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		PROJECT : 1X800 MW COAL BASED NORTH CHENNAI THERMAL POWER PROJECT STAGE III			
		CUSTOMER : M/s TANGEDCO			
		PURCHASE SPECIFICATION FOR (BALANCE) MECHANICAL LABORATORY INSTRUMENTS FOR C & I			
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		1.0 GENERAL REQUIREMENT 2.0 TECHNICAL SPECIFICATION 3.0 ITEM WISE SUB-VENDORS / MANUFACTURER LIST			
		REVISIONS :	APPROVED BY  ASHISH MANJHI		
			PREPARED BY  PANDU.K	ISSUED 416	DATE 29.11.2019



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SECTION- A

GENERAL INSTRUCTIONS TO BIDDERS:

Introduction: Bidders are required to offer Laboratory Instruments (C&I Package) in Power Plant applications as per BHEL Technical Specification (refer Section C).

1. All required documents against this Tender/Specification shall be submitted in English only.
2. In order to accept the Technical offers / proposals from Bidders for the project mentioned in this Specification (refer Sections C), certain Pre-qualification criteria are required to be met by Bidder.
3. Pre-qualification requirements are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details required for BHEL's acceptance.
4. In case Bidder does not submit Complete PQR Documents or the Documents submitted by vendor does not meet the PQR Criteria mentioned, offer of such bidders will be summarily rejected and will not be considered for Further evaluation in the tender.
5. Technical Bids of those bidders who meet the PQR Criteria shall be opened for Review and further consideration by BHEL.
6. Changes in technical specification scope / BOM, if any shall be informed to participating bidders only.
7. If a vendor does not quote for all the listed items, then his complete offer will be technically rejected. Please note that essence of this tender is packaging and hence all items within this project are to be offered so as to have one packaged vendor for this project.
8. **Evaluation methodology:** BHEL shall initially open Bidder's PQR documents only as per Section-B of this specification for review & acceptance. Only after acceptance of PQR documents, BHEL shall open Bidder's technical offers for evaluation.
9. Bidders are required to submit offers as detailed below:
AA). Documents pertaining to Pre-Qualification requirement (Section B of this Specification) shall be in a separate cover / soft-folder with reference no. "Section B" marked on it.
BB). Technical offers/proposals for the Project, whose requirements are mentioned in Sections C will be submitted in a separate cover / soft-folder with Project name & reference marked on it.
10. Vendors, without permanent vendor code in BHEL EDN are required to fill up online supplier registration format available in website <http://supplier.bhel.in/> at the time of submission of bids.
11. Name & registered address of The Bidder with Organization chart and contact details shall be submitted.
12. Bidder shall be responsible for complete package supply, installation / commissioning and satisfactory demonstration to customer. Wherever OEM representative to be deputed for commissioning bidder shall coordinate at his own cost and complete the work. Qualified technical persons shall only be deputed by the bidder for commissioning of the items in the package.
13. Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the vendor documents by End users / Customers, vendor shall accompany BHEL representative for discussions.
14. Bidders shall confirm to submit unit price of each instrument for each project as quoted; which shall be used for addition / deletion of items, valid for the tenure of purchase order from the date of bid opening, for the commercially successful offer.



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SECTION- B

Pre-Qualification Requirements (PQR) of Bidders for Laboratory Instruments:

1. Vendor should have supplied Lab instruments equipment to process plant/ refinery/ power Plant / nuclear plant / testing Lab etc.
2. Minimum One no. purchase order for Lab instrument equipment shall be submitted which should not be more than 5 years old from date of bid opening for establishing continuity in business.
3. The Bidder based outside India, who are making offer for this tender shall have authorised representatives in India for support related to documentation, commissioning & any other co-ordination work. Please provide supporting details.
4. Bidder has to submit letter of undertaking stating that they will take care of service Requirements till guarantee / warranty period / commissioning & Demonstration and handing over whichever is later for all items.
5. Bidder should have a clean track Record, i.e., the Bidder should not be under Hold or blacklist by any of the BHEL units/any Govt. of India PSU / Govt. of India as on bid submission date. To this effect a declaration should be given by the bidder.
6. **Important note:** - In case Bidder does not submit details mentioned in above clauses or meet the requirements of Pre-qualification requirements, Offers will be summarily rejected and Bidder's Technical offers/proposals will not be evaluated. Please read carefully the General instructions in **Section-A** of this specification.



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SECTION- C

GENERAL TECHNICAL REQUIREMENT

1. Testing instrument/devices offered shall be proven type and shall incorporate latest design.

The workmanship and design shall be in accordance with the best engineering practice and shall be such, as have proved to be suitable for the intended purpose and shall offer satisfactory performance even in the worst environmental conditions.

Testing instruments/devices shall be furnished with all necessary accessories whether specifically indicated herein or not.
2. i) All instruments offered, shall conform to the relevant IS or international standards.
Accuracy of the calibration instruments should be traceable to National or international standards indicating date of calibration and due date of calibration. Calibration and trace ability certificate shall be provided with the Lab instruments.

ii) The various instruments/devices, small tools, accessories etc., shall be furnished with suitable and durable boxes of convenient size, complete with necessary packing etc., in order to have safe storage when not in use.
3. Measuring/testing instruments, along with allied accessories shall be suitable for continuous operation (both indoor and outdoor installations as applicable).
4. The various equipment / devices, tools, accessories etc., shall be furnished (in applicable cases) with suitable and durable boxes of convenient size, complete with necessary packing etc. in order to have safe storage when not in use.
5. The Bidder shall supply testing instruments/ devices, specified hereinafter, for meeting the requirement of the power plant. The Bidder shall be responsible for proper functioning of supplied items. The Bidder shall also be responsible for erection and commissioning the test equipment where applicable.
6. It is obligatory to the Bidder to furnish a complete list of spare parts for these testing/calibrating, instruments /devices. The Bidder shall render guarantee for easy availability of all the spare parts required, especially for the components, which are prone to failure.
7. The Bidder shall repair the defective instruments/devices free of cost within the guaranteed period or replace the same if required.
8. Scope of service of the Bidder shall also include operational and service training of Owner's personnel at site.
9. Calibration and test certificates, as applicable, shall not be more than one (1) year old.
10. All electronic portable instruments shall be powered from rechargeable battery system. Battery charger suitable for the instrument shall also be supplied which can be in-built or standalone type.
11. Electrical power supply requirement of the instruments offered under this specification shall be 240 V AC, 50 Hz, single phase.
12. All the microprocessor based maintenance and calibration instruments shall have provision for data logging facility for keeping calibration/maintenance record with proper communication facility to down load these data on the Lab PC.
13. Packing shall be as per guidelines provided at BHEL specification ref. ED 049 00 92, rev. 05 attached herewith.

14. Calibration Standards

The calibration standards shall be traceable to the National Bureau of Standards of the United States of America, comparable Indian Standards, or to applicable standards existing in the country where the equipment is manufactured and tested. The Bidder shall elaborate in the proposal the standards followed for the equipment manufacturing and testing.



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A. TECHNICAL SPECIFICATION:

MECH-LAB-ITEMS (MECH-LAB-ITEMS, Qty. 1Set):

Following items to be offered:

1. Fluidized Temperature Bath (Microprocessor Based) (Qty. 2Nos):

Range	:	50°C to 700°C
Accuracy	:	± 0.1°C
Stability	:	+ 0.02°C to + 0.03°C
Power Supply	:	220/240 V AC, 50 Hz
Display	:	Dual display indicator and controller
Protection	:	Fuses, overheating protection with low Flow cutout, over pressure, alarms for low flow, blocked filter (with auto cutout) etc., designed to eliminate powder loss.
Accessories	:	Set of test cables Insertion tubes Carrying case Instructions for use Reference sensor for comparison calibration: Pt100 (1/10DIN accuracy), (-) 50 to 670degC.
Features	:	Sealed design of the bath with ceramic filter to ensure no alumina powder discharge / loss. The bath should also have capability to maintain Fixed Point Cells so as to check whether the RTD is suitable for undertaking the calibration or not.
Computer Interface	:	RS 232
Standards	:	Designed as per latest IEC safety standards.

2. Low Temp Portable Dry block type Calibrator (Qty. 1 No.):

Portable Dry Block type temperature calibrator with microprocessor based Controller heater shall be supplied for field calibration of temperature Instrumentation viz. T/C, RTD, switches, gauges, indicator, recorder, surface Sensors, IR thermometers etc. Calibrator shall be supplied in three ranges as Follow (One no. for each range):-

Instrument shall meet the following requirements as a minimum.

Range	:	-55°C from ambient temperature to 140°C
Type	:	Removable Insert type.
Stability	:	± 0.03°C
Uniformity	:	± 0.02°C
Measuring volume	:	Sufficient to allow calibration of sensors With thermos-wells and to avoid stem conduction error.
Serial Interface	:	RS232 with necessary software.
Accessory	:	Standard RTD traceable to International Standard, stirred liquid container kit, oil, TPW cell, Gallium Cell, surface sensor calibrator kit and black body target kit.

