	ppm	10
13.	pH		7.0 – 8.5
14.	Turbidity	NTU	<15

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

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing, handing over to end customer

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

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
1.	Blower complete with
	i. Casing
	ii. Rotor and Shaft assembly
	iii. Common base frame and shock absorber
	iv. Suction filter
	v. Suction & Discharge silencers
	vi. Lubrication system
	vii. Accessory piping within the skid
	viii. Safety Valves , Check valves & Butterfly valves
	ix. Acoustic Enclosure to meet specified Noise Level
	x. Coupling / Belt & Pulley with guards
	xi. Expansion joints at Discharge
	xii. Companion flanges with gaskets and fasteners
	xiii. Bearing cooling
	xiv. Cooling arrangement to reduce the discharge air temperature to <100 deg C
	xv. Foundation bolts for supplied items
	xvi. Instruments like Temperature gauge, Bearing Temperature gauge/ sensor as required and as specified.
	xvii. Mechanical Running and Performance test at shop
	xviii. Painting and Rust Prevention during shipment and construction
	xix. Supervision of Erection & commissioning at site
	xx. Proper Packing



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Sl. No	Scope
	xxi. Special tools & tackles as applicable
	xxii. Mandatory spares
	xxiii. Erection and start-up spares as applicable
	xxiv. Installation, operation and maintenance manuals
	xxv. Any other items required for completeness of the equipment except the items covered in the exclusions.
Bidder to refer to the P&ID enclosed in Annexure-X indicating the scope split.	

6.1	CONSTRUCTION FEATURES
a.	Each blower shall be a complete unit with casing, rotor, shaft and drive unit etc.
b.	The blowers shall be Rotary, positive displacement type with lube oil system, instrumentation and accessories. It shall be compact and simple in design requiring minimum number of spares.
c.	The oxidation blowers should be complete with drive arrangement consisting of coupling, coupling guard, base frame shock absorbers, mounting bolts, air filter, Acoustic enclosures, silencers, safety valves and check valves etc.
d.	The Oxidation Blowers shall be designed for continuous operation along with suitable cooling arrangement to meet the exit temperature < 100 deg C. The Bidder shall specify the cooling water requirement for reducing the temperature of discharge air.
e.	The rotor shall be ground all over and accurately machined. 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.
f.	The air intake filter cum silencer, preferably dry type, to prevent dust and other atmospheric impurities from entering the blower shall be provided for each blower. Air filter shall have better filtering efficiency.
6.2	COOLING ARRANGEMENT
a.	The discharge air temperature of <100 Deg C is to be obtained by a Quenching/Cooling arrangement in at the common discharge: ▪ Required pipe fittings within the scope of terminal points ▪ Required number of spray nozzles. ▪ Water quantity required ▪ Required flow control devices like valves, temperature gauges and other instruments. Allowed pressure drop of water at oxidation air quenching arrangement shall be $\leq 2.0 \text{ kg/cm}^2(\text{g})$. Bidder to provide quenching water requirement in



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b.	The vendor to provide the following along with cooling arrangement Required flow control devices like valves, pressure gauges and other instruments.
6.3	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 meeting the provenness criteria as stipulated in Annexure-I.
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 Annexure-I. 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
6.4	ROTORS & Impellers
a.	The rotor shall be made of Cast iron or forged steel or proven design standard meeting the provenness criteria as stipulated in Annexure-I.
b.	Rotor assemblies shall be statically balanced and then dynamically balanced as per ISO 1940.
6.5	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 Annexure-I.
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



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	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.
h.	Blower induced vibration due to flow pulsations shall be avoided through suitable design.
i.	Bearing temperature sensor shall be provided for remote monitoring of the bearing metal temperature of blowers. 3 Nos of RTD (4 wire) shall be provided to measure bearing temperature at each DE and NDE ends.
6.6	BELT & PULLEY/ COUPLING
a.	The HT drive motor is excluded from the scope of supply. However, the bidder shall supply coupling or Belt & Pulley for secondary transmission.
b.	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 by bidder.
c.	All rotating parts such as coupling or belt & pulley shall be covered with suitable protective guards. Guards shall be easily removable type.
6.7	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.
6.8	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



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	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)
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. Belt & Pulley /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.	Bearings shall be of anti-friction type only. The bidder shall provide the countermeasure for the fretting corrosion on the fitting surface of the thrust disc and separated outer race of anti-friction bearings.
iii.	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 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 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:	



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a)	All interconnecting piping whichever is necessary for operation of each unit shall be provided complete with shut off valves, check valves, strainers and fittings. Details of Oxidation blower piping : diameter=350mm, Material: A53-B, Thickness: Sch -20
b)	Details of valves are given below: i) BUTTERFLY VALVE Rating: CL 150, Body: A216WCB, Trim:13CR, Lining: EPDM, Connection: WAFER, Operation: Electrically operated with hand wheel integral starter type. ii)CHECK VALVE: Rating: CL 150, Body:A395, Trim: 13CR, connection: RF Type: BC,SWING. iii)GATE VALVE: Rating: CL 150, Body: A105, Trim:13CR, Lining: Seat STL, Connection: SW, Operation: Hand wheel, Bonnet: BB,OS&Y
8.	Blower control:
i.	Bidder to provide the control logic for the oxidation blower.Each blower shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a control cabinet.
ii.	Provisions shall be made for the interface between the local cabinet and the DCS such that the operation of the forced oxidation system can be controlled from the control console in the FGD Control room.
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.
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.



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10.	PROVISION FOR VIBRATION MONITERING:
iv.	Provision for vibration sensor, key phase sensor shall be provided. There shall be provided for X axis & Y axis vibration measurement in bearing housing. Provision shall be in line AP1670, 15 editions, provision shall be covered suitably.

7.0 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, belt & pulley 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 enclose 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

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S.No	Description
	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 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

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S.No	Description
	inclusive in supply portion.
29.	Material of construction for all equipment/components shall be subject to BHEL/UPRVUNL 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/UPRVUNL approved vendor list.
31.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from UPRVUNL for all equipment's & 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 UPRVUNL, the same may be replaced with another UPRVUNL 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 UPRVUNL 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 thick, 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/ UPRVUNL 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/UPRVUNL during detail engineering

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S.No	Description
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/UPRVUNL 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" b. "Not considered in scope of work"
8.0	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 pump internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure-VII. 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.(UPRVUNL)
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.

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S.No	Description
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: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. UPRVUNL THERMAL POWER CORPORATION PANKI, 1x660 MW. PANKI TEHSIL, KANPUR DISTRICT, UTTAR PRADESH, INDIA. EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA. 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:



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S.No	Description
	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. 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.
9.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
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 for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the

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S.No	Description
	scope of supply.
2.	The bidder will be informed well in advance for the visit. Bidder shall include 6 working days of visit in the offer.
3.	TA/DA, travelling, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
10.0	EXCLUSION
	The following work associated with the air blower will be by others: a. Supply of main drive HT motor b. Civil foundations c. Walkways, platforms and ladders d. Element handling hoists
11.0	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/UPRVUNL 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/UPRVUNL.
3.	Oxidation blowers will be inspected at the Bidder's works before dispatch or where the test facilities are available. Testing will be done as per the quality plan being approved by BHEL/UPRVUNL.
4.	The Bidder shall conduct performance test for the remaining blowers and submit the reports.
5.	Final inspection and release by BHEL / UPRVUNL 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/UPRVUNL 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.

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S.No	Description
11.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
12.	BHEL/UPRVUNL 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 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 UPRVUNL 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.
12.0	PAINTING
1.	Surface Preparation : Blast Cleaning SA 2.5
2.	PRIMER COAT: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) DFT 60 $\mu\text{m min}$ FINISH COAT: Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats) DFT 60 $\mu\text{m min}$ Total DFT : 120 $\mu\text{m min}$ The above painting is just a tentative schedule. Painting details will be informed during contract stage. a. Base: To be informed during contract stage b. Lettering: To be informed during contract stage
3.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope
4.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. Bidder shall submit the painting scheme during detail Engg in line with the specification and shall be subject to approval of BHEL / UPRVUNL.



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S.No	Description
13.0	SPARES, TOOLS & TACKLES
13.1	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 "Initial Spare Parts List". The List of such spares to be provided during bidding stage.
13.2	INITIAL SPARE PARTS (MANDATORY SPARES):
	Bidder to quote for below mentioned mandatory spares with break up price: a. Impeller assembly – 1 no. b. Bearings - 1 no. of each type Bidder shall quote for the "Initial Spares Part List", 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 Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan. 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
13.3	Recommended Spares (Final 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 will remain valid up to 6 months after placement of Notification of Award for the main equipment.
13.4	SPECIAL TOOLS & TACKLES:
	Any special tools & tackles required for the entire equipment to disassemble, assemble or



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S.No	Description
	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.
14.0	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 head of the blower to be guaranteed. 3) The Bidder shall guarantee 98.0% equipment availability for a continuous period of 120 days. 4) The Bidder shall ensure a design of the equipment to achieve an average target availability of 90%. 5) Noise level-≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 6) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 7) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for UPRVUNL's approval. 8) 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.
15.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
	POWER GUARANTEE Bidder to specify the guaranteed Shaft power per blower operating at the duty point in their offer. Bidder has to meet the minimum efficiency as stipulated in clause no: 5.0 sl no:2.
1.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Power consumption quoted by bidder shall be limited to the ceiling value specified below. The Lowest of the power consumption quoted by any qualified bidder shall be taken as the base or ceiling value. Bid prices of other bidders will be loaded for every KW excess over the ceiling value as per the formula given below. In case, Guaranteed Shaft power offered by the bidder exceeds the ceiling value specified



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S.No	Description
	above, his bid price will be loaded for excess power consumption as per the formula given below. Adjustment factor for excess power consumption in INR(Indian Rupees) = (GPC-CV) X PL X No's of Working Blowers GPC- Guaranteed Power Consumption quoted by bidder in KW CV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading @ 246000 INR /KW Exchange rate as applicable on bid opening date will be considered. No Price advantage apart from NIL Power Loading will be given if Guaranteed Power consumption offered is less than the ceiling value.
16.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
1.	If actual Power Consumption during prove out (or) PG Test measured at motor input terminals operating at the duty 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 INR = (GPC-APC) X P X No's of working Blowers • GPC- Guaranteed Power Consumption quoted by bidder in KW • APC- Actual Power Consumption in KW • P- Penalty @ 584000 INR / KW
2.	Minimum Acceptance Level: 120% of Functional Guarantee Value. UPRVUNL/BHEL reserves the right to reject the equipment if actual power consumption exceeds the minimum acceptance level.
17.0	WARRANTY
1.	The Bidder warrants that the equipments/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 36 months from the date of supply or 24 months from the date of commissioning , whichever first occurs. If during the Warranty 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, UPRVUNL/BHEL reserves the right to reject the equipment. However, UPRVUNL/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .

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S.No	Description
18.0	FIRST FILL OF CONSUMABLES:
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 UPRVUNL/BHEL's approval herein shall be furnished eighteen (18) months prior scheduled COD. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to UPRVUNL 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.
19.0	TRAINING
	Successful bidder shall provide comprehensive training for UPRVUNL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Oxidation blower- Operation & Maintenance, Troubleshooting etc.
20.0	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.
21.0	DOCUMENTATION
A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno commercial evaluation. As a minimum requirement, document as per Annexure-VI:A , shall be furnished to fully describe the scope of work and services offered.
B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified as per Annexure-VI:B. However as minimum the following shall be submitted.



