

**Technical Corrigendum**

Tenderdocuments (total 106 pages)					
S. No.	Document Reference	Page	Clause/SI. No	Tender statement	Shall be read as
1	CE/416/LAB(M)/ENNORE/PS. Page 06 of 23 (2.01 Pneumatic Test Bench (PR0800000030, Qty.: 1 No.))	63 of 106	2.01 (o)	-	<b><u>New point added.</u></b> (o) Workbench with wood top approximate size 75 x 300 cms. with side drawers (fitted with lock) and board on back of the bench top with electric fittings. Workbench shall be fitted with all essential tools as describes above. Workbench shall also be fitted with electrical fittings – sockets and color coded banana jacks for each kind of voltage mentioned above and one 20-watt fluorescent lamp at each table.
2	CE/416/LAB(M)/ENNORE/PS . Page 18 of 23 (2.35 Furniture for C&I Lab (PR0490000878, Qty 1 Set))	75 of 106	2.35	Two (2) nos. Workbench suitable for electronic work and pneumatic work with wood top approximate size 75 x 300 cms. with side drawers (fitted with lock) and board on back of the bench top with electric fittings. Workbench shall be fitted with all essential tools as describes above. Workbench shall also be fitted with electrical fittings – sockets and color coded banana jacks for each kind of voltage mentioned above and one 20-watt fluorescent lamp at each table.  Three (3) nos. teak wooden work table with thick laminated top size 1x2 meters. Eight (8) nos. high adjustable wheeled swivel chairs. Four (4) nos. vertical cabinets 1000 x 480 x 2000 mm made of sheet steel (Sheet thickness of 18 gauge) and equipped with safety locks. Four (4) nos. open shelf 1000 x 200 x 2000 mm with partitions made of steel shall be provided.	Three (3) nos. teak wooden work table with thick laminated top size 1x2 meters. Eight (8) nos. high adjustable wheeled swivel chairs. Four (4) nos. vertical cabinets 1000 x 480 x 2000 mm made of sheet steel (Sheet thickness of 18 gauge) and equipped with safety locks. Four (4) nos. open shelf 1000 x 200 x 2000 mm with partitions made of steel shall be provided.





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**SECTION- A**

**GENERAL INSTRUCTIONS TO BIDDERS:**

All required documents against this Tender/Specification shall be submitted in English only.

Introduction: Bidders are required to offer SWAS to be used in Power Plant applications.

In order to accept the Technical offers / proposals from Bidders for the project mentioned in this Specification (refer Section C), certain Pre-qualification criteria are required to be met by Bidder.

Pre-qualification requirements are clearly mentioned in Section-B of this Specification. Bidder to read the same carefully and submit the details/documents required for BHEL's acceptance.

In case Bidder does not include the details or meet the requirements of Pre-qualification requirements, their offer will be summarily rejected and Bidder's Technical offers will not be evaluated.

Bidders are required to submit offers as detailed below:

- A. Documents pertaining to Pre-Qualification requirements for Section-B along with point-wise compliance.
- B. Technical offers/proposals for the Project, whose requirements are mentioned in Sections C to be submitted along with point-wise compliance.

Note 1:-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.

Note 2:- Technical clarifications/deviations w.r.t specifications including PQR shall be discussed with only those vendors who quote for this tender. Bidder shall furnish Clause-wise compliance / deviation list along with the offer, which is mandatory for evaluating the offer. The deviations to be clearly mentioned in the offer and acceptance of these deviations will be subject to customer/BHEL approval. If Bidder incurs any additional cost for the withdrawal of any deviation, the same shall be borne by the bidder without any cost implication to BHEL.



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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. Vendor should be in business of supplying Lab instrument equipment for at least last two (2) years from the date bid opening.
3. 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.
4. 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 coordination work. Please provide supporting details.
5. 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.
6. 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.
7. **Important note:** - In case Bidder does not submit details mentioned in above clauses or meet therequirements 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