3. Medium temp Portable Dry block type Calibrator (Qty. 1 No.):

Portable Dry Block type temperature calibrator with microprocessor based Controller heater shall be supplied for field calibration of temperature Instrumentation viz. T/C, RTD, switches, gauges, indicator, recorder, surface Sensors, IR thermometers etc. Calibrator shall be supplied in three ranges as Follow (One no. for each range):-

Instrument shall meet the following requirements as a minimum.

Type	:	Removable Insert type
Range	:	35°C to 650°C
Stability	:	± 0.03°C
Radial homogeneity	:	± 0.081°C
Measuring holes	:	Bore size ranging from 5 mm to 15 mm
Accessories	:	Standard Thermocouple traceable to



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Calibration volume : International Standard, surface sensor calibration kit, black body target kit.
Sufficient to accommodate above bore sizes in single insert

4. High temp Portable Dry block type Calibrator (Qty. 1 No.):

Portable Dry Block type temperature calibrator with microprocessor based Controller heater shall be supplied for field calibration of temperature Instrumentation viz. T/C, RTD, switches, gauges, indicator, recorder, surface Sensors, IR thermometers etc. Calibrator shall be supplied in three ranges as Follow (One no. for each range):-

Instrument shall meet the following requirements as a minimum.

Type	:	Removable Insert type
Range	:	150°C to 1200°C
Stability	:	± 0.2°C
Radial homogeneity	:	± 0.2°C
Measuring holes	:	Bore size ranging from 5 mm to 15 mm
Accessories	:	Standard Thermocouple traceable to International Standard, surface sensor calibration kit, black body target kit.
Calibration volume	:	Sufficient to accommodate above bore sizes in single inser

5. Thermocouple Test Furnace (Qty. 1 Set):

Purpose : For testing & calibrating temperature sensors in particular thermocouples and resistance thermometers by comparative measurement. Specially shaped metal insertion pieces are matched to one another so that optimum temperature uniformity is achieved. Holes drilled in the insertion section accept the test probe (min. 6 nos.) and the reference sensors. The controller should be highly advanced with digital filter circuit ensuring high integrity of measurement correcting for drift, rejecting 50Hz pick-up and filtering out other sources of input noise.

Insertion length	:	up to 180 mm in a zone of constant temp.
Insert pieces material	:	Heat resistant steel for temperature up to 1000°C (Temp. difference inside the insertion piece 0.4 K)

Technical Data

a. Connection voltage	:	240V, 50 Hz
b. Power connection	:	3 KW (approx.)
c. Maximum temp.	:	1100°C x 1200°C
d. Temperature constancy	:	Approx. ± 0.1 K over an hour Approx. ± 1 K over one day
e. Accuracy	:	± 0.25 deg. C at 1000 deg. C

Accessories:-

a) STANDARD 'S' TYPE THERMOCOUPLE WITH COLD JUNCTION

T/C Type	-	S (Platinum Vs Platinum 10% Rhodium)
Uncertainty	-	0 to 1100°C – 0.9°C 1100°C to 1300°C – 2.2°C
Hot sheath temperature Range	-	0°C to 1600°C
Hot Junction measuring assembly	-	7mm dia. x 300mm long gas tight 99.7% recrystallized alumina sheath
Cold Junction	-	4.5mm dia. x 250mm long stainless steel sheath
Copper Extension wire	-	2000mm thermos-electrically free multi-strand (Teflon coated)
Immersion	-	100mm min
Response time	-	5 minutes min
Calibration Certificate	-	6 point calibration from accredited lab with National/International traceability
Carrying case	-	To be supplied



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b) ICE POINT REFERENCE SYSTEM FOR THERMOCOUPLES

The Temperature Reference Unit should provide a stable and accurate 0°C or elevated Reference Temperatures between 45°C and 70°C for providing thermocouple referencing as per ISO9000 and should be suitable for referencing of up to 50 thermocouples.

This system should be compact in design.

It should be a self-contained solid state unit utilizing peltier technology which provides maintenance free operation and features rapid cool down from high ambient temperatures and becomes stable within 10 minutes from switch on.

An alarm should be there which should get activated if the reference temperatures deviates by more than 0.2°C.

Thermocouple Reference Junctions should be located in a reference block and connected to their respective input and output terminals in an isothermal enclosure which has a uniform temperature throughout thereby ensuring no thermoelectric EMFs at the terminals.

Accuracy	:	±0.03°C
Feature	:	Errors introduced by thermocouple loading can be removed by Adjusting controller offset.
Stability	:	±0.05°C at 20°C ±10°C
Ambient Range °C	:	2°C to 65°C
Stabilizing time	:	10 minutes from 44°C
Thermocouple Capacity	:	Up to 50 Double Junction Channels
Monitor / Fitted PRT	:	4 wire Connected PT100, 1/3 Din, ±0.1°C Accuracy
Alarm facilities	:	Non-latching relay rated 5 Amps 240V



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D. BILL OF MATERIAL:

SL. No.	Item Description	Certification	UOM	Quantity
1	Fluidized Temperature Bath	Test .Report	NO.	2
2	Low Temp Portable Dry block type Calibrator	Traceable CC	NO.	1
3	Medium temp Portable Dry block type Calibrator	Traceable CC	NO.	1
4	High temp Portable Dry block type Calibrator	Traceable CC	NO.	1
5	Thermocouple Test Furnace	Test Report from OEM	ST.	1

Legends:

OEM: Original Equipment Manufacturer



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E. SUB-VENDOR / MANUFACTURER LIST:

SL NO	Lab Instrument	MAKE
1	Microprocessor based Fluidized Temperature Bath	Scandura, Tinsley, BEAMEX, Jofra, Isotech, Nagman
2	Low, Medium & High temp Portable Dry block type Calibrator	Scandura, Tinsley, BEAMEX, Jofra, Isotech EUROTRON INSTRUMENTS-ITALY, EUROTRON INSTRUMENTS LTD-UK, AMETEK- DENMARK/USA, Nagman Chennai, Wika Instruments-Germany
3	Thermocouple Test Furnace	Isotech, Scandura, Beamex, Jofra HART SCIENTIFIC- USA (FLUKE), EUROTRON INSTRUMENTS LTD –UK, AMETEK- DENMARK/USA, Wika Instruments-Germany, Nagman Chennai

Note:

- 1.0 Discussions will be held only with participating bidders.
- 2.0 Package vendor shall offer items from their principals. Only where items are not available then items can be chosen from one of the approved makes.



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REVISION HISTORY SHEET

REV NO.	DATE	NATURE OF CHANGE	REASONS	CHANGED BY	APPROVED BY
00	11/05/1995		-	VS, SHG	NJ
01	05/06/1995	ANNEXURE ADDED	ACCEPTANCE CRITERIA INCLUDED FEED BACK FROM QUALITY	SHG	NJ
02	06/03/1997	CL.6.4.1 ALTERED	FEEDBACK FROM SHIPPING	SHG	NS
03	20/12/1999	IS YEAR OF ISSUE REMOVED	-	CCR	NS
04	15/12/2009	INCLUSION OF MR GRADE PLYWOOD SHEET FOR PACKING (Commercial Grade)	FEEDBACK FROM SHIPPING & GENERAL REVIEW	PGD / KPN	MSR
05	21/03/2013	Inclusion of recommendations pertaining to spares in page-12&26	Recommendations from Corporate systems & IT	HRN	MS

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APPROVED: M. Sivaramaiah

PREPARED: PGD/KPN ISSUED: STDS GROUP DATE: 30/03/13



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1. **PURPOSE:** To describe the materials and procedure for Packing.
2. **SCOPE:** Applicable for packing of control cubicles, loose items, spares of Control Equipment and Transmission System Control products.
3. **MATERIALS**
 - 3.1. **WOOD**
 - 3.1.1 **For Inland contracts:**
 - 3.1.1.1 Plywood of Boiling Water Resistance (BWR) grade and termite, fungus proof as per IS: 303 of 12 mm thick for control cubicles, single and multi cubicles, loose items and spares cases. The plywood shall be bonded with high Quality Phenol Formaldehyde Synthetic Resin and specially treated with preservatives to repel termites and wood destroying organisms. The plywood shall with stand the stress caused by cyclic changes in weather conditions. It shall be durable and resistant to heat, sun and moisture. The sheets such procured shall have IS mark IS 303 and BWR grade stamped on it.
 - 3.1.1.2 Silver oak wood of cross section 45x45 mm as support battens for Loose items, spares and single suit, two suit, three suit Cubicles and 70x45 mm for longer sections to be used. These Silver oak wood battens shall be treated with ASCU solution as defined in 4.0. In the case of plywood, treatment with ASCU solution need not be done.