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S.No	Description
	a. The following characteristic curves of the blower shall be submitted: i. The system-resistance point at different loads shall be indicated in the above performance curves. Drawings that are reviewed by the UPRVUNL/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 a 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. UPRVUNL / 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 UPRVUNL 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 UPRVUNL'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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22.0 ANNEXURES

ANNEXURE –I QUALIFICATION REQUIREMENT.

The Bidder is required to meet the provenness criteria and/or qualification requirement for critical equipment and bought out items as per criteria stipulated below:

Oxidation blowers for the Wet Limestone based Flue Gas Desulphurization (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previous experience of manufacturing and supplying the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year as on 02nd Nov 2015.

Name of Equipment	Type of Equipment	Application	Equipment Rating
Oxidation blower	Rotary, positive displacement type blower	Wet Limestone based FGD application in Coal fired power plant	Flow 8500 Nm ³ /hr (minimum) with Head 11000 mmWC (minimum)

Bidder shall offer and supply only the type of above equipment (s) for which he himself is qualified.

End user certificate has to be provided for meeting the Qualification requirement.



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ANNEXURE –II- TECHNICAL DATA SHEET

Sl. No	Description	Data
1.0	GENERAL	
	a. Client	: BHEL-Ranipet
	b. Project	: Panki (1x660 MW)
	c. Ultimate Customer	: UPRVUNL
	d. Location	: Panki Tehsil, Kanpur Dist., Uttarpradesh, India
	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 No's
2.0	MANUFACTURER DETAILS	
	a. Model	:
	b. Type	: Rotary, positive displacement type oxidation blowers(roots)
	c. Type of Driver	: Directly coupled / Belt & Pulley
	d. Area classification	: Safe
	e. No of Stage	: Single(1)
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	: 9000 Nm ³ /hr-wet(g)
	g. Suction pressure KPa	: Bidder to Provide
	h. Discharge pressure mmWc	: 8700 mmwc (g)
	i. Differential Pressure	: Bidder to confirm
	j. Suction temperature Deg C	: Ambient
	k. Discharge temperature Deg C	: <100
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



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	i. Speed Maximum/ Normal/Minimum	:	Bidder to Provide
	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

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE III- SCHEDULE OF GUARANTEES

Sl. No	Description	Data
1.	Rated capacity of Blower Nm ³ /hr	:
2.	Total head at design capacity mmWc	:
3.	Guaranteed power consumption at rated capacity & 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 (%)	:

SIGNATURE OF BIDDER

NAME

DESIGNATION



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE –IV- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE – V

a) **REFERENCE LIST as per format shown below.**

S.N o	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limest one Based FGD Yes/No	Mod el	Capacity Nm ³ /hr.	Head mmWc	Speed rpm	Year of Commg	Qty

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE -VI

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	No of copies With proposal
1.	Signed compliance to specification	1
2.	Quality function requirement	1
3.	Data Sheet-(Annexure-II)	1
4.	Schedule of Guarantee (Annexure-III)	1
5.	Deviation List (Annexure-IV)	1
6.	Anchor Plan & Civil foundation Loading details	1
7.	Performance curve i. Flow v/s Total pressure ii. Flow v/s efficiency iii. Flow v/s power consumption iv. Torque vs. speed curve for Motor selection	1
8.	Proforma Packing List	1
9.	Shortest Manufacturing Time	1
10.	Approximate weight of each skid	1
11.	Reference plant details	1
12.	Required Electric power & other Utility List	1
13.		1
14.	General Assembly Drawing	1
15.	Blower and Motor Sizing Calculation	1
16.	Cross-sectional Drawing	1
17.	Sub-Vendor List	1
18.	Scope of Supply	1
19.	Quality Plan	1
20.	Spare List (Mandatory, Recommended)	1
21.	Start-up & Commissioning Spares	1
22.	List of Special Tools	1
23.	Delivery Schedule	1

**TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW****PANKI:FGD:AOB:R00**

24.	Test Arrangement & Test procedure	1
25.	T-S curve	1
26.	Hoist/Crane requirement	1
27.	P & I Diagram	1
28.	Catalogue	1

B) DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	Sizing calculation for HT Motor	1	2 weeks after contract
2.	Utility Consumption	1	2 weeks after contract
3.	Foundation Data including Anchor plan	1	2 weeks after contract
4.	Performance curve i. Flow v/s Total pressure ii. Flow v/s efficiency iii. Flow v/s power consumption iv. Torque vs. speed curve for Motor selection	2	2 weeks after contract
5.	Assembly drawings of each equipment	1	1 month after contract
6.	Cross section detail drawing	1	1 month after contract
7.	Data Sheet	1	2 weeks after contract
8.	Lubricating oil list	1	2 months after contract
9.	Special tools list	1	2 months after contract
10.	Installation and assembly procedure	1	4 months after contract
11.	Inspection and Test Procedure	1	1 month after contract
12.	Inspection & Test record	1	In 2 weeks after test
13.	Inspection Certificate	1	In 2 weeks after test
14.	Sub vendors List	1	2 weeks after contract
15.	Manufacturing Schedule	1	2 weeks after contract
16.	Progress report	1	Every month
17.	Proforma Packing List	1	2 months prior to shipping
18.	Approximate weight of each skid	1	2 months after contract

**TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW****PANKI:FGD:AOB:R00**

Sl. No.	Description	No of copies After award of contract	Delivery Time
19.	Required Electric power	2	2 weeks after contract
20.	Blower and Motor Sizing Calculation	1	2 weeks after contract
21.	Material Test Certificates	2	In 2 weeks after test
22.	Pre Commissioning Check List	2	4 months after contract
23.	Scope of Supply	2	2 weeks after contract
24.	Quality Plan	4	1 month after contract
25.	Erection Manual	• 5 hardcopies and 3 electronic copies in English	4 months after contract
26.	Commissioning Manual	• 5 hardcopies and 4 electronic copies in English	4 months after contract
27.	Operation and Maintenance Manual	• 5 hardcopies and 4 electronic copies in English	4 months after contract
28.	Spare List (Mandatory, Recommended)	1	1 month after contract
29.	Start-up & Commissioning Spares	2	1 month after contract
30.	List of Special Tools	1	1 month after contract
31.	Delivery Schedule	1	2 weeks after contract
32.	Test Arrangement & Test procedure	2	1 month after contract
33.	T-S curve	2	2 weeks after contract
34.	P & I Diagram	2	2 weeks after contract
35.	Catalogue	2	2 weeks after contract

SIGNATURE OF BIDDER

NAME

DESIGNATION



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE-VII

TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING (applicable for supplies from outside India)

Refer to Specification No: PE-TS-888-100-A001 for detailed specification on Seaworthy packing.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE-VIII

Refer to various clauses of inspection and Testing. Sample QP enclosed.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE-IX

Refer to the UPRVUNL instrument Specification enclosed

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE-X

Reference P&ID drawing indicating the scope between BHEL and the vendor

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF OXIDATION BLOWER -: PANKI (1X660)MW

PANKI:FGD:AOB:R00

ANNEXURE XI- VENDOR TO PROVIDE THE LIST OF COMMISSIONING SPARES

Sl. No.	Description	Quantity
1.		
2.		
3.		
4.		
5.		

Qty will be Number or Set as applicable

- Vendor to identify each and every item which they consider as commissioning spares. Each and every part that is considered to fall under guarantee clause shall be indicated in this list.
- Rubber items which are having a **Shelf-Life** will also be considered as wear item.

SIGNATURE OF BIDDER

NAME

DESIGNATION

Bidder's signature with seal and date

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	
		VOLUME II B	
		SECTION D	
		REV. NO. 0	DATE 10/08/2010
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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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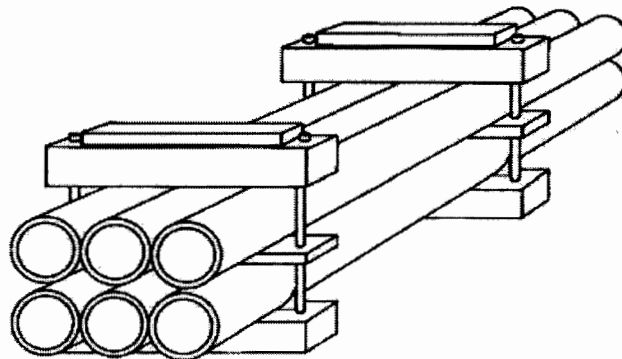
Structural Steel, reinforcing rods, bars, etc., should be packed in bundles of uniform length. Refer to articles 8.1.2, for strapping requirements. Bundle weight not normally to exceed 2,000 kg. Fabricated structures and structural steelwork, etc, should be bundled and packed using wooden beams and long bolting to secure the load.

8.2 Bundling – Packing Category I

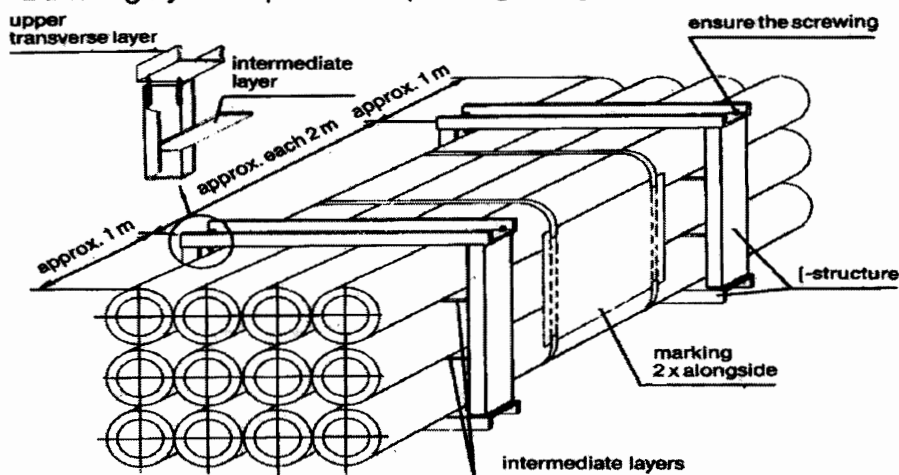
8.2.1 Type of Equipment

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)