### 1.0 GENERAL REQUIREMENT

- 1.01 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.
- 1.02 Electrical power supply requirement of the instruments offered under this specification shall be 240 V AC, 50 Hz, single phase.
- 1.03 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 work station.
- 1.04 The Vendor shall submit with the proposal a full list, full description and detail specification, photograph and catalogue drawing as required of testing/maintenance equipment/tools offered. Information for the items offered shall include (as applicable) working principle, power supply and other utility details, dimensional details, mounting details, accuracy, recommendation for installation, storage etc.  
*Technical literatures/ catalogs shall be submitted in softcopy only.*
- 1.05 The Vendor shall provide all the necessary accessories with test instruments/devices, durable boxes of convenient size with various instrument devices, small tool, accessories, **test leads, Indian connector power plug, tubes, fittings, leather carrying cases, instrument carrying box** or equivalent, etc. for all portable equipment as recommended by the manufacturer.
- 1.06 The Vendor shall include a complete list of spare parts for these testing/calibrating instruments/devices in the list of recommended spare parts. The Vendor shall render guarantee for easy availability of all the spare parts required especially for the components which are prone to failure.
- 1.07 The Vendor shall repair the defective instruments/devices free of cost within the warrantee period.
- 1.08 Bidder shall ensure with appropriate documentation that direct service/support from the M&C item supplier/manufacturer shall be available to the owner for all M&C items for a minimum period of 5 years after the expiry of defect liability period.
- 1.09 The Vendor shall ensure that all the consumables like batteries, recorder pens, special papers etc, for the testing/calibration or instruments/devices shall be easily available for the life of the project.
- 1.10 The calibration standards of all M&C equipments furnished under this subsection shall be traceable to National Bureau of Standards, USA or NPL, India or to the applicable standards existing in the country where the equipment is manufactured and tested. The vendor shall include traceable calibration certificate from accredited laboratory, test reports etc. as per the BOM at clause 3.0.
- 1.11 In the event of order vendor have to submit datasheets with catalogs and a layout of C&I Laboratory in soft copy (PDF / AUTOCAD) for end-user's approval.
- 1.12 In the event of approval of datasheet, vendor has to submit calibration & test certificate for end-user's approval.
- 1.13 Packing shall be as per guidelines provided at BHEL specification ref. ED 049 00 92, rev. 05 attached herewith.
- 1.14 In the event of dispatch clearance vendor have to submit installation, operation & maintenance manuals for each items (2 sets of hardcopies along with the equipment to site) along with the soft copy for electronic transmittal.
- 1.15 Commissioning & demonstration of all instruments at site is under vendor's scope.



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- 1.16 Vendors to offer in-compliance to the item-wise sub-vendor / manufacturer list, at clause 4.0. Discussions will be held only with participating bidders.
- 1.17 Measuring/testing instruments, along with allied accessories shall be suitable for continuous operation (both indoor and outdoor installations as applicable).
- 1.18 The various equipments / 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.
- 1.19 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, to check and make any necessary additions/tools as required for proper maintenance and testing of the installed instruments and controls. The Bidder shall also be responsible for erection and commissioning the test equipment where applicable.
- 1.20 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.
- 1.21 The Bidder shall repair the defective instruments/devices free of cost within the guaranteed period or replace the same if required.
- 1.22 Computer Aided Calibration system offered, shall meet the demands of high precision transfer / secondary standards for automatic testing & calibration of temperature, pressure & electrical parameters in quick time and for issuance of simple, error free, reliable, fully traceable calibration certificates conforming to ISO standards / Protocol. Complete lab softwares with life time validity shall be provided by bidder, which shall be loaded on Lab operating station and Lab laptop parallelly. Any lab software mentioned or not shall be provided by bidder. Any software required for any lab instrument/equipment shall also be provided by bidder.
- 1.23 Measuring/testing instruments, along with allied accessories shall be suitable for continuous operation (both indoor and outdoor installations as applicable).
- 1.24 All the calibration instruments shall be provided with RS232C port for Lab WORK STATIONS & laptop interface with their own interfacing cables & software.
- 1.25 All the portable type lab instruments shall be provided with own rechargeable battery & charger.
- 1.26 The scope shall include the arrangement and installation of instrument workshop equipment supply and connection of all electric power supply including air distribution system.

## **2.0 TECHNICAL SPECIFICATION**

### **2.01 Pneumatic Test Bench (PR0800000030, Qty.: 1 No.)**

The pneumatic test bench made of anodized aluminium and modular in design, enabling easy change of arrangement / layout as and when required, shall be provided. The test bench shall be complete with shut-off valves, air filter-cum-pressure regulators and pressure gauges for testing E/P converters, pneumatic transmitters, controllers, power cylinders, control valves etc.

Test Bench shall have provision to get the Instruments air from Plant Instrument Air compressor or alternatively from industrial grade oil free air compressor. The dimension for the test bench shall be approximately 2000mm x 800mm x 800mm (LxWxH). The test bench shall be furnished as per the following general specification:

- (a) Complete with regulated air supply outlet of 0-20 psi and 0-30 psi, display plate with two four and half digit digital pressure indicator of range vacuum to 20,000 mm WG and 0-30 psi, accuracy 0.1+/-0.05% of F.S.
- (b) Complete with built-in selector for read out in 5 engg. units i.e. kg/sq.cm., psi, mmWcl, bar, mmHg.