Alternative to silver oak battens, Plywood support battens of suitable cross section and combination of thickness can also be used as per clause 3.1.1.4

APPROVED : M. Sivaramaiah

PREPARED:
PGD/KPN

ISSUED: DATE:
STDS GROUP 30/03/13

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3.1.1.3

Plywood for general purposes i.e. moisture resistance or MR grade (Commercial ply wood) and termite, fungus proof as per IS: 303 of 9 mm / 12 mm thick for control cubicles, single and multi cubicles, loose items and spares cases. The plywood shall be bonded with high quality Phenol Formaldehyde Synthetic Resin and specially treated with preservatives to repel termites and wood destroying organisms. The plywood shall withstand the stress caused by cyclic changes in weather conditions. It shall be durable and resistant to heat, sun and moisture. The sheets so procured shall have IS mark IS 303 and MR grade stamped on it. 9 mm thick plywood can be used with additional plywood support/ reinforcement suitable battens both for small cases and also for panels. Support batten as indicated at 3.1.1.4 shall be used.

Sample drawings of panels & loose boxes are attached for ready reference.

[Fig : 10 to 13]

3.1.1.4 Support Battens:

Ply wood sheet of cross section 18 mm x (100 mm) for support batten for loose items, spares, and plywood sheet of cross section 18 mm thk x 100 to 150 mm width as support batten for standard panels up to 2450 x 1350 x 2500 mm panels. Support batten of plywood cross section 12 thk x 75 to 100 mm can also be used for small cases apart from 18 mm x 100 mm cross section. These plywood support battens can also be used in place of silver oak support battens as referred in clause 3.1.1.2. Additional support battens/ cross battens of suitable sizes are to be provided on need basis.

Sample drawings of panel's i.e. single suit, two suite and three suit cubicles are attached for ready reference [Fig: 10 to 13].

Special support battens for Rlys and similar panels:

Plywood of cross section 18 mm x 75mm x 3 no's at both bottom end and top end of front and back shock's , and also at top portion of both corner shock's for fixing with bolt and nut/ clamps, and 18 mm x 150 mm x 2 nos cross section as support batten/ slanting reinforcement batten on all sides. On need basis 18mm x 125 mm x 2 to 3 no's of plywood cross section can also be used additionally depending upon the size and weight of the panel.

Plywood shock's can be fixed with both Bolts and mechanical latching clamps or combination of both as the case may be.

Sample drawings of panels are attached for ready reference.

[Fig : 8 & 9]

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3.1.2 For Export Contracts

- 3.1.2.1 Plywood of Marine grade as per IS: 710 of 9 / 12 mm Thick for control cubicles of single / two / three suite for loose items and spare cases. For suit of four and longer cubicle sections, 19mm thick is to be used.

It shall be highly resistant to attacks from fungi, termites and wood destroying organisms including marine borers. The plywood shall withstand the stress caused by cyclic changes in weather conditions. It shall be durable and resistant to heat, sun and moisture. The sheet shall have IS: 710 and marine grade marking.

3.1.2.2 Same as clause 3.1.1.2.

- 3.1.3 BHEL EDN will be carrying out test on ISI marked ply Wood whenever required.

- 3.2 Fasteners: M8 x 130 mm and M8 x 150 long zinc plated Bolts and M8 zinc plated nuts for fixing, and spring Washers or suitable size can also be used.

- 3.3 Nails: Nails of dia 3.15 mm and about 40 mm for nailing of plywood and silver oak batten. Suitable smaller size is to be used for other nailing.

- 3.4 Polyethylene sheet: The polyethylene sheets are used to make covers for the jobs individually. The material shall have a minimum thickness of 0.175 mm (175 microns).

The polyethylene sheet shall be clear and transparent manufactured out of virgin material. Reprocessed material shall not be used.

- 3.5 Bituminised water proof kraft paper - used for lining the inside of shookees of cubicles.

- 3.6 Bitumen coated Hessian polyethylene kraft paper used for lining the inside of top cover for cubicles and all inner and top sides for small boxes.

- 3.7 Rubberised Coirs- used for cushioning and to fill the gap inside packing boxes. The coir shall be about 100 mm wide and 25mm thick.

- 3.8 Foam rubber/U Foam - This is used for covering the delicate items. This material is normally provided by BHEL.

- 3.9 Thermocole (Expanded polystyrene) sheets - This is used for covering delicate items. This material is normally provided by BHEL.

- 3.10 Silica gel - shall be of indication type to conform to IS: 3401: shall be blue in colour while usage.

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

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BHEL-EDN		BANGALORE-560026
SILICA GEL		
INDICATING TYPE		
BLUE	: ACTIVE	
ROSE	: REDUCED ACTIVITY	
WHITE	: NO ACTIVITY. TO BE REPLACED	WITH FRESH
	SILICA GEL	

- 3.12 Cotton / Plastic tape-This is used for tying small items and also to prevent vibrations of moving parts within the cubicles.
- 3.13 Polyethylene bags - These are to be used for keeping the packing slips. The bag shall be of size 70 mm X 100 mm (minimum).
- 3.14 Hessian cloth, twine thread, paint will have to be used in packing certain items.
- 3.15 Marking plate - This shall be of anodized aluminium sheet. Details and specifications are given in Fig-3.
- 3.16 Marking ink - Ink used shall be normally black in colour. The ink shall be indelible, non fading and non washable in water.
- 3.17 Packing Slip Holder - This shall be of galvanised iron tinned sheet / aluminium sheet.
- 3.18 Mechanical Latching clamps : For CLW Railway panels and similar Panels self locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. Sample drawing attached [refer Fig.7]. For reusable boxes, these clamps provides easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.
- 3.19 Flex/Vinyl digital print media for labeling:
Labels made out of Flex/Vinyl/ other digital media shall be used for export contracts & some prestigious domestic contracts on need basis apart from existing present marking/ labeling system.
- 3.20 Aluminium foil for packing:
On need basis, suitable size & thickness of aluminium foil shall be used for packing of electronic panels and loose items for both indigenous & export contracts.
- 3.21 Pallets :
All cubicles are mounted on the pallets by BHEL. For loose items, HMI items & small cabinets for which no pallets are available, suitable size pallets have to be arranged by the contractor.

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4.0 Chemical treatment for silver oak preservation

- 4.1 The silver oak battens are to be treated with ASCU solution. For plywood wood treatment is not required.
- 4.2 The chemical used shall be ready mix ASCU paste. This consists of Arsenic, copper sulphate, sodium dichromate. This paste shall be mixed at the rate of 1 kg of paste per 10 liters of water. Alternate to this CCA can also be used as indicated at para 4.4
- 4.3 The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000 liters of solution shall be constructed. The solution shall be prepared in the presence of BHEL- EDN's representative by contractor. The wooden battens shall be soaked in the solution for a minimum of 12 hours.

The solution shall be replenished after treating a maximum of 12 cubic meters of wood for 2000 liters of solution. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, quantity of wood treated and the details of replenishment.

Samples of solutions [only paste before mixing] shall be tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The solution [paste] shall be tested as and when required.

4.4 Specifications for water soluble type wood preservatives: Copper - Chromium - Arsenic [CCA]:

Copper - Chromium - Arsenic preservative formulation shall be as per IS : 10013 Part - II - 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

Arsenic Pentoxide	$As_2O_5 \cdot 2H_2O$	12.5
Copper Sulphate	$CuSO_4 \cdot 5H_2O$	37.5
Sodium Dichromate	$Na_2Cr_2O_7 \cdot 5H_2O$	50.0
Or		
Potassium Dichromate	$K_2Cr_2O_7$	

- 5.0 Jointing of plywood- to the extent possible, single plywood sheet shall be used in case of equipment of large size, jointing is allowed as bellow.
- 5.1 The joining shall be as close to the center of equipment as possible, but not less than 500 mm from one edge.
- 5.2 While joining (2 or more plywood sheets), care shall be taken to fix the sheets in the direction of the grain structure.
- 5.3a For joining Plywood and Silver oak wooden batten:
While joining, 2 sheets shall be kept close to each other and treated

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silver oak batten of 100 mm width and 45 mm thick to be used and nailed to both plywood sheets alternately (2 numbers) in zig-zag manner.

5.3b For Joining plywood with plywood sheets :

While joining, 2 sheets shall be kept close to each other and plywood sheet batten of minimum 100 to 200 mm width and 18 mm thick to be used depending upon the size of the box/ case and nailed to both plywood sheets alternately (2 numbers) in zig-zag manner. Suitable size nails to be used.

5.4 Jointing of silver oak batten : Only single length silver oak batten shall be used. In case of height or width of equipment is more than 2400 mm, jointing of batten is acceptable. The jointing of batten shall be such that two batten are kept together and one more batten of width & length of about 200 mm to be nailed on both the planks as in Clause 5.3 above.