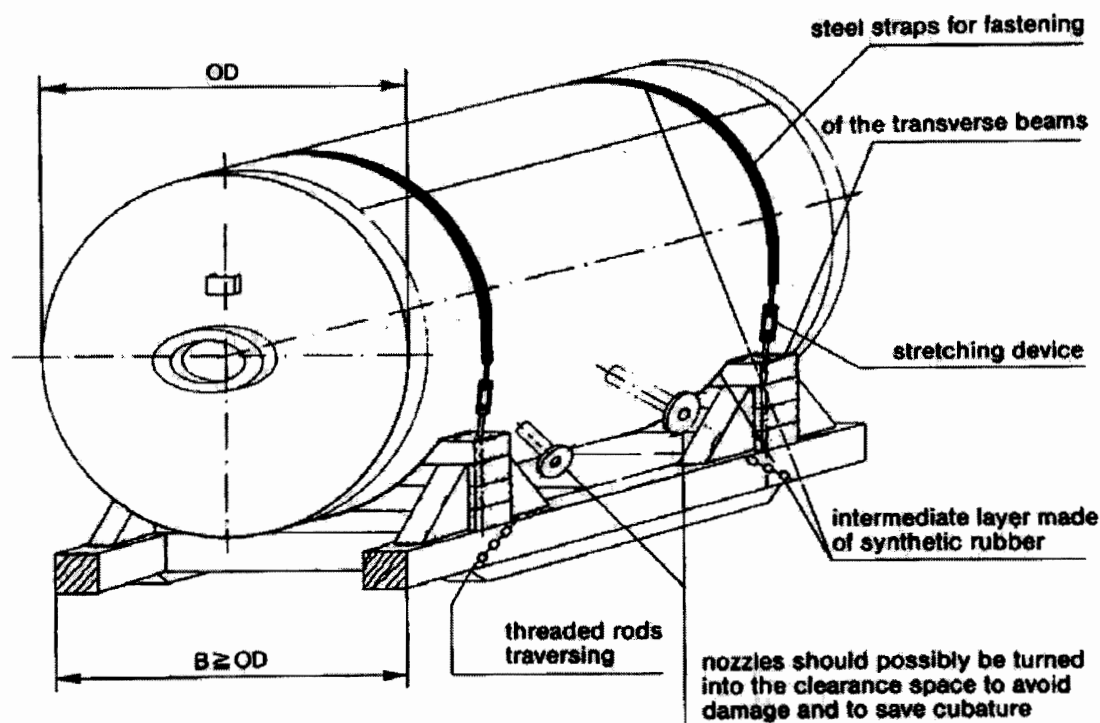
8.3.1 Type of Equipment

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

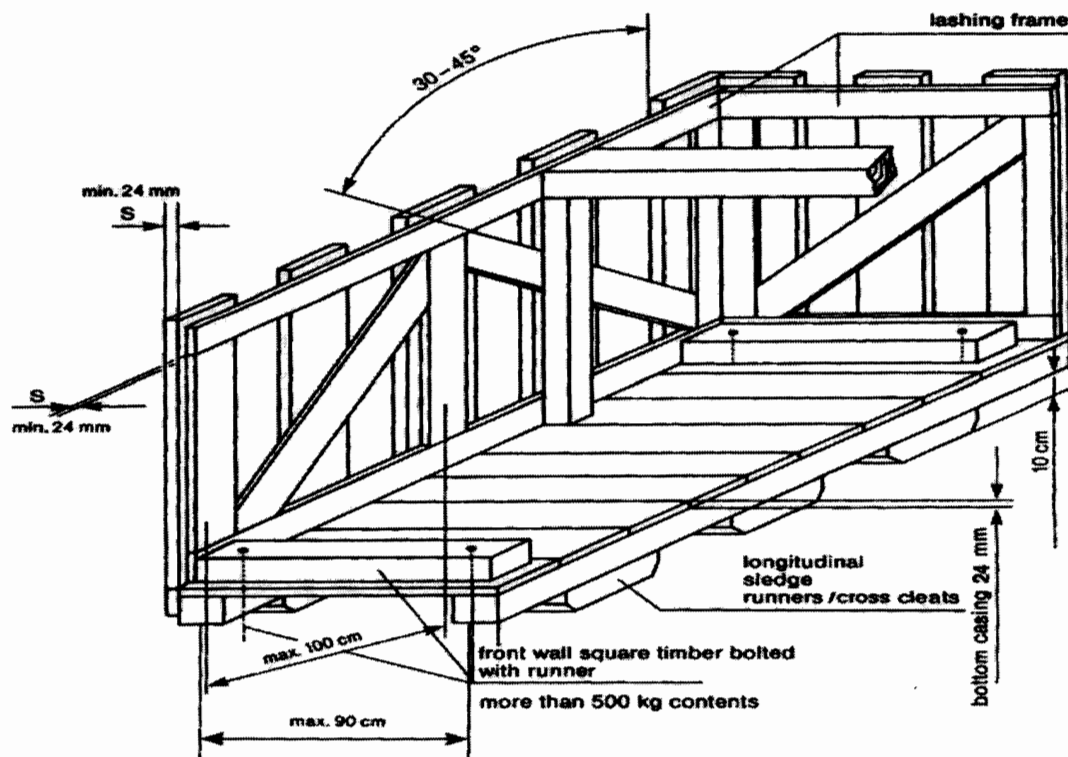
Fabricated equipment, which cannot be transported on cradles; frame-works, prefabricated piping and fittings, mechanical and electrical assemblies. *This type of packing is recommended where many parts of the equipment/component/assembly are not protruding out.*

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

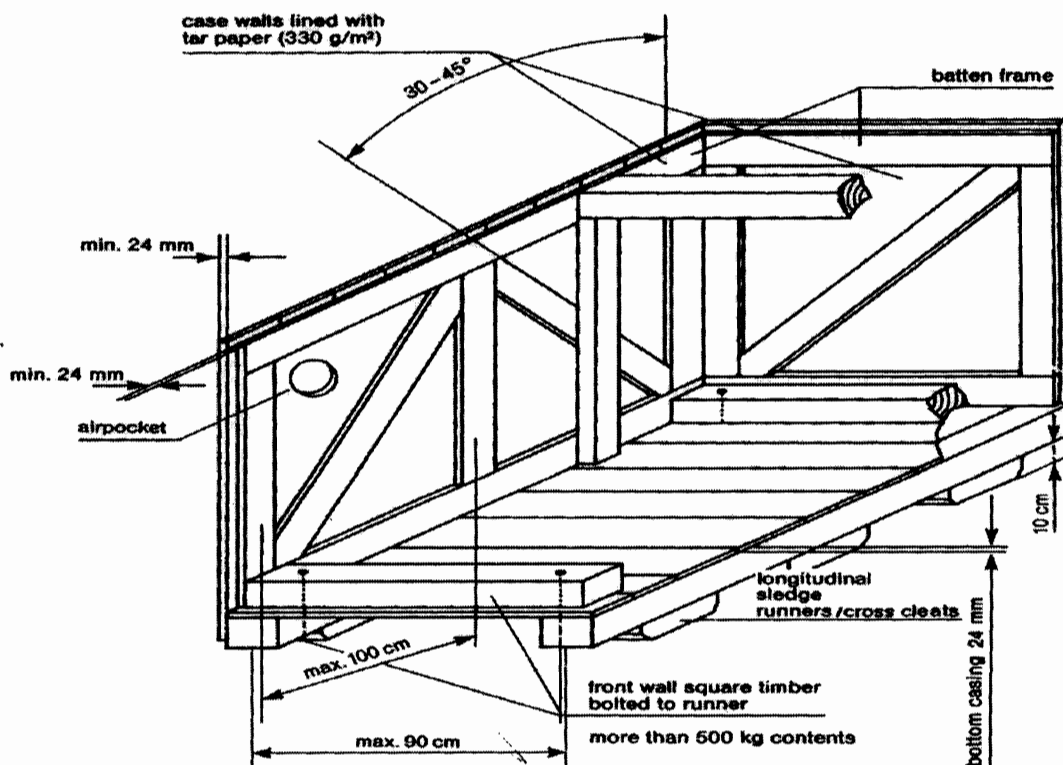
8.4.2.1 Type of Equipment

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.

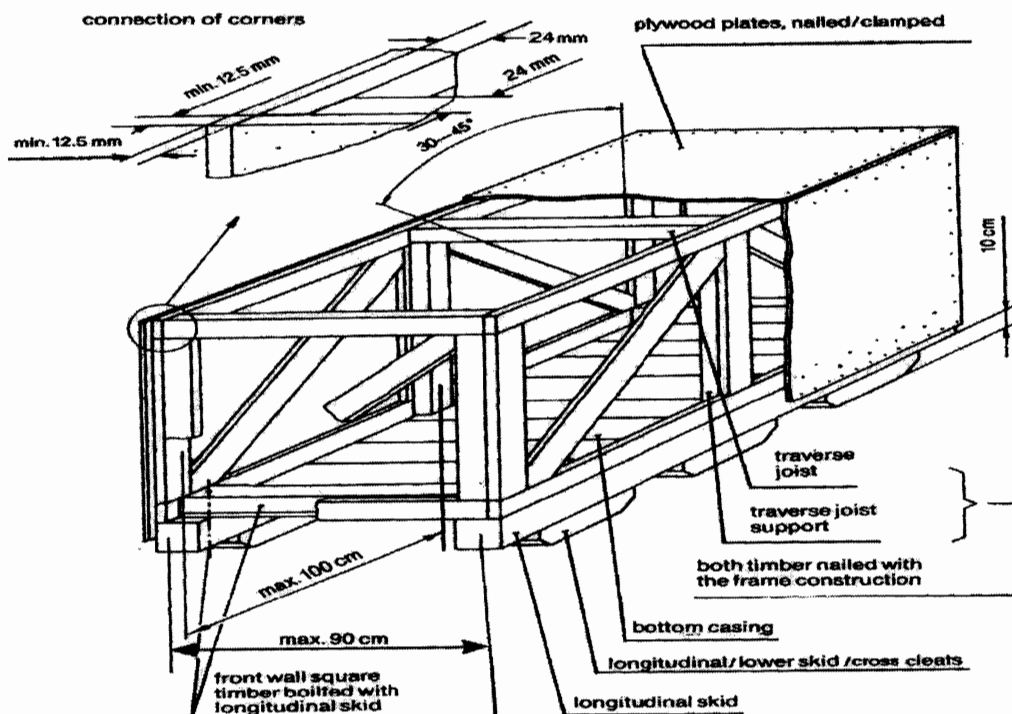
Packing Category IV



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.