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- (c) Complete with overload protection valve
- (d) Complete with control plate with mimic panel incorporating three precision pressure regulators, filter reducing unit for the air supply, three 150 mm dial pressure gauges having ranges 0-2, 0-4, 0-10 Kg/cm<sup>2</sup> respectively and accuracy  $\pm 0.25\%$  full scale.
- (e) Complete with Actuator testing stand with accessories like E/P convertor, regulators and pneumatic lines etc.

- (f) Test Bench shall also include the following:

Sno.	Items	Qty
i.	DC voltage power pack (220V)	1
ii.	DC voltage stabilizer 0-60V	1
iii.	4½ digit digital multimeter (Accuracy :0.1%)	1
iv.	0 - 260 V AC socket	1
v.	220 V DC socket	1
vi.	0 - 60 V DC socket	1
vii.	Current source (0 - 55 mA)	1

- (g) The standard high accuracy resistors shall be included to load and measure the current output of devices.
- (h) Necessary control devices for voltage and current adjustments control, switches for power supplies to feeders, isolation etc., shall be included.
- (i) All electric circuits shall be protected against overload by fuses, whose holders are located on front of the panel. All electrical Circuits and metal structures shall be properly grounded. Pneumatic test bench should have instrument earth tapping points.
- (j) The test bench shall be complete with overload protection valve, precision pressure regulators, filter reducing unit for the air supply and all necessary accessories Including 1 set supports for instrument under test, desk with drawers etc.
- (k) Complete with set of supports for the instrument under test, desk with minimum three (3) drawers (fitted with lock), board on back of the bench top with electric fittings – sockets and colour coded banana jacks for each kind of voltage, one 20-watt fluorescent lamp and all other necessary accessories.
- (l) Complete with calibration software for record keeping and report generation
- (m) Integrated with desktop PC & Laserjet Printer (A4 size)
- (n) The Vendor shall be responsible for connection of instrument air line from his tapping point and also keep provision of giving supply from Air-Sets also. Vendor must ensure that the consumption of air in the test bench is within the design capacity of the above tapping/piping or source.
- (o) Workbench with wood top approximate size 75 x 300 cms. with side drawers (fitted with lock) and board on back of the bench top with electric fittings. Workbench shall be fitted with all essential tools as describes above. Workbench shall also be fitted with electrical fittings – sockets and color coded banana jacks for each kind of voltage mentioned above and one 20-watt fluorescent lamp at each table.

**2.02 Portable Calibrator for Vacuum (PR0680000836, Qty.: 1 No.)**

Range	:	- 14.2 to 0 psi
Accuracy	:	$\pm 0.025\%$ FS
Display	:	7 segment LCD with 4½ digit
mA Input	:	4-20 mA
Power supply	:	Chargeable Battery
Accessories	:	Charger/Adapter Test Leads Carrying Case Manual

### **2.03 U – Tube Manometer (PR0680000372, Qty.: 2 Sets)**

Item No.	Range of U – Tube Manometer	Total Quantity for 2 Sets
1	0- 1000 mmwc (- 500 mmwc to + 500 mmwc)	2 No.
2	0- 2500 mmwc (- 1250 mmwc to + 1250 mmwc)	2 No.

- a) This type of manometer shall be mercury filled clear Borosilicate glass U tube intended to be used for low static differential pressures or vacuum.
- b) The scale shall be graduated in mm and smallest division shall be 1mm.
- c) Zero adjustment facility shall be provided.
- d) The manometer shall be tested for safe operation up to 7.0 Kg/cm<sup>2</sup> pressure.
- e) All 'wetted parts & fitting's material other than U tube & manifold shall be 304SS.
- f) All required accessories such as 3 valve manifold, tripod stand, spirit level etc. shall be provided.
- g) Cases shall be of Aluminum on three sides and aluminum cover with clear acrylic front.
- h) Packing material shall be Teflon.
- i) End connection shall be ½ NPT (F), with check valves.
- j) The scale shall be provided with vernier arrangement.
- k) Liquid drain plug shall be provided.
- l) Coloured liquid & storing bottle, fillup pump, fill up funnel and nylon tubes shall also be included.

### **2.04 Inclined Tube Manometer (PR0680000453, Qty.: 2 Sets)**

Item No.	Range of Inclined Manometer	Total Quantity for 2 Sets
1	0- 50 mmwcl	2 No.
2	0- 100 mmwcl	2 No.
3	0-200 mmwcl	2 No.