5.5 The above jointing is to be done close to center of equipment.

6.0 Packing procedure

6.1 Packing of cubicles for inland contracts.

6.1.1 Packing to be done using materials given in clause 3.0.

6.1.2 The cubicles are fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets.

6.1.3 Loose parts : All loose parts in the cubicles, shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

6.1.4 Additional loose items which may be kept inside the cubicle.

- a. The components which are removed from cubicle for loose shipping, such as meters shall be kept inside the cubicle individually kept in wooden box and tied firmly to the bottom of cubicle.
- b. Other items which are given loose in addition to cubicle, shall be packed in separate boxes (like cables).
- c. For transformer cubicles loose items shall be packed in separate boxes and these boxes may be tied firmly in bottom of cubicles.
- d. Items which are bigger in size such as impulse tubes may be kept at the top of cubicles firmly bunched and tied.

6.1.5 Wooden batten : This batten shall be silver oak wood .In case of Cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/ battens of proper size shall be provided to give strength to the package.

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- 6.1.6 Silica gel: Silica gel (as in 3.10) packed in cotton bag (as in 3.11) shall be kept at different place inside the cubicle as per BHEL-EDN directions. Each suit of cubicle shall provided with 1 kg of silica gel (for a suit of 4 cubicles, 4 kg of silica gel shall be used).
- 6.1.7 Polyethylene sheet covering: Cubicles shall be covered with polyethylene petticoat (sheet as in 3.4). This shall be tailor made to fit the cubicle. The sealing shall be such as not to allow any moisture to enter the cubicle. This sheet is to be folded to the bottom pallet with wooden planks on 2 larger sides.
- 6.1.8 After completion of this, the arrangement is as shown in Fig.1.
- 6.1.9 Rubberised coir: (as in 3.7) to be nailed from inner side of plywood after pasting kraft paper for full length with a pitch less than 500mm with a min. of 2 rows of cover is to be used.
- 6.1.10 Bituminised water proof kraft paper: (as in 3.5) to be pasted with glue on 4 inner sides of plywood. Whenever 2 pieces of kraft paper are used, the joint shall have an over lap of min 20 mm.
- 6.1.11 Bitumen coated Hessian polyethylene kraft paper (as in 3.6) to be nailed using nails (as in 3.3) on top cover inner surface. This sheet shall project outside on 4 sides by atleast 100 mm and shall be folded and nailed on to the sides. Joining of 2 sheets shall have an overlap of min 20 mm.
- 6.1.12 After completion of above steps, the arrangement shall be as given in Fig.2.
- 6.1.13 Marking Plate : One no (as in 3.15) shall be nailed to the front side of case, item as shown in Fig.3.
- 6.1.14 Case Marking : After complete packing, marking of various details and symbols as given by EDN shall be done using indelible ink (as in 3.16)
- 6.1.15 Packing Slip : Packing slip kept in polyethylene bag (as in 3.18) shall be placed inside the box at appropriate place before closing the top. in addition one more packing slip covered in polyethylene cover and packing slip holder (as in 3.17) shall be nailed to front or rear of shook.
- 6.1.16 At the end of this stage, the arrangement is as shown in Fig.4. Front and rear shook fixing arrangement to the bottom of the pallet is as shown in Fig.5
- 6.1.17 The lifting arrangement of the packed case is shown in Fig.6
- 6.2 Packing of cubicles for export contracts Procedure is same as that given in 6.1 except for the following changes:
- Two Polyethylene petticoat (as in 6.1.7) instead of one
 - Fumigation may have to be done if required (BHEL Scope).

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- 6.3 Packing of empty Cubicles Procedure is same as that given in 6.1 except For following changes
- Bituminised kraft paper, bitumen coated Hessian polyethylene paper, silica gel need not be used.
- 6.4 Packing of loose items/spares for inland contracts
- 6.4.1 All the materials and procedure are same as in 6.1 except that :
- No joining of plywood and silver oak batten
 - Inner sides of all 6 sides shall be nailed with bitumen coated Hessian polyethylene kraft paper (as in 3.6) using nails.
 - Kraft paper (as in 3.5) is not required
 - Silica gel quantity is 100 gm approx per box.
 - Rubberised coir is to be nailed to inner surfaces of bottom 4 sides of box.
 - Bottom plywood sheet / pallet shall be of 18 mm thick for all practical purposes and 12 mm thick for smaller boxes on need basis. Suitable bottom beams made out of plywood/ any other wood of suitable cross section 75x36 mm, 75x54 mm, 75x75 mm, 100x100 mm.
 - Support battens of cross section 12x75 mm, 12x100mm, 18x75 mm, 18x100 mm can be used depending upon the size of the boxes. Plywood support battens can be used in the place of silver oak battens.
 - Clause 6.1.10 is not applicable. Individual items to sealed with polyethylene sheet (as in 3.4) and one full cover of polyethylene sheet covering of all items is to be made.
- 6.4.2 In few cases gabled roof (single or double gable) may have to be made, details of which will be given by EDN.
- 6.4.3 Internal Packing: Items that go into the box shall be packed using polyethylene sheet/ U foam/ thermocol sheets/air bubbled sheets/ paper cartoons and cotton tape. Any space left between the job and the sides and the top of the box shall be filled with rubberised coir/air bubbled sheet /thermocole to get proper cushioning effect. Certain items like transformers, reactors, breakers, etc shall be bolted to the bottom of the box using bolts, nuts and washers.
- 6.5 Packing of Loose items/ Spares for Export Contracts: Procedure is same as that given in 6.4 except for following changes:
- Two polyethylene covers to be provided,
 - Fumigation may have to be done, if required, for which payment will be made by EDN.
- 6.6 Any other changes/ new methods/ alternative packing systems can be undertaken with prior information and approval from the dept. For other parameters and further details concerned agency may please be contacted.

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7.0 ACCEPTANCE CRITERIA OF PLYWOOD :

**PLYWOOD FOR GENERAL PURPOSE
GRADE FOR PACKING - AS PER IS:303**

1. Plywood sheets shall have IS:303 & BWR / MR grade stamped on each sheet.
2. Packing/contractor should give a certificate to this effect.
3. Contractor shall identify each sheet with their name/firm in suitable place.
4. Visual checks to be done by packing contractor and EDN-QC CE shipping.
5. For other parameters, testing will be done at authorised laboratories/institutions by EDN on sample basis.

7.1 FOR BWR GRADE : TABLE-1 QUALITY REQUIREMENTS OF PLYWOOD

Sl NO	Defect Category	Maximum Number of Defect Permitted on any one surface of panel (as applicable to Type A Surface of IS:303)
1.	Blister	Nil
2.	Check	Individual check not more than 50mm in length and the total length not more than 300mm/m ²
3.	Discoloration	Nil
4.	Dote	5cm/m ²
5.	Insect hole	Scattered up to 12 holes/m ²
6.	Joints	One joint for every multiple of 200mm provided no individual piece is less than 100mm in width
7.	Knots(dead)	2 up to 12mm dia/m ²
8.	Pin knots(dead)	2/m ²
9.	Pin knots(live)	No restriction
10.	Knots(tight)	6 up to 25mm dia/m ²
11.	Patches	4 patches/m sq provided they are all tight patches & do not mar the appearance

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12. Splits. 2 splits each not more than 1mm wide and length not more than 100mm provided they are filled with suitable filler

13. Swirl Unlimited provided they do not mar the

7.2 FOR MR GRADE : TABLE -2 QUALITY REQUIREMENTS OF PLYWOOD

Sl NO	Defect Category	Maximum Number of Defect Permitted on any one surface of panel (as applicable to Type A Surface of IS:303)
1.	Blister	Nil
2.	Check	Individual check not more than 100mm in length and the total length not more than 1000mm/m ²
3.	Discoloration	5 %
4.	Dote	15cm/m ²
5.	Insect hole	Scattered up to 24 holes/m ²
6.	Joints	: No restrictions
7.	Knots (dead)	4 up to 20mm dia/m ²
8.	Pin knots (dead)	: 6/m ²
9.	Pin knots (live)	No restriction
10.	Knots (tight)	: No Restrictions
11.	Patches	Any number provided they are all tight patches & do not mar the appearance
12.	Splits	3 splits each not more than 4 mm wide and length not more than 150 mm provided they are filled with suitable filler
13.	Swirl	NO restrictions

7.3 Thickness of Plywood sheets:

The plywood boards shall be of uniform thickness within specified tolerance limit specified. The faces of plywood boards shall be reasonably smooth.

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7.4 PERMISSIBLE DEFECTS:

Gaps in cores and cross-bands may be permitted except for 3 ply plywood, provided the width of the gap does not exceed 1mm in case of and 2 mm in case of plywood of more than 5 ply and provided such gaps, if more than one, shall be spaces not less than 80mm away from each other and are staggered not less than 50mm away as between ply, the next ply having the same grain direction.

7.5 WORKMANSHIP AND FINISH:

The plywood boards shall be of uniform thickness.

The faces of plywood boards shall be reasonably smooth and face veneers shall be reasonably uniform thickness.