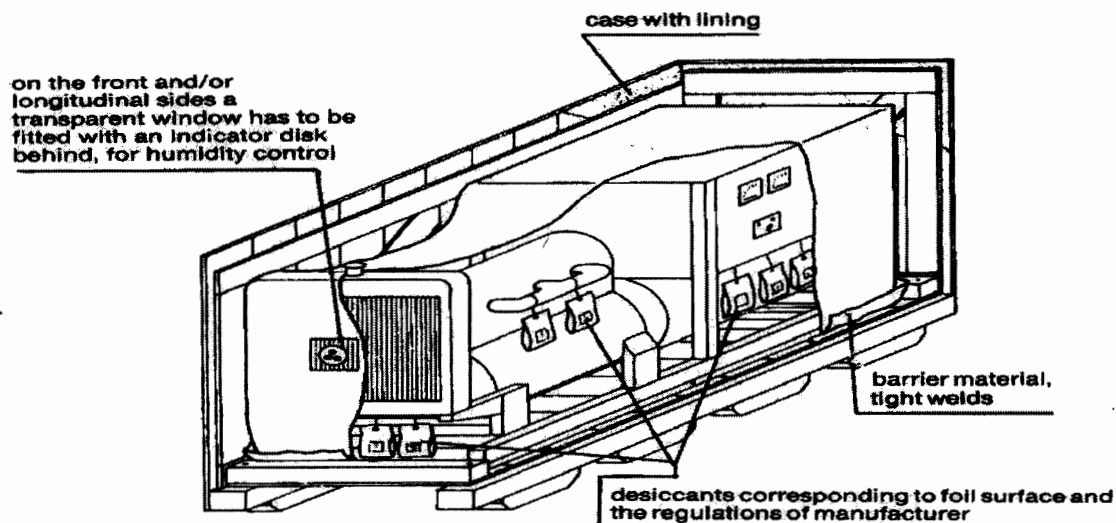
8.4.5.2 Type of Construction

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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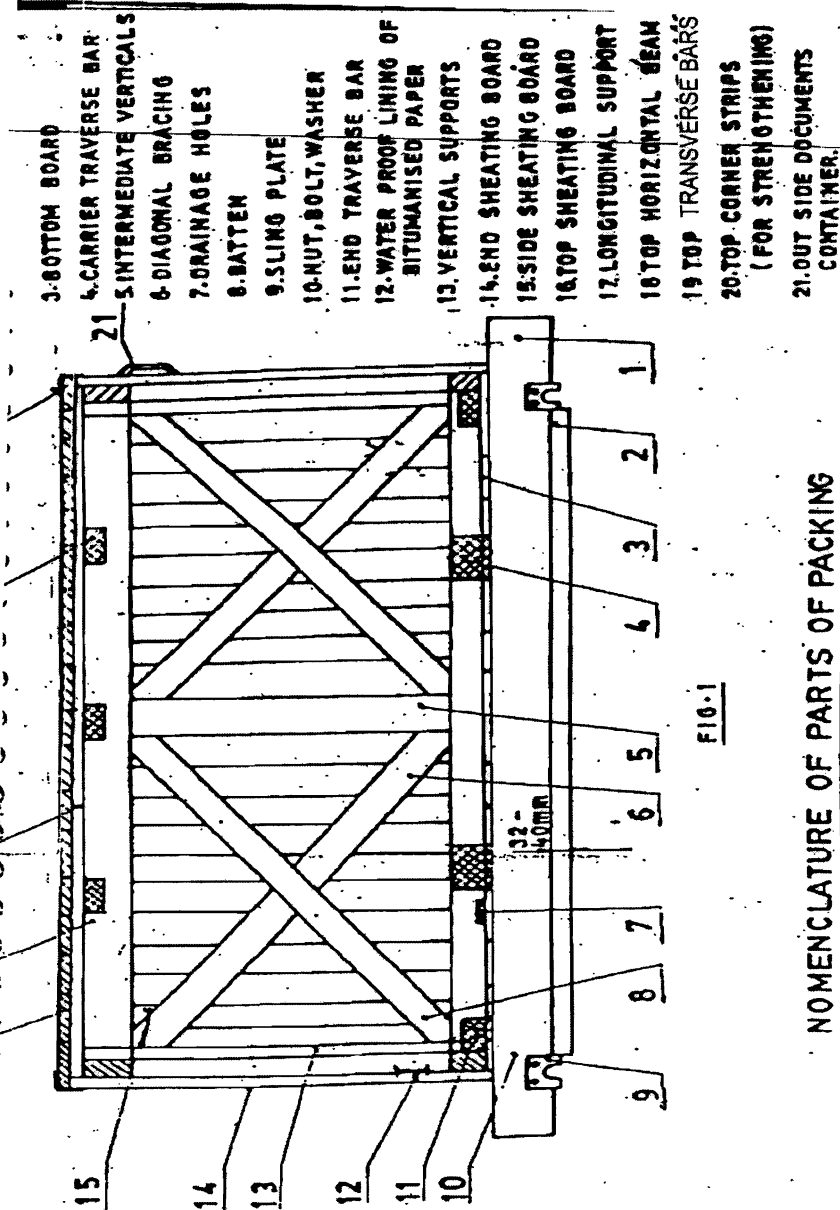


FIG-1

NOMENCLATURE OF PARTS OF PACKING

CASES

FIG-1

- 1 SLIDE
- 2 UNDER SLIDE BOARD

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BOTTOM FRAME ARRANGEMENTS

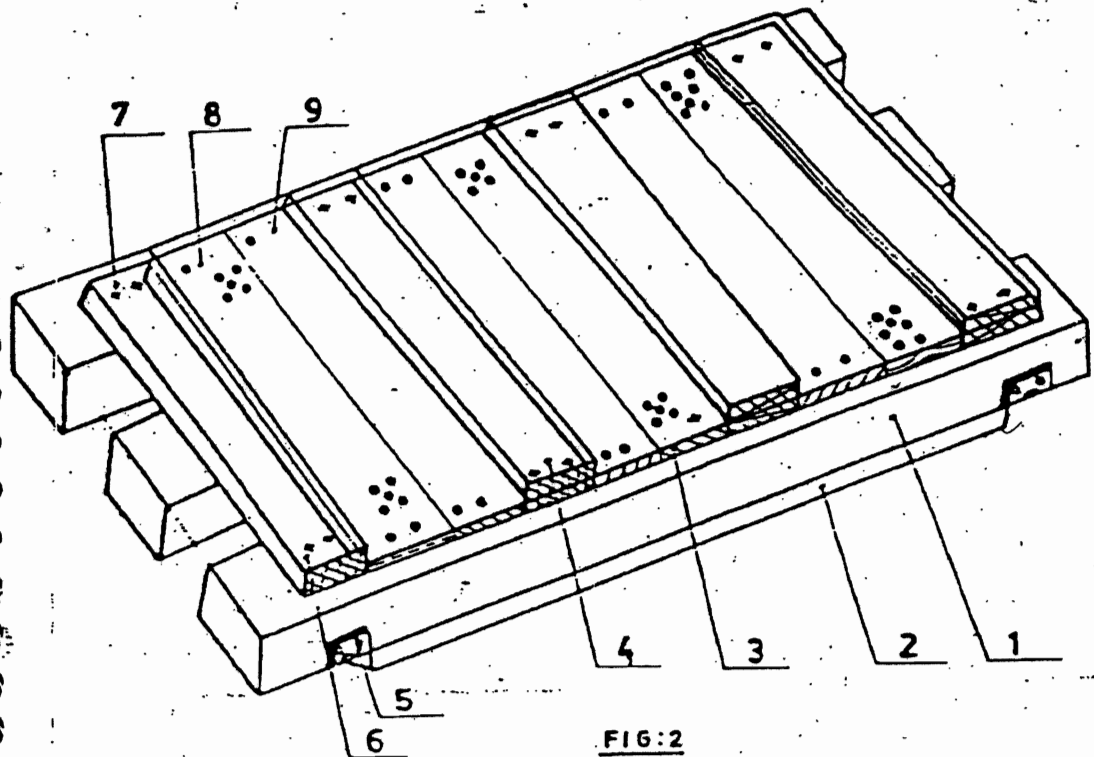


FIG:2

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 transverse 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

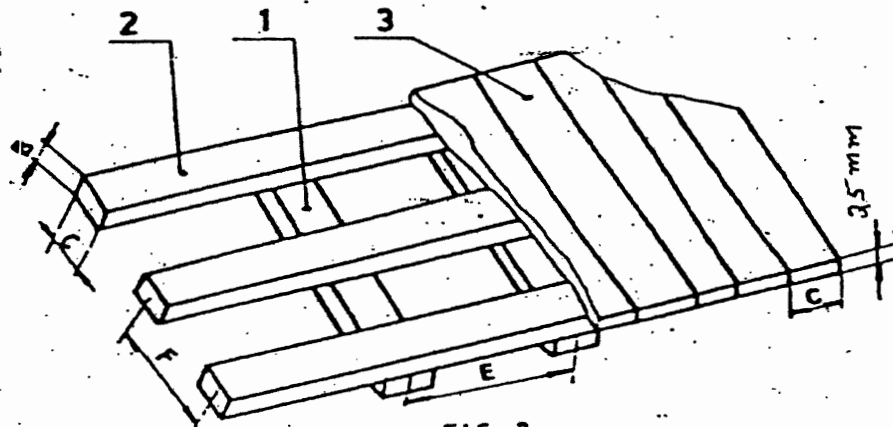
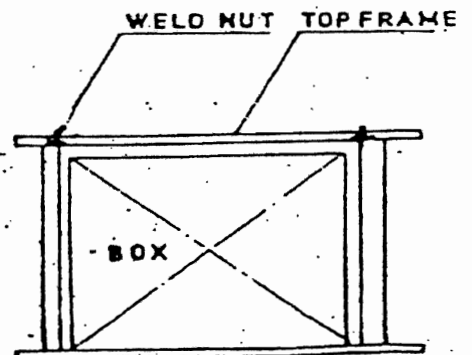
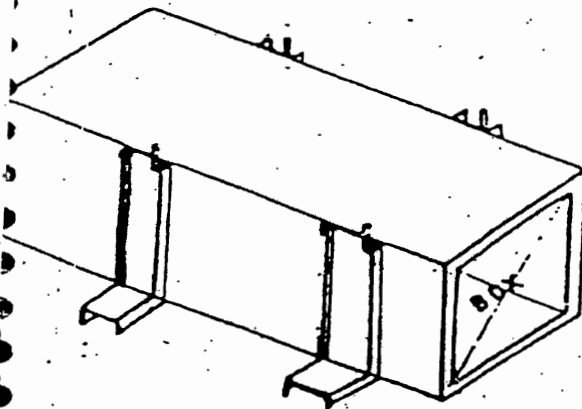