- a) Portable inclined tube manometers of free standing type for above ranges shall be supplied by bidder.
- b) The scale shall be graduated in mm and accuracy shall be 0.1 % of FSD.
- c) This type of manometer shall be mercury filled clear Borosilicate glass U tube intended to be used for measurements of draft, air velocity and air pressure around atmospheric pressure.
- d) Indicating tube and oil chambers shall be drilled and reamed in a solid block of clear acrylic plastic material.
- e) Cases shall be as per OEM standard specifications.
- f) These manometers shall have leveling screw at the bottom and spirit level bubbles for accurate leveling.
- g) Packing material shall be Teflon.
- h) Each manometer shall be complete with connecting tubes, ½" NPT process adaptors, range scale, tube chamber, fillup pump(syringe type), fill up funnel, mounting box, zero adjustment, aspirator(squeezing type), manometer liquid & drain plugs etc.
- i) All 'wetted parts & fitting's material other than U tube & manifold shall be 304SS.
- j) 3 valve manifold of 304SS, shall also be provided.





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**2.05 Test Manometer (PR0680000364, Qty.: 2 Nos.)**

- a) This type of manometer shall incorporate mercury well and extended 1500mm transparent plastic tube with graduated scale for the measurement of pressure.
- b) The scale shall be graduated in both mm of Hg and Kg/cm<sup>2</sup> and shall be compensated for liquid level changes within the manometer well.
- c) The vent or vacuum connection at the top of the extended tube shall include an in-line liquid check valve to prevent mercury spills.
- d) The manometer shall be tested for safe operation up to 17.5 Kg/cm<sup>2</sup> pressure.
- e) The manometer body shall be of steel channel construction and moisture proof.

**2.06 Digital Manometer (PR0680000860, Qty.: 2 Nos.)**

- a) The range shall be 0.2 to 2 kg/cm<sup>2</sup> and accuracy shall be 0.25% or better.
- b) Ranging from -10,000 to +10,000 mmwc
- c) It shall be usable for high and low differential pressure instrument.
- d) It shall have large dual LCD with back light
- e) It shall have USB & Computer interface with RS 485 male connector.
- f) Battery operated digital manometer mainly use for air and gas (vacuum) services.

**2.07 Dead Weight Tester (PR0680000267, Qty.: 1 No.)**

- a) Applicable Standard : ASME PTC 19. 2-1964 except as modified in this specification.
- b) Type : Dual range (High Range & Low Range) allowing an automatic change of scale of 10:1 ratio.
- c) Piston Material : Hardened 420 SS
- d) Ranges : 1-60 & 60-600 Kg/cm<sup>2</sup>
- e) Accuracy :  $\pm 0.015$  percent of actual reading
- f) Calibration :  $\pm 0.01\%$  traceable to NBS
- g) Connection : Suitable for 1/8, 1/4, 3/8 and 1/2 inch NPT
- h) Accessories :
  - i. Following weights of each type shall be provided:
    - a. 10 & 100Kg/sq.cm 4nos.
    - b. 9 & 90kg/sq.cm 1no.
    - c. 5 & 50kg/sq.cm 1no.
    - d. 2 & 20 kg/sq.cm 2nos.
    - e. 1 & 10kg/sq.cm 1no.
    - f. 0.5 & 5 kg/sq.cm 1no.
    - g. 0.2 & 2 kg/sq.cm 2nos.
    - h. 0.1 & 1 kg/sq.cm 1no.
    - i. 0.05 & 0.5 kg/sq.cm 1no.
    - j. 0.02 & 0.2 kg/sq.cm 2nos.
    - k. 0.01 & 0.1 kg/sq.cm 1no.
  - ii. Tools like wrenches, spanners etc.
  - iii. Hard storage Carrying case
  - iv. Oil filters to prevent contamination and wear
  - v. Spirit level, spare seals, keys, spare oil
  - vi. Instruction manual
  - vii. Software & hardware for interfacing.  
Software shall be provided to correct for effect of environment factors such as gravity & temperature to determine the pressure generated by dead weight tester.



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- i) Application : Laboratory calibration of pressure and differential pressure gauges/ transmitters, pneumatic transmitters and controllers.