7.6 TESTS:

For testing any other mechanical property of general purpose plywood, Subject to agreement between the purchaser and the supplier, reference shall be made to the provisions of IS 1734 Part 1 and 20)

8.0 Details of Drawings / Figures attached:

Fig- 1	:	Packing of panel - Preparation
Fig- 2	:	Shookes preparation
Fig- 3	:	Marking Plate
Fig- 4	:	Packed panel with plywood and silveroak battens
Fig- 5	:	Detailed joining of pkg shookes with battens
Fig- 6	:	Lifting of packed case
Fig- 7	:	Mechanical Latching clamps
Fig 8 & 9	:	CLW Railway panel packing
Fig 10 to 13:	:	Packing of panels and spares packing cases.
Fig 14	:	All Units supplying Initial and O & M spares (Recommendations from Corporate Systems & IT)

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Additional points to be taken care for :

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

(Recommendations from Corporate Systems & IT)

Sl	Activity
1	All Initial and O&M spares preferably supplied in one lot to site and progressive inventory till all spares are accumulated could be kept at units.
2	Spares (Initial and O&M) should be supplied in separate Boxes / Containers and not mixed in main supply boxes.
3	i) Initial spares Box / Container to be labeled as "INITIAL SPARES " in RED. Ref fig: 14 (Page-26). ii) O & M spares Box /Container to be labeled as" O&M SPARES " in GREEN. Ref fig: 14 (Page-26).
4	iii) Initial Spares Box to have red Color strip as per diagram. Ref fig: 14 (Page-26). iv) Majority of spares (initial and O&M) are for indoor storage at site. v) O&M spares box to have green Color strip as per diagram. Ref fig: 14 (Page-26).
5	vi) Spares (Initial and O&M) Packing list kept inside the boxes and affixed securely outside the box to contain vii) Custom name viii) Project / Power station Name ix) Customer PO No and date x) Sl no of customer PO. xi) Quantity total & dispatched. xii) Unit work order number xiii) All above to be developed from Unit IT System
6	xiv) All spares (Initial and O&M) items to have tags (wono, item customer order no, customer item.description)
7	xv) Supply of spares by Vendor should also be instructed for following point 2,3,4,5,6 mentioned above.

Action By : Sites on arrival of spares (Initial and O&M)Receipt .

	Activity
1	Material utilized if any from Initial and O&M spares , should have prior written approval of concerned MUs. Such MUs shall also confirm replacement dates which should be entered in the system for creation of repository.



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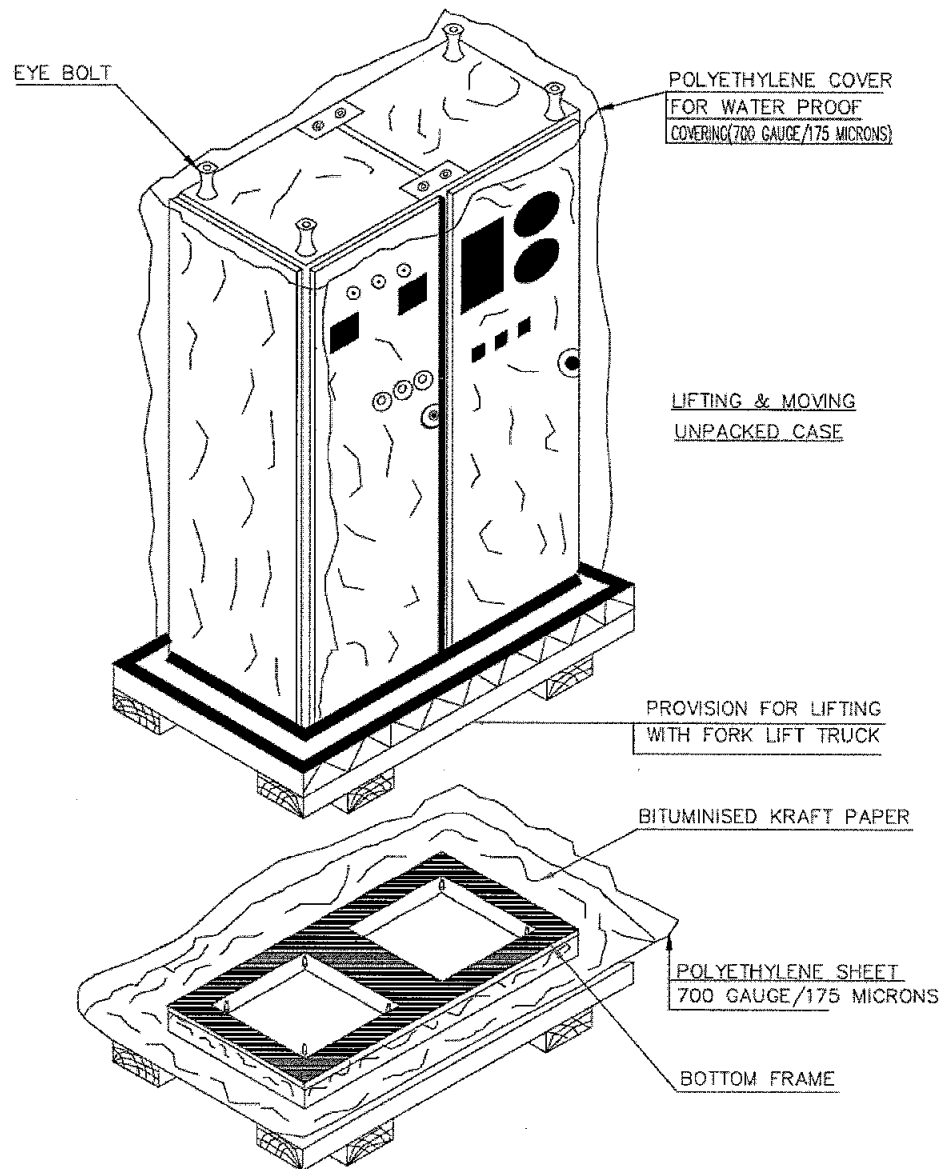


FIGURE-1



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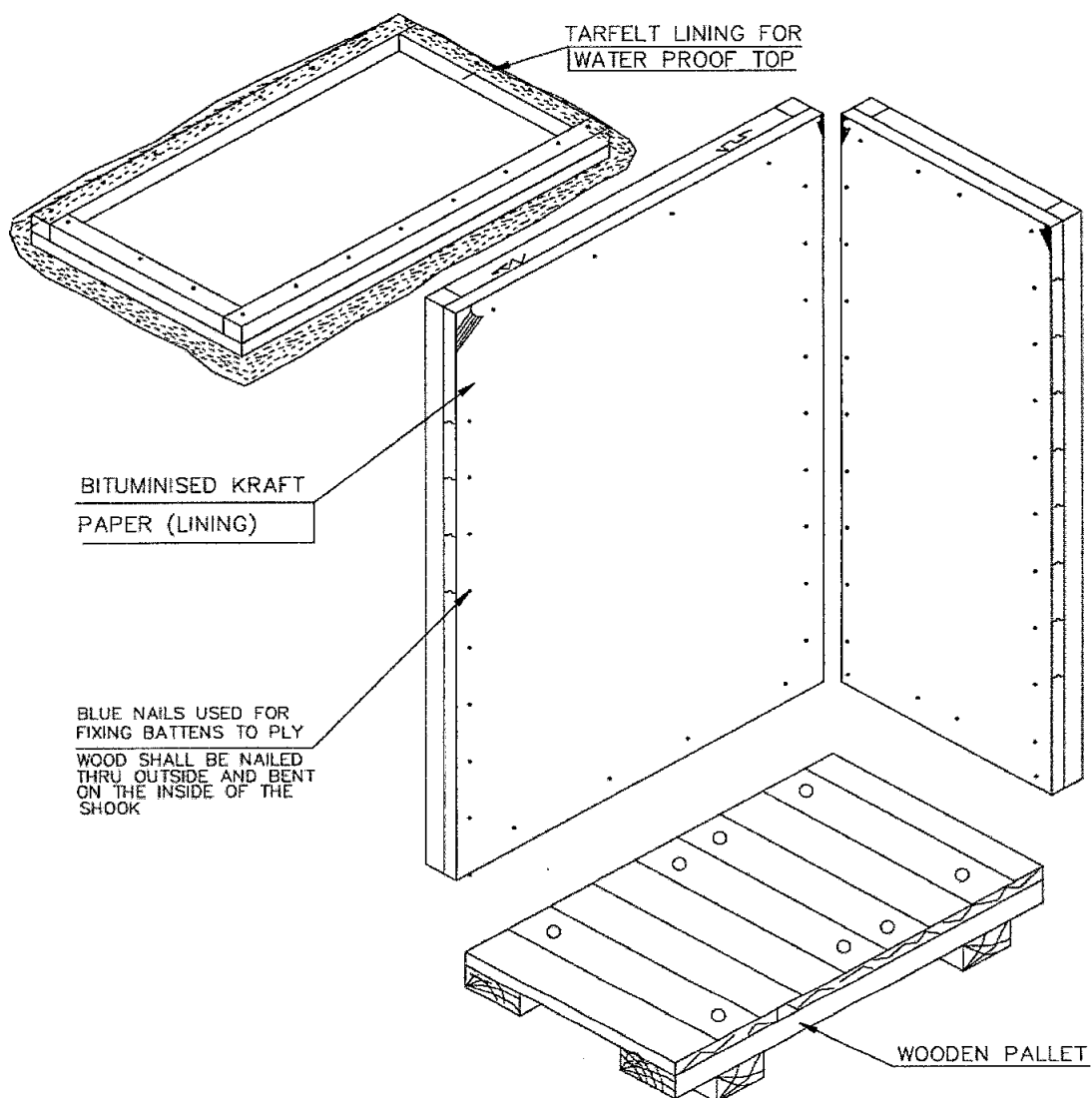