FIG-3

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

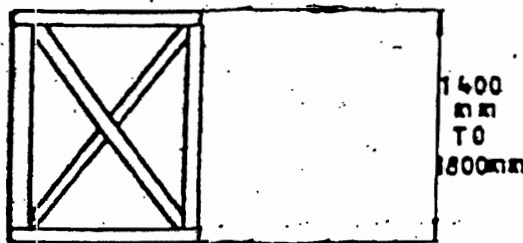


FIG:6

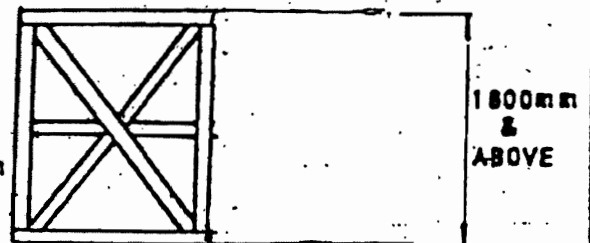


FIG:8

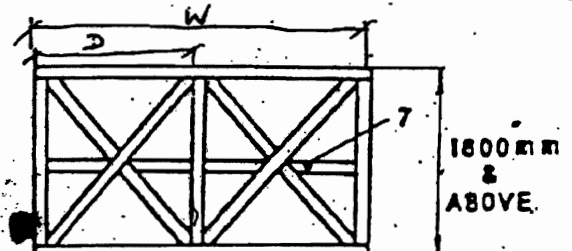


FIG:7

7- Middle Horizontal Support

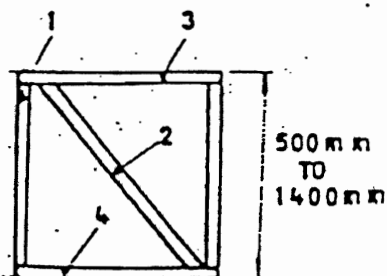


FIG:5

1- Vertical Support

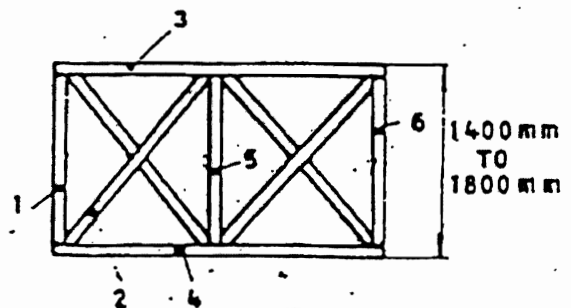


FIG:7

1, 5, 6 - Vertical Support

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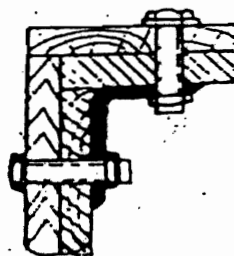
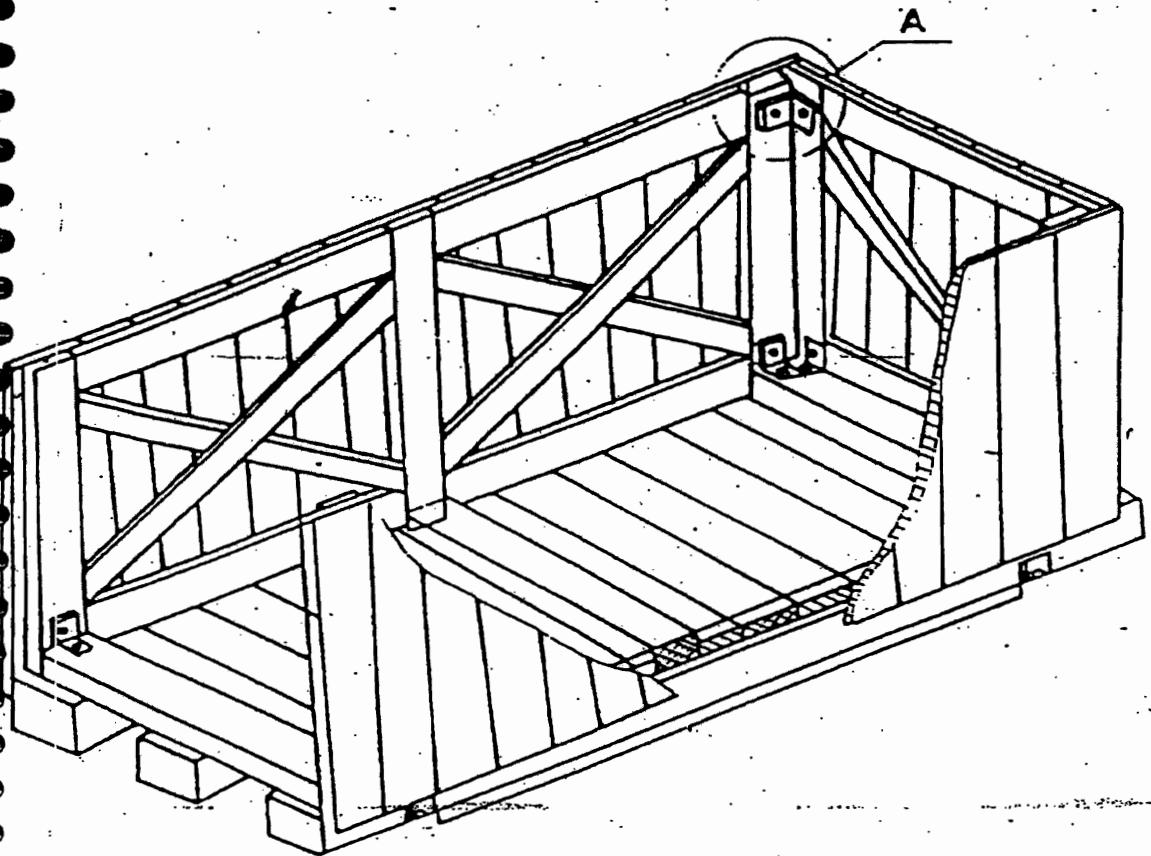
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ARRANGEMENT OF PACKING CASE



DETAIL-A

**HOLE DIAMETER
MUST CONFORM
TO BOLT DIA**

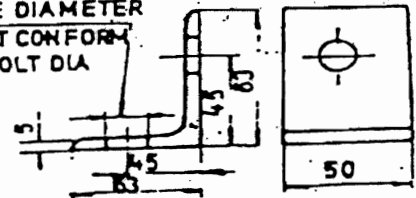


FIG:10

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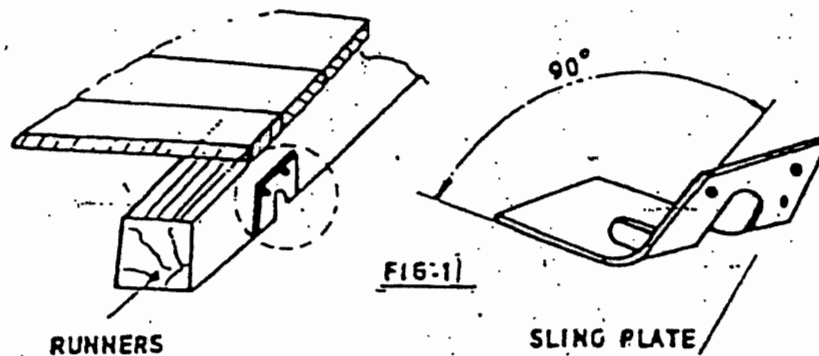
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**ARRANGEMENT OF SLING & PLATE ON
CASES**

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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

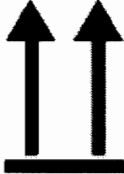
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Table-2

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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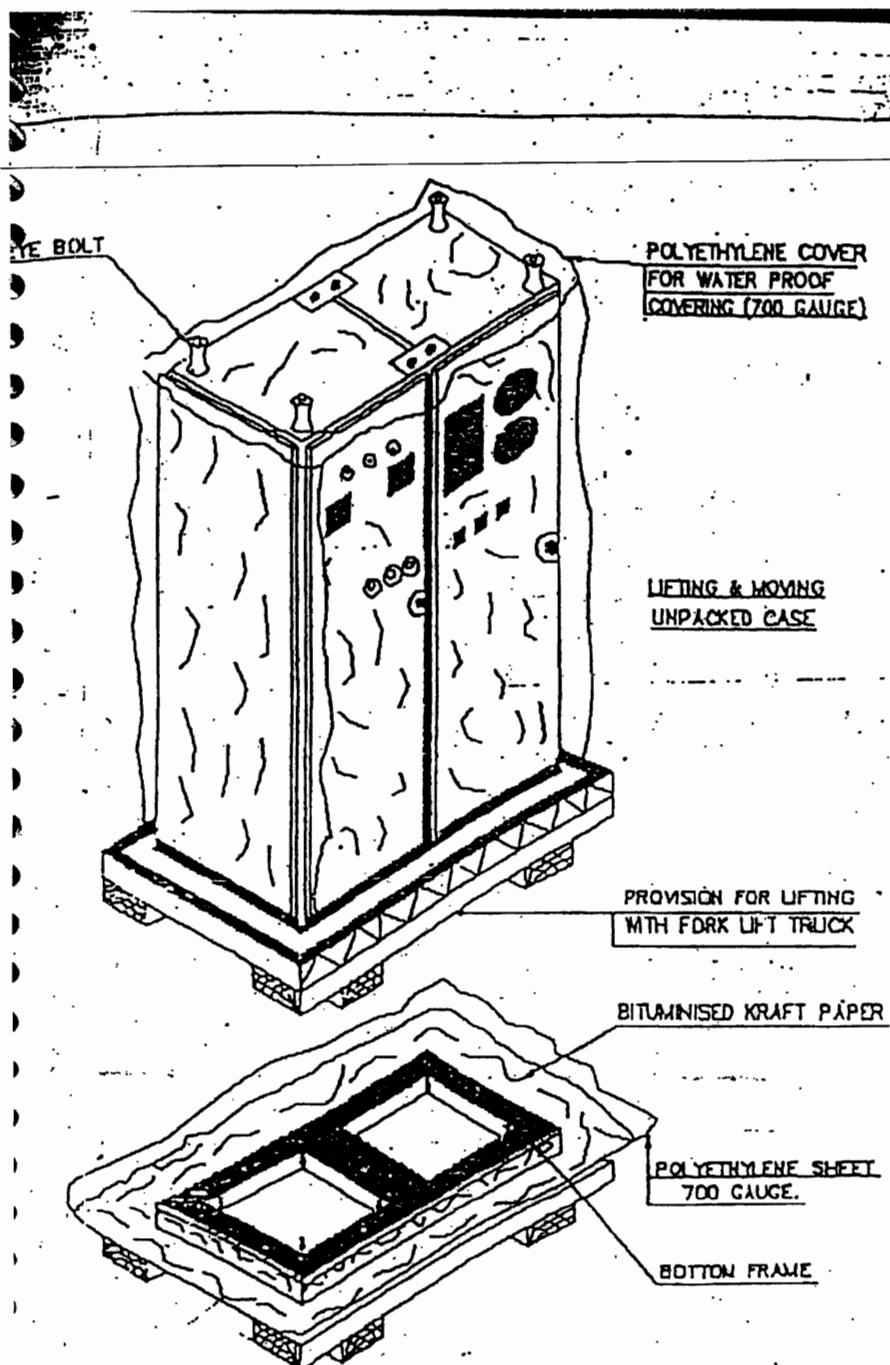