FIGURE-2



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

225

170

FIG-3 : MARKING PLATE



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PLYWOOD SHOOKS BOLT TYPE WITH SILVER OAK BATTONS

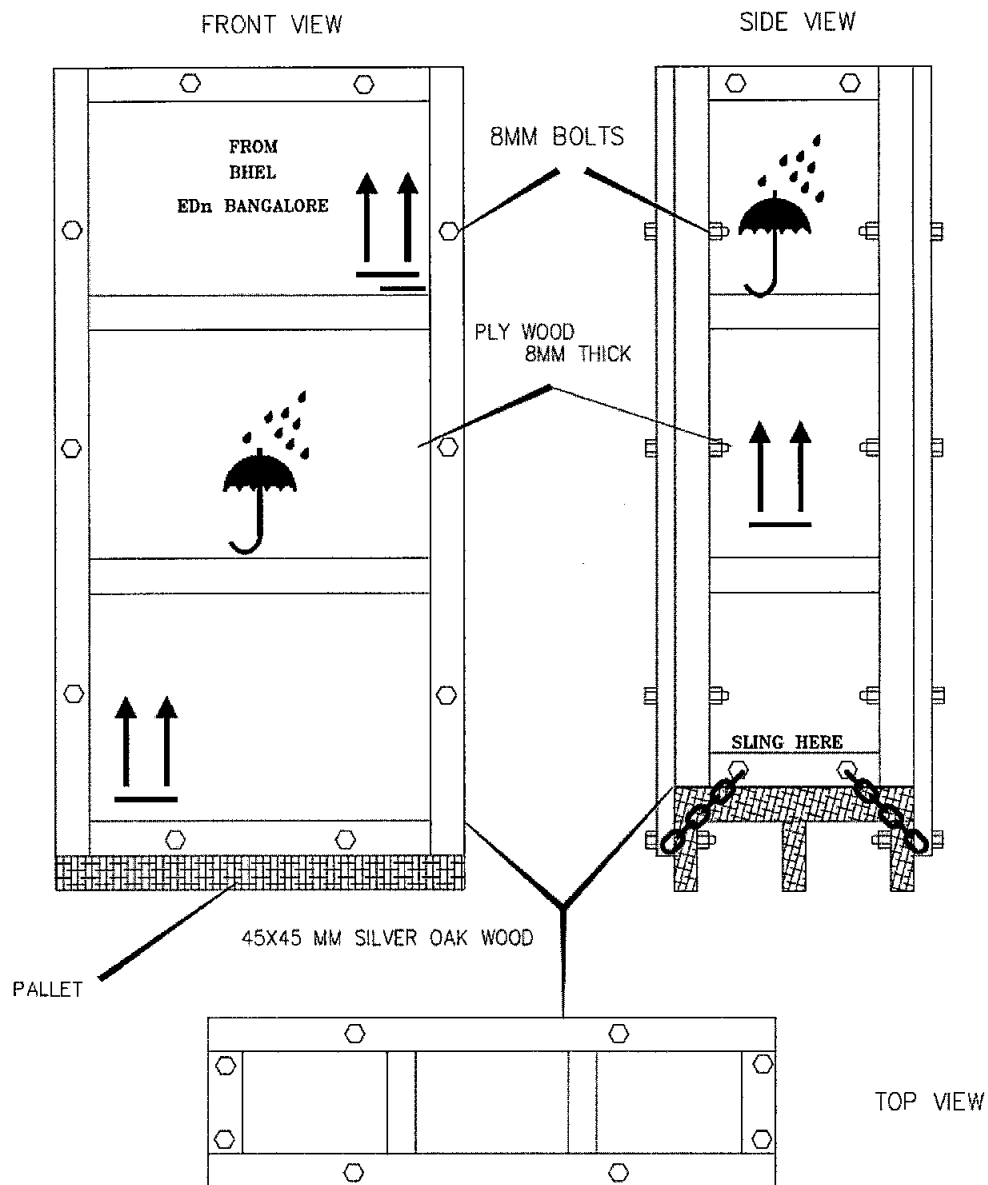


FIG-4



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LAP JOINTS

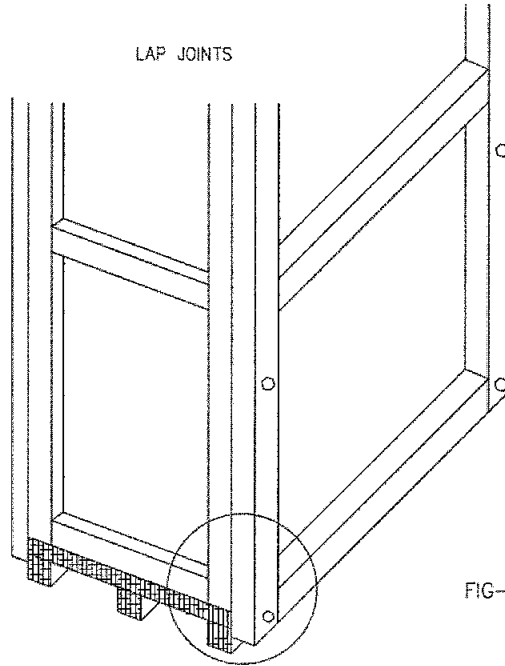
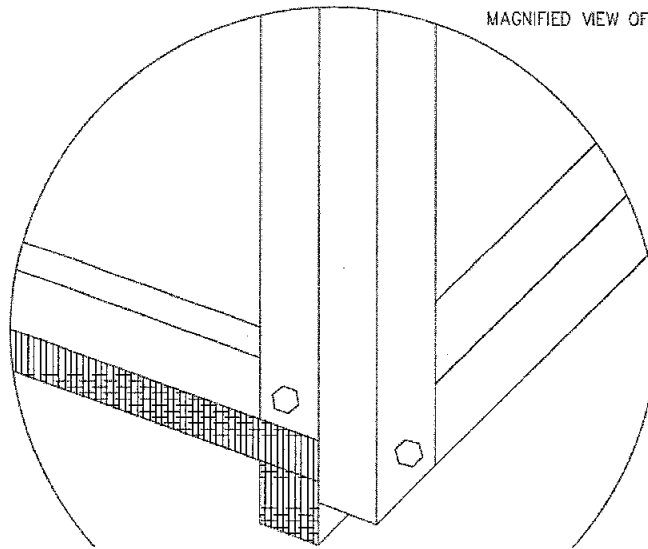


FIG-5

MAGNIFIED VIEW OF THE LAP JOINT





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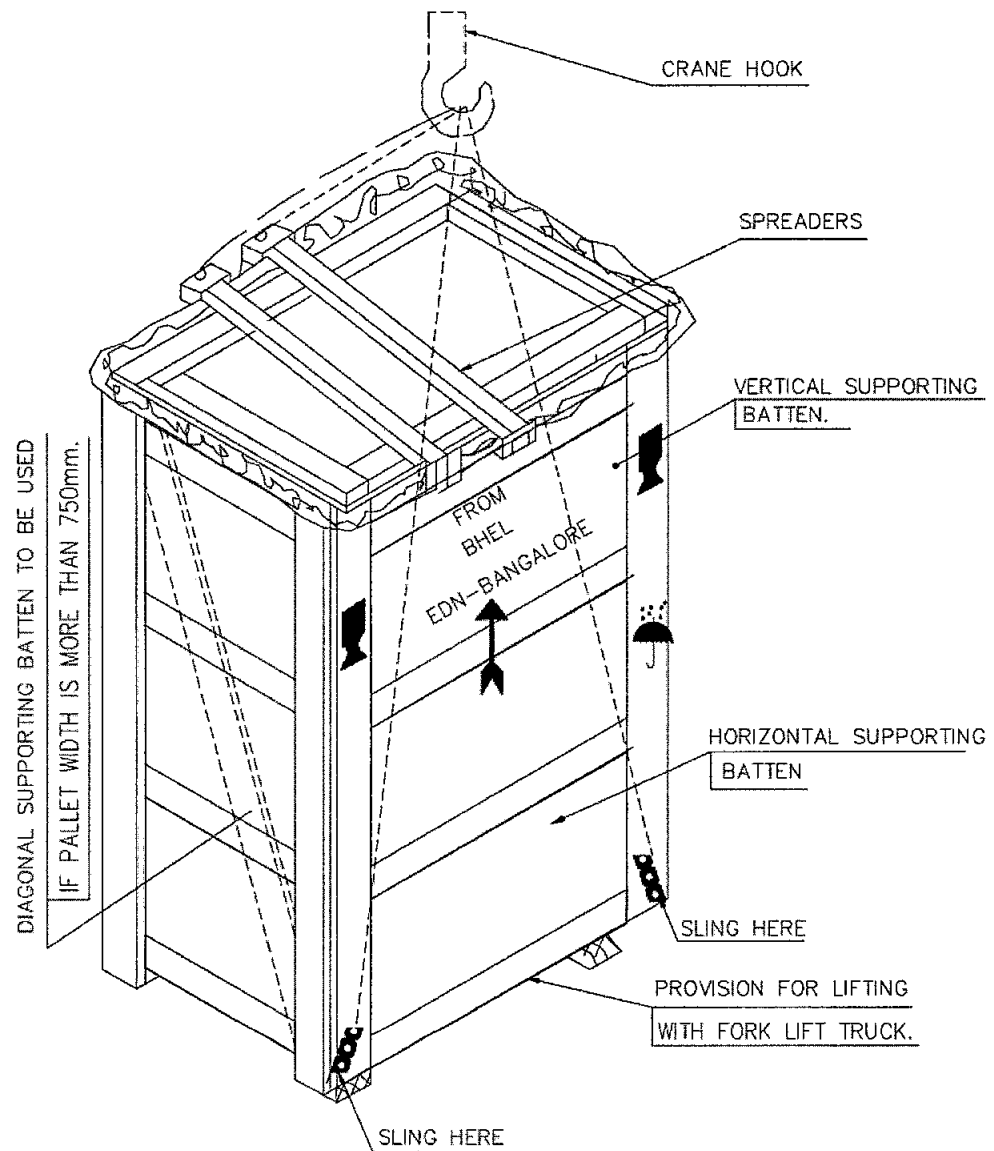


FIG-6 : LIFTING OF PACKED CASE



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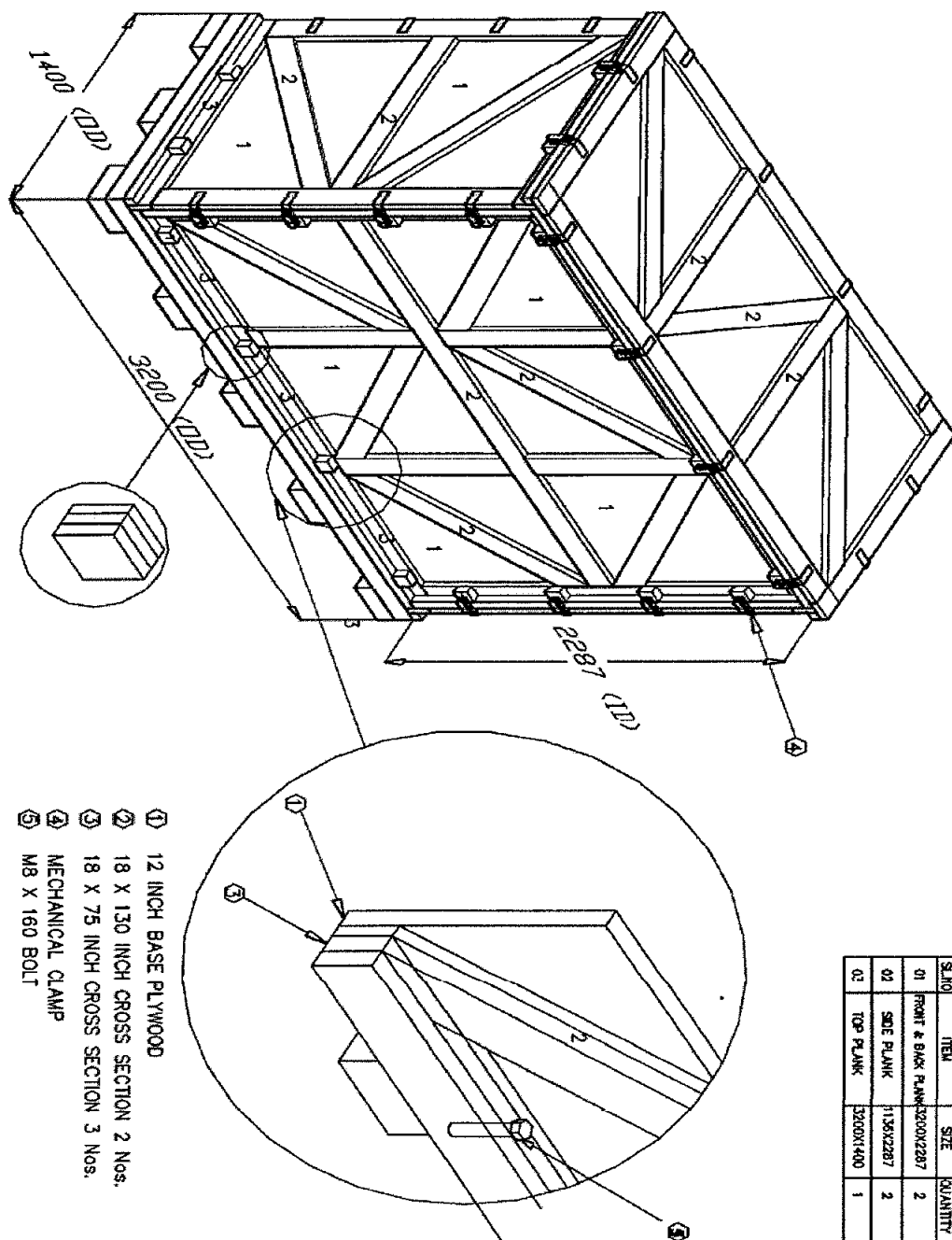


Fig - 8 : CLW Railway Panel Packing with Plywood & Plywood Support Battens



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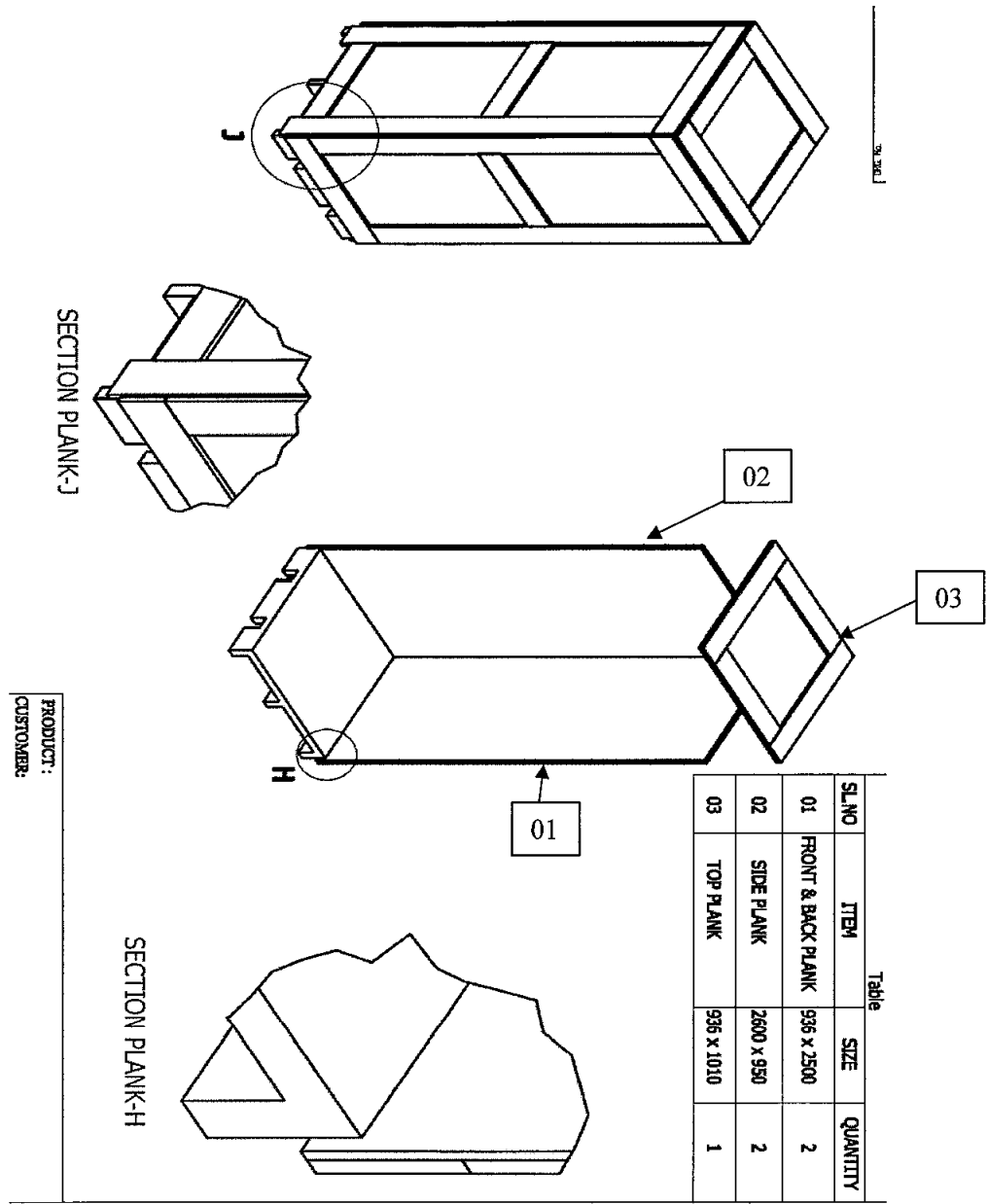


Fig-10 : Plywood Packing for Single Suit Panel.