FIGURE-14



TITLE

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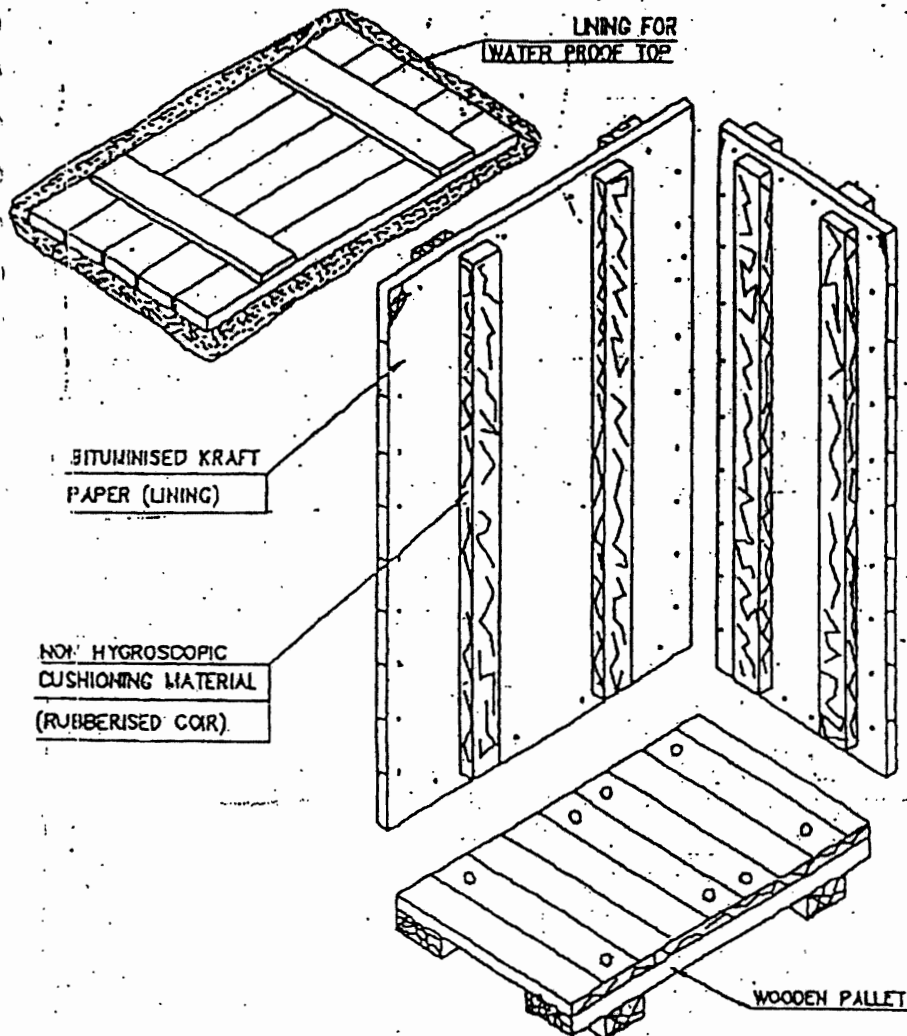
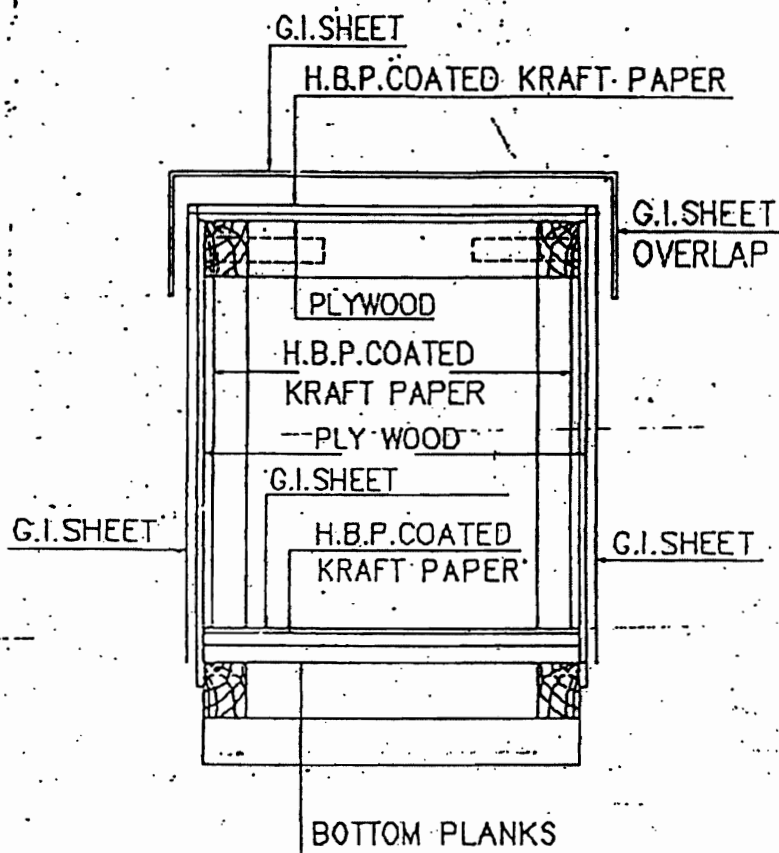


FIGURE-15

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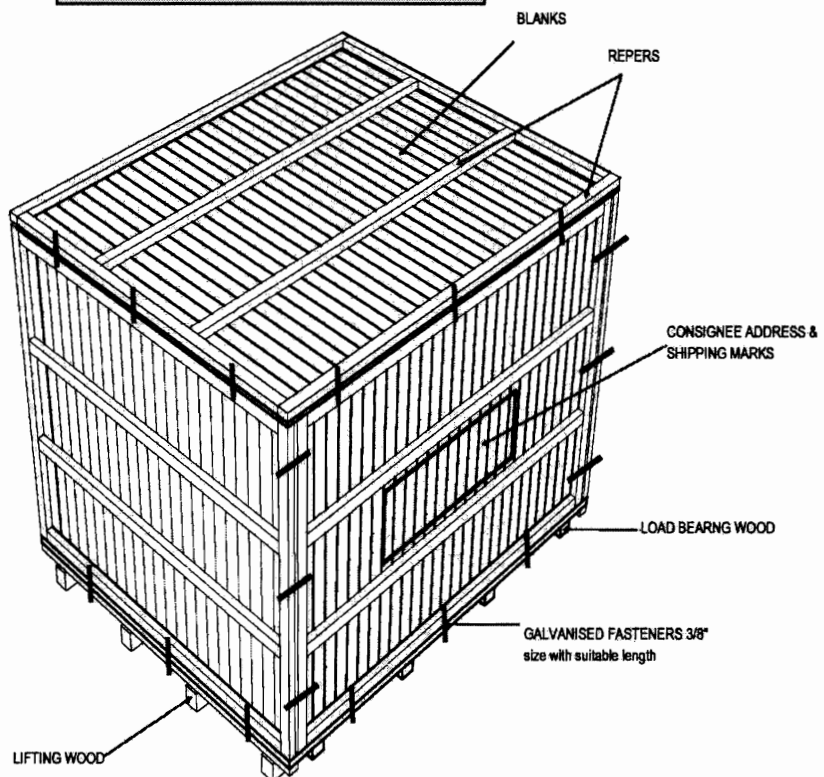
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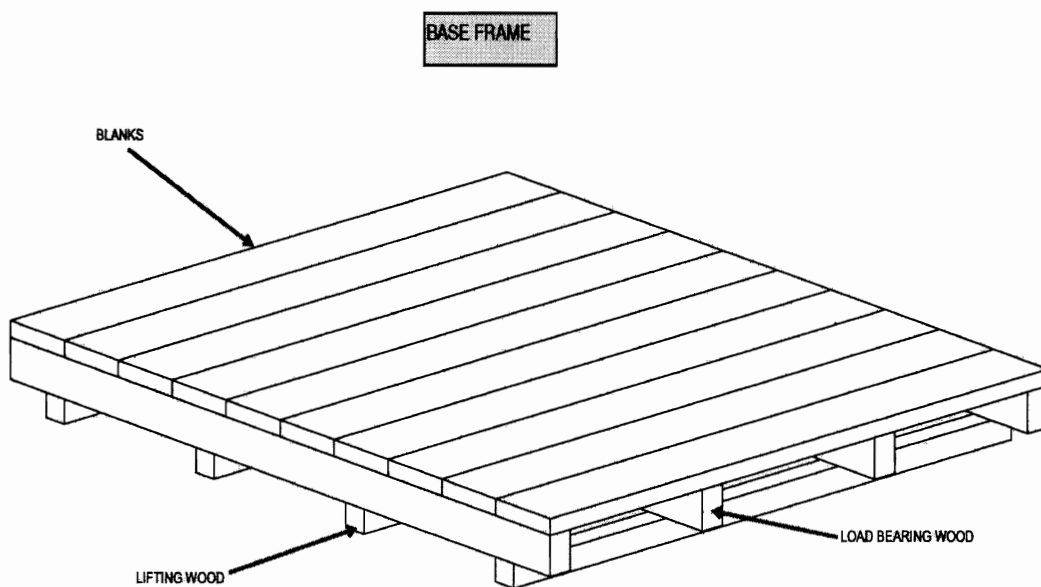
MODEL: FASTNERS TYPE (BASE, SIDE & TOP
ATTACHED WITH BOLT, NUT & WASHER)

This Type of case to be used for
following items:

1. BALL SEPERATOR
2. BALL COLECTOR SKID



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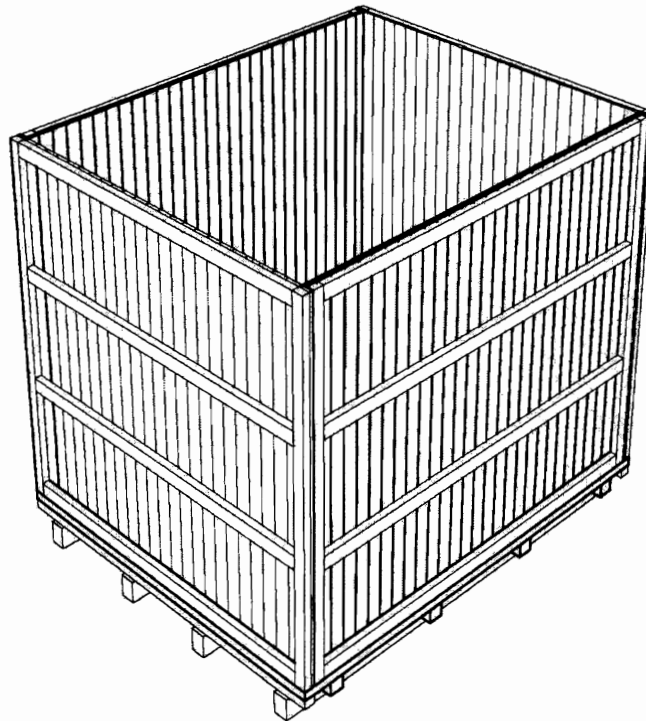
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MODEL: FASTNERS TYPE - WITHOUT TOP





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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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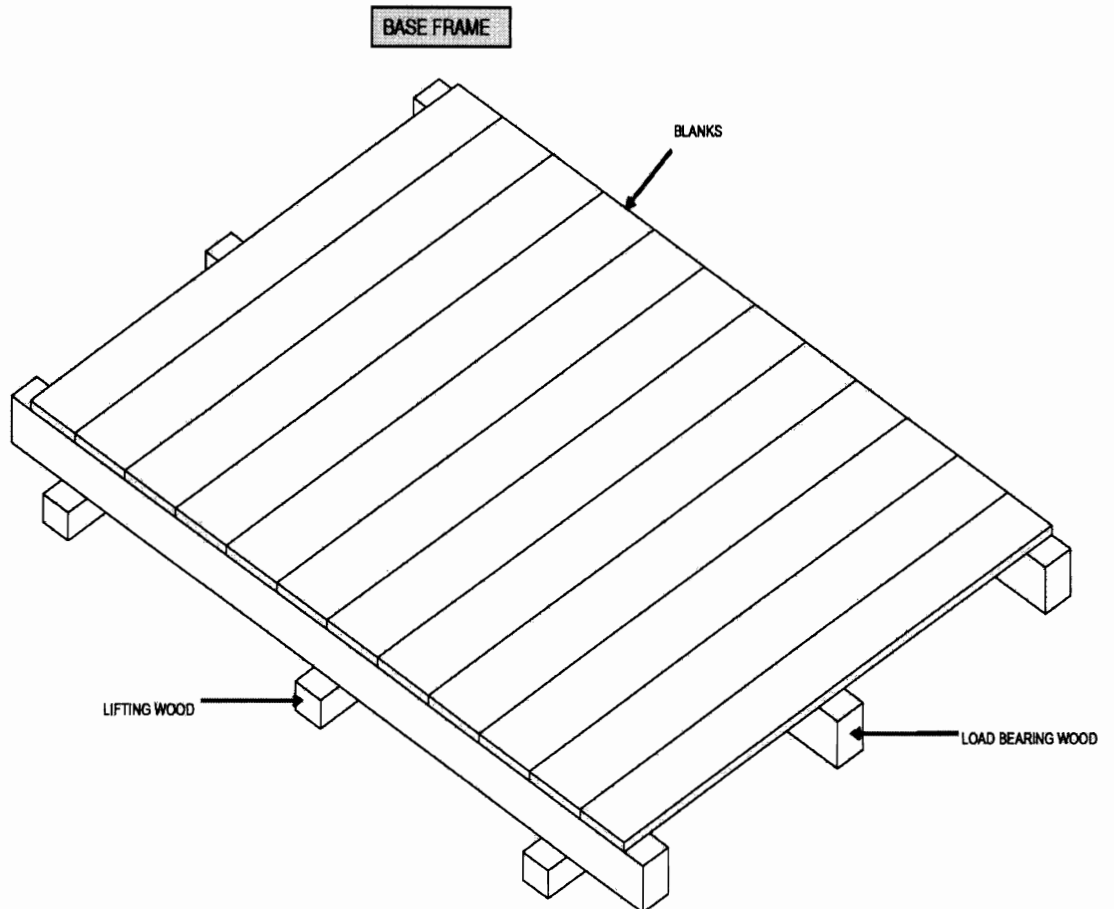
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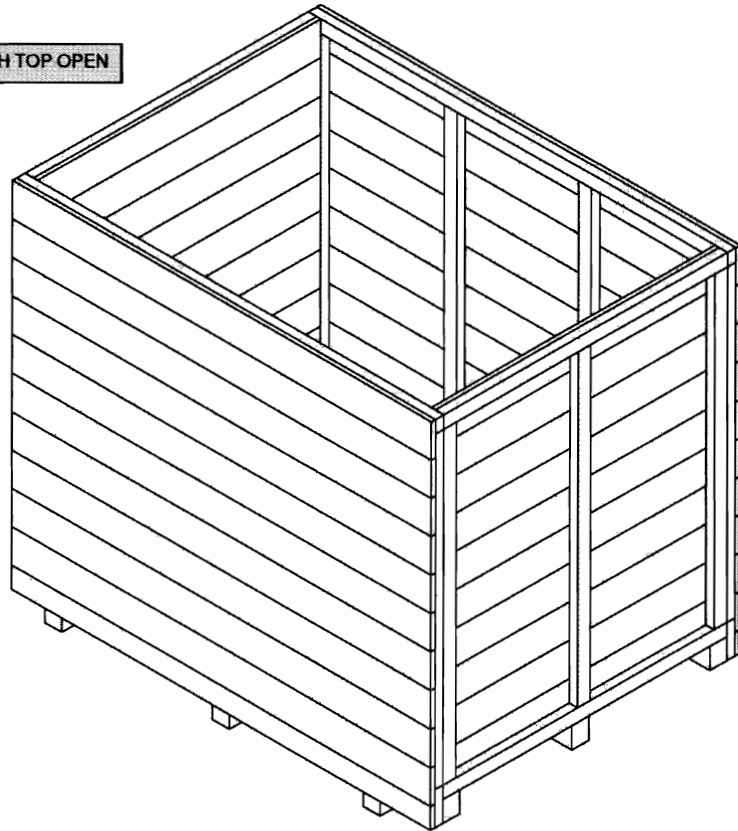
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NAILING TYPE MODEL WITH TOP OPEN



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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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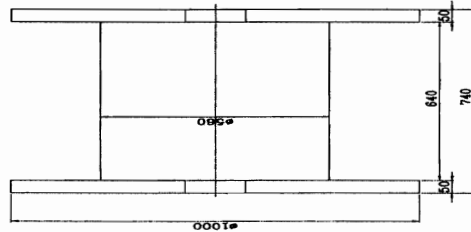
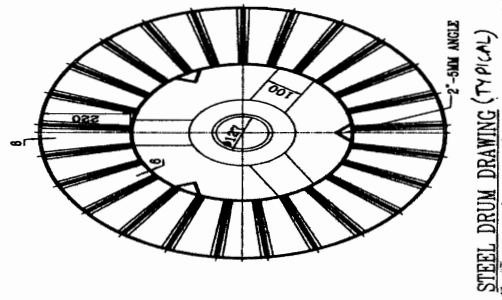
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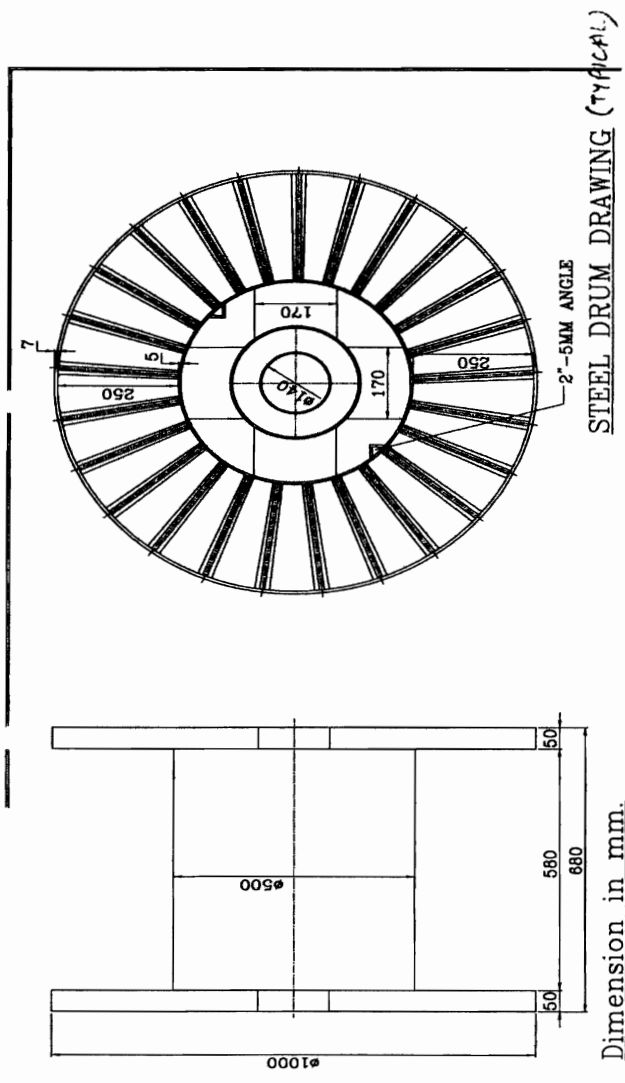
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Dimension in mm.

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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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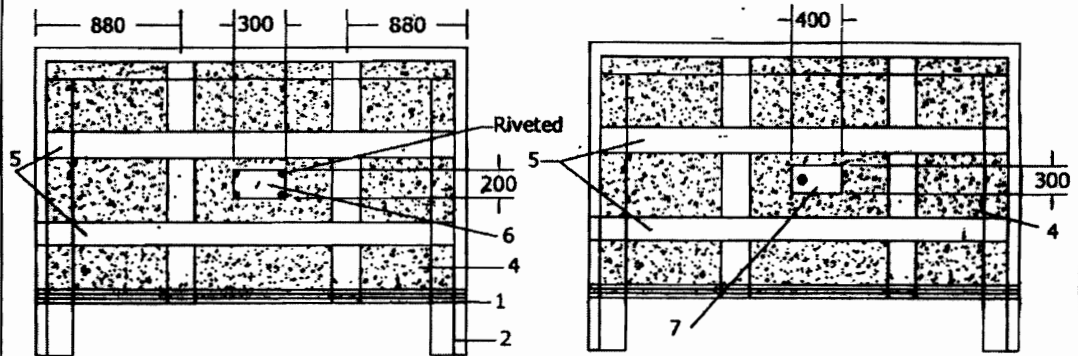
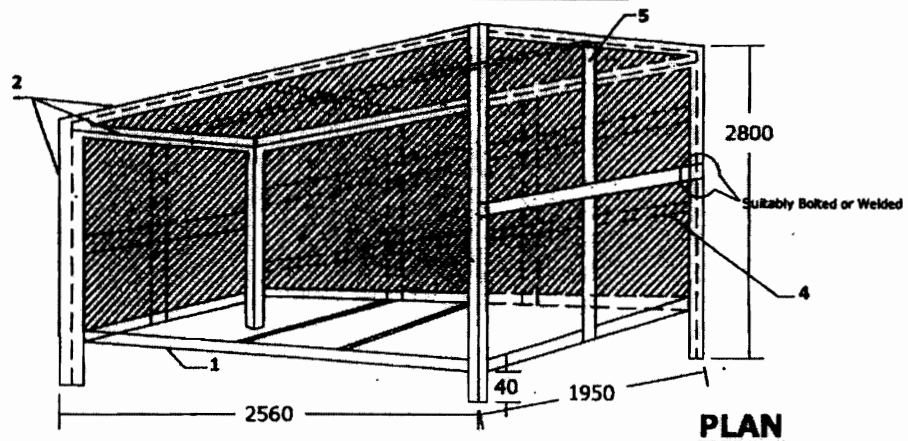
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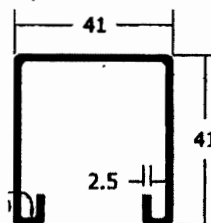
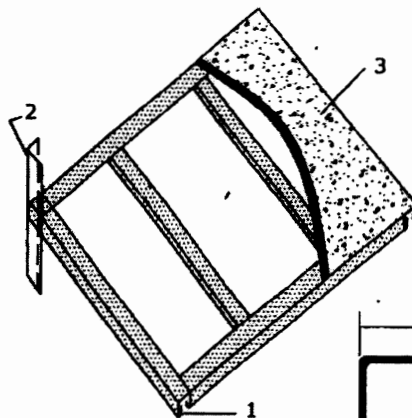
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STEEL PACKING (TYPICAL DETAILS)**Note:**

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.