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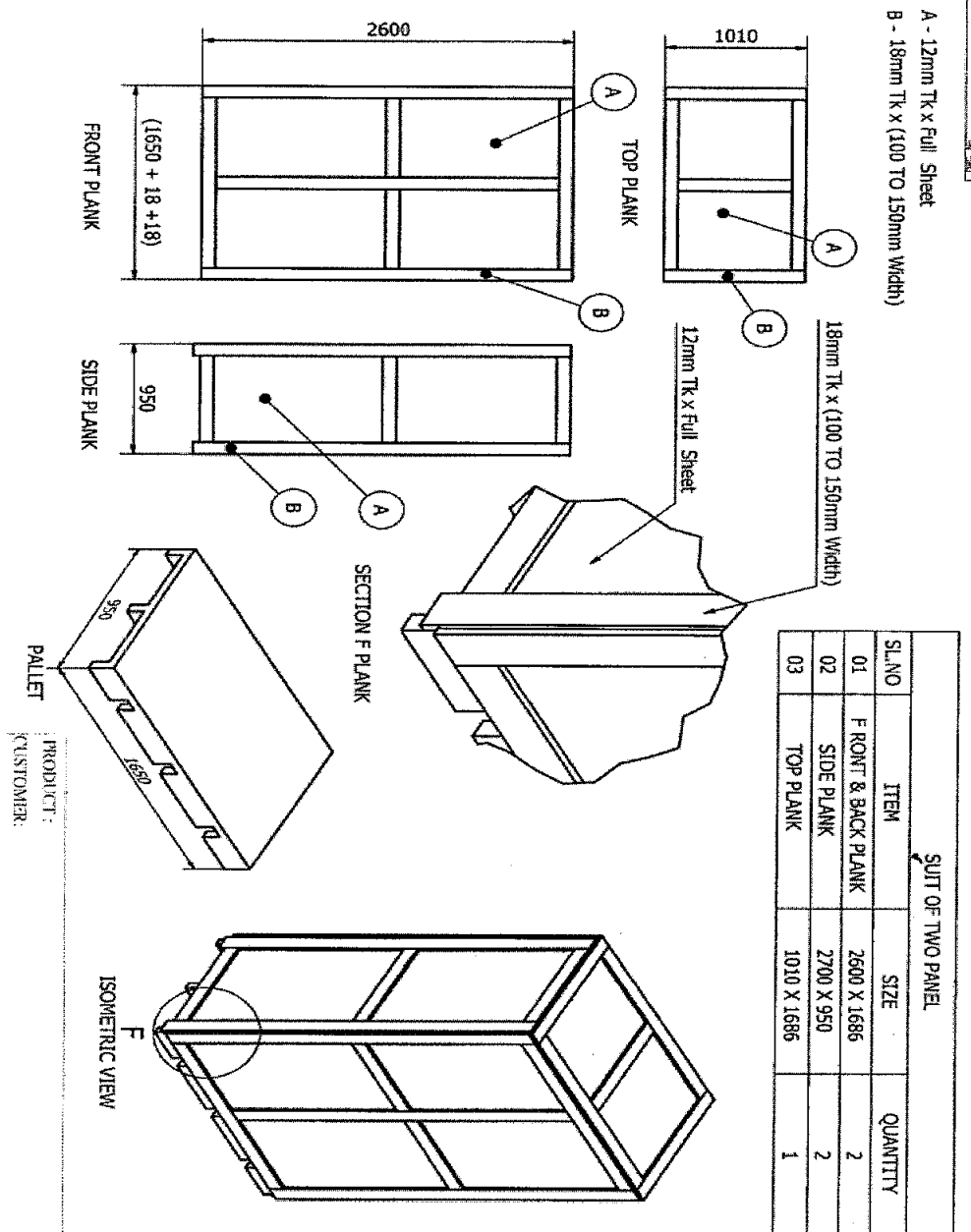


Fig - 11 : Plywood Packing for 2suit panel.

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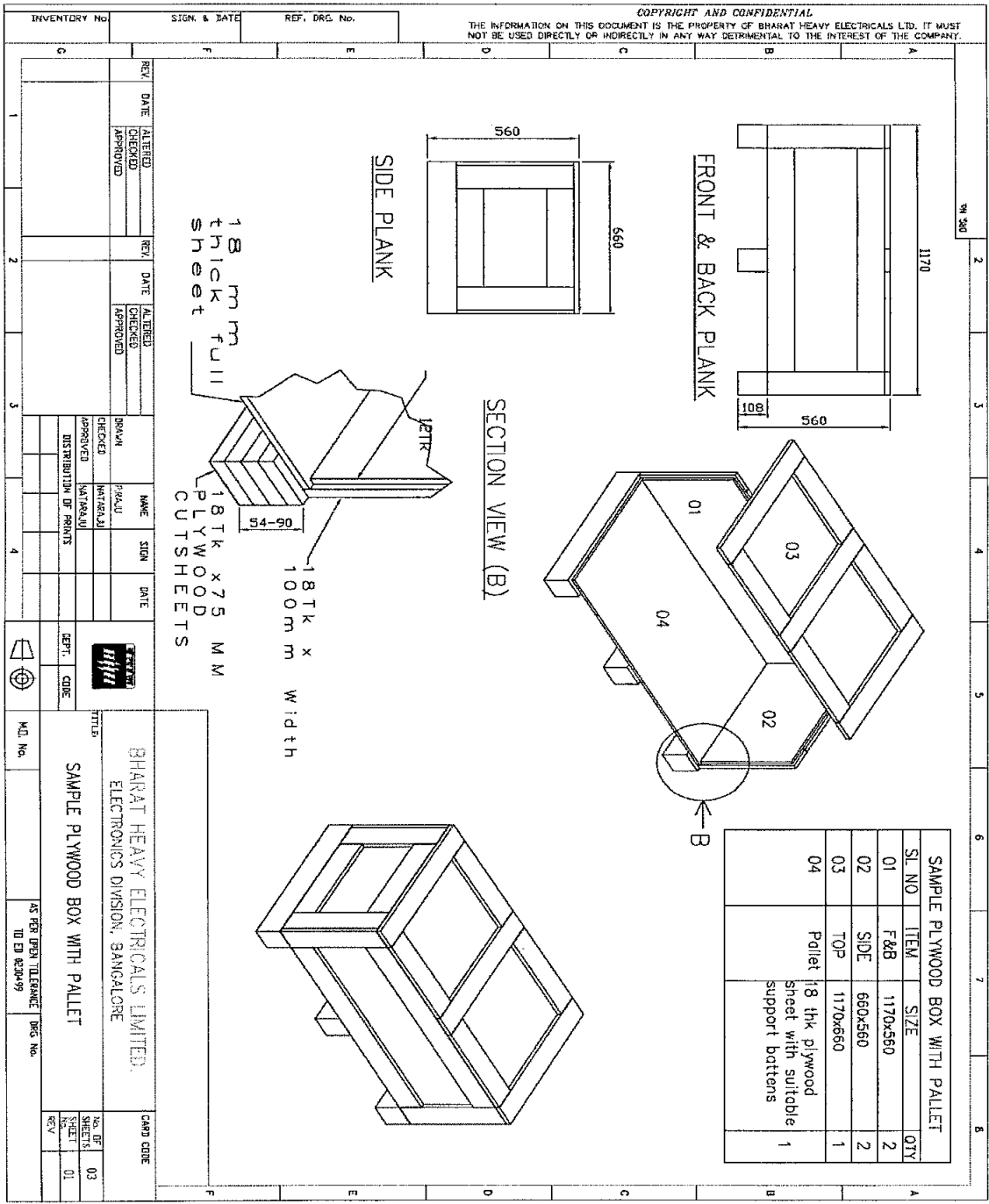


Fig – 13 : Plywood small case with Pallet

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

Fig: 14