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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

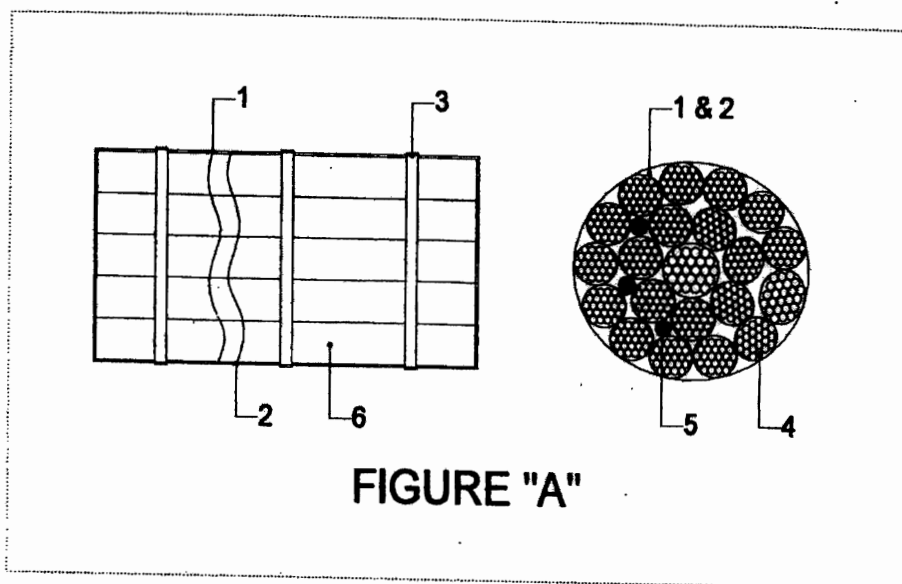


FIGURE "A"

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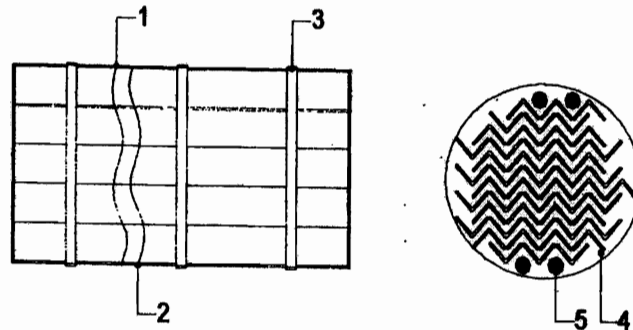
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PACKING PROCEDURE FOR STRUCTURAL STEEL**FIGURE "B"**

- 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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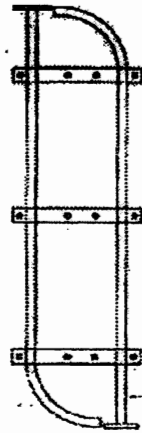
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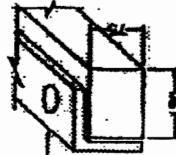
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packing procedure for poles



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

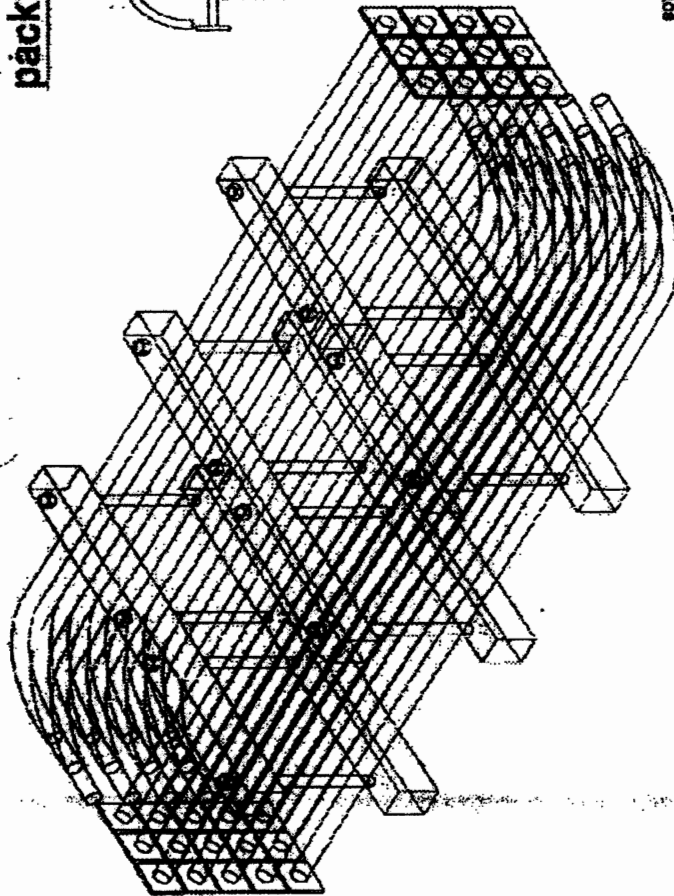


FIGURE "C"

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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

	TITLE TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS	SPECIFICATION NO. PE-TS-888-100-A001	
		VOLUME II B	
		SECTION D	
		REV. NO. 0	DATE 10/08/2010
		SHEET 52	OF 52

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.

Annexure-VIII Quality requirement and Sample QP

Quality requirement

- (a) Since this items comes under Sub-QR Category, hence inspection at vendor works is applicable by BHEL/BHEL TPI and UPRVUNL/UPRVUNL'S CONSULTANT as per UPRVUNL/UPRVUNL'S CONSULTANT Approved Quality plan.
- (b) Supplier shall submit the MQP in UPRVUNL/UPRVUNL'S CONSULTANT Format (Sample QP attached herewith) for approval of UPRVUNL/UPRVUNL'S CONSULTANT. We wish to submit that attached QP is indicative only. Stage inspection and Quantum of check may vary during final approval by customer (UPRVUNL/UPRVUNL'S CONSULTANT).
- (c) With respect to Sub QR Engg may kindly comment and take care of Proveness Criteria from UPRVUNL/UPRVUNL'S CONSULTANT Engg. UPRVUNL/UPRVUNL'S CONSULTANT inform that if the item is covered under Sub-QR List, the proposed vendors for the same shall be accepted by UPRVUNL/UPRVUNL'S CONSULTANT QA subject to clearance by UPRVUNL/UPRVUNL'S CONSULTANT Engg.
- (d) Painting shall be as per approved painting schedule.
- (e) In case of order placed on foreign vendors, vendor has to finalize Inspection agency from the List enclosed in Annexure 'A' at their own cost and carry out inspection as per the approved Quality plan. Vendor has to furnish BHEL the inspection reports and other documents required as per approved Quality plan duly signed by the Inspection Agency after their witness for our review and acceptance.

(Note: NTPC is the consultant for UPRVUNL)

Annexure-A

List of Third Party Inspection Agencies

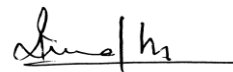
Sl no	Name of Third Party Inspection Agency
01	M/s Bureau Veritas
02	M/s TUV- Nord
03	M/s TUV- SUD
04	M/s TUV Rheinland
05	M/s Lloyds Register
06	M/s SGS
07	M/s Germanischer Lloyds
08	M/s Quest
09	M/s Certification Engineers International
10	M/s Intertek
11	M/s IR class Systems and Solutions
12	Ms/ DNV
13	M/s Fichtner
14	M/s ABS Inspection services

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: OXIDATION BLOWER SYSTEM: FGD						QP NO		FGS:722		
										REV. NO:		00		
										DATE:		12.02.2019		
												PAGE NO:		Page 1 of 2
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

1.1	Blower parts – (Casing Impeller Shaft etc.)	Chem.& Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Measurement Visual	1/Heat 100% 100%		Appd. Dwg./Datasheet		TC & IR	√	P P P	V - -	V - -	
1.2	Shaft	UT	MA	Testing	100%		ASME Section-V	Tech. Spec./ Manufacturer UT Procedure	UT Report	√	P	V	V	
2.0	CASING													
2.1	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%		Appd.Dwg.		IR		P	-	-	
2.2	Hydro test of Casing	Hydro test 1.5times of Max work pr for 30 min	MA	Measurement & Visual	100%		Appd. Dwg	No leakage	IR	√	P	V	V	
3.0	ROTATING COMPONENTS													
3.1	Machining of components	Dimensions Surface Defects(Rotor & Shaft)4	MA	Measurement MT/PT	100% 100%		Appd. Dwg.		IR		P	V	V	
3.2	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd. Dwg.		IR		P P	-	-	
3.3	Rotor Assembly	Dynamic balance test	MA	Measurement Visual	100%		ISO 1940	G 2.5	IR	√	P	V	V	
4.0	Blower Inspection													
4.1	Assembly	Dimensions, Completeness	MA	Measurement Visual	100%	100%	Appd. Dwg.		IR	√	P	W	W	Inspection at manufacturer works. *1 No. for NTPC 100% for
4.2	Performance Test	Volume, Power & Discharge Pressure	MA	Measurement	100%	100%	ASME PTC10	Approved data sheet / drawing	TR	√	P	W	W	
4.3	Mechanical Run	Noise	MA	Measurement	100%	100%	ANSI S5.1:1971	-DO-	TR	√	P	W	W	

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.
M: MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR(BHEL)/BHEL AIA
N: CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS
MA: MAJOR AND **MI:** MINOR

PREPARED BY



Rakesh Kumar Madhu,(SEr/QA)

REVIEWD & APPROVED BY

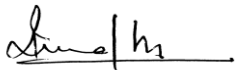


K C Gandhi Parimalam,(DGM/QA)

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: OXIDATION BLOWER SYSTEM: FGD						QP NO		FGS:722		
										REV. NO:		00		
										DATE:		12.02.2019		
												PAGE NO:		Page 2 of 2
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

	Test	Vibration Level	MA	Measurement	100%	100%	ISO 10816-7	-DO-	TR	√	P	W	W	BHEL
		Bearing temperate rise,	MA	Measurement	100%	100%	Approved Drawing /Data Sheet		TR	√	P	W	W	
5.0	BOUGHT-OUT PARTS (Gear Box)													
5.1	Heat Treatment of Gear Wheel	Hardness	MA	Measurement	100%		Approved Data Sheet/Drawing		TR	√	P	V	V	
5.2	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd.Dwg.		IR		P P	-	-	
6.0	FINAL BLOWER PACKAGE INSPECTION													
6.1	Final Complete Assembly	Dimensions, Completeness	MA	Measurement Visual	100%	01 No	Appd. Dwg		IR	√	P	W	V	
7.0	PAINTING													
7.1		Surface treatment and inspection	MI	Visual	100%		NTPC Approved Painting Schedule		IR	√	P	V	-	
7.2		Paint Quality – Colour & DFT Check	MI	Visual Measurement	10%				IR	√	P	V	-	
8.0	Review of QA Documents	Verification of QA Documents	MA	Verification	100%		As per Appd. MQP		IR	√	P	V	-	
9.0	Inspection before Delivery													
9.1	Packing	Size, appearance & Firmness	MI	Measurement Visual	100%		As per Appd. "Packing Procedure"		IR		P	-	-	

Note : Motor for Oxidation Blower is Separate MQP will be submitted for same.

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR(BHEL)/BHEL AIA N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS MA: MAJOR AND MI: MINOR	PREPARED BY  Rakesh Kumar Madhu,(Ser/QA)	REVIEWD & APPROVED BY  K C Gandhi Parimalam,(DGM/QA)
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2.06.02 Resistance Temperature Detector (RTD)

S.No.	Features	Essential/ Minimum Requirements
1.	Type of RTD	Four /Three wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2.	No. of element	Duplex
3.	Housing/Head	IP-65/Diecast Aluminum. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.
4.	Sheathing of RTD	Metal sheathed, ceramic packed
5.	Calibration and accuracy	As per DIN-43760/IEC 60751 Class-A for RTD
6.	Characteristic	Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7.	Accessories	Thermo well (as specified below) and shall be spring loaded for positive contacts with the well
8.	Standard	DIN-43760/IEC 60751 for RTD and ASME PTC-19.3 (latest edition) for Thermo-well.
9.	Sheath Material/ Insulation	316SS/Compacted Magnesium Oxide.

NOTES:

- 1) The specifications for RTDs of winding/ bearings of motor/ pump can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be PT100.



Annexure-X- Oxidation Air Blower P&ID