**2.08 Vacuum Tester (PR0680000488, Qty.: 1 No.)**

- a) Applicable Standard : ASME PTC 19. 2-1964 except as modified in this specification.  
b) Type : Air operated, dead weight type vacuum tester.  
c) Piston Material : Hardened 420 SS  
d) Ranges : 50-1000 mbar  
e) Accuracy :  $\pm 0.025\%$  or better for range 125-1000 mbar.  
f) Accessories : i. Following weights shall be provided:  
a. 1 weight corresponding to 5 mbar  
b. 3 weights corresponding to 20 mbar  
c. 2 weights corresponding to 10 mbar  
d. 6 weights corresponding to 50 mbar  
e. 6 weights corresponding to 100 mbar  
f. Any other weights, as recommended by the OEM.  
ii. Leveling screw, gauge post, spirit level, vacuum adapter, spanners, pointer remover, pointer punch, 1/2 inch, 1/4 inch and 1/8 inch NPT adapters, dust cover, adapter seals  
iii. Hard storage Carrying case  
iv. Instruction manual

**2.09 Standard Pressure Gauges (PR0160000050, Qty.: 1 Set=13 Nos  
Total 2 Set = 26 Nos.)**

- a) Applicable Standard : ASME PTC 19. 2-1964 except as modified in this specification.  
b) Type : Bourdon tube  
c) Material :  
- Bourdon : 316 SS  
- Movement : 316 SS  
- Case : Die-cast aluminum/carbon steel  
d) Dial Size : 300 mm  
e) Scale details : Graduations in black lines on white dial  
f) Ranges : Following Standard Pressure Gauges shall be provided:  
a. (-) 1 to (+) 1 Kg/cm<sup>2</sup>  
b. 0-1.6 Kg/cm<sup>2</sup>  
c. 0-2.5 Kg/cm<sup>2</sup>  
d. 0-4 Kg/cm<sup>2</sup>  
e. 0-6 Kg/cm<sup>2</sup>  
f. 0-10 Kg/cm<sup>2</sup>  
g. 0-16 Kg/cm<sup>2</sup>  
h. 0-25 Kg/cm<sup>2</sup>  
i. 0-40 Kg/cm<sup>2</sup>  
j. 0-60 Kg/cm<sup>2</sup>  
k. 0-250 Kg/cm<sup>2</sup>  
l. 0-400 Kg/cm<sup>2</sup>  
m. 0.2-1 Kg/cm<sup>2</sup>



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- g) Accuracy :  $\pm 0.1$  percent
- h) Connection : Quarter (1/4) inch NPT Male bottom
- i) Application : For field testing of pressure instruments and Calibration of pressure instruments

**2.10 Hydraulic Pressure Gauge Tester (PR0680000313, Qty.: 2 No.)**

Hydraulic Pressure Gauge Tester shall also be provided to compare the gauge under test with above mentioned standard Pressure Gauges and shall be designed for use with a light hydraulic mineral oil for pressure up to 1200 Kg/cm<sup>2</sup> with accuracy of 0.015% of reading.

**2.11 Mercury Thermometers (PR0680000380, Qty.: 1 Set=13 Nos  
Total 2 Set = 26 Nos.)**

- a) Applicable Standard : National Bureau of Standards & ASTM PTC 19.3-1961
- b) Type
  - Bulb/ Stem : Mercury in Glass
  - Scale : Mercury in glass Red reading mercury tubing with figures and graduations clear bold and precisely placed.
- c) Material
  - Bulb/ Stem : 316 SS
  - Scale : Hardened Borosilicate Glass
- d) Range : Following Mercury Thermometers shall be provided:
  - a. (-) 30 to (+) 20 °C
  - b. 0 to 50 °C
  - c. 50 to 100 °C
  - d. 100 to 150 °C
  - e. 150 to 200 °C
  - f. 200 to 250 °C
  - g. 250 to 300 °C
  - h. 300 to 350 °C
  - i. 350 to 400 °C
  - j. 400 to 450 °C
  - k. 450 to 500 °C
  - l. 500 to 550 °C
  - m. 550 to 600 °C
- e) Accuracy :  $\pm 0.5$  of graduation
- f) Graduation : 0.1 °C for lower range & 1 °C for range > 200 °C
- g) Connection : M 20 x 1.5
- h) Application : For field testing of performance of local instruments.



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**2.12 Flowmeter Calibrator (PR0680000283, Qty.: 3 Nos. {1 No. of each Range})**

- a) Accuracy : +/- 2%
- b) Range : Following Flowmeter Calibrators shall be provided:
  - i. 0 – 1000 mmwcl
  - ii. 0 – 6000 mmwcl
  - iii. 0 – 30000 mmwcl
- c) Display : 3-digit LCD

**2.13 Digital Thermograph / Hygrometer (PR0680000801, Qty.: 1 No.)**

A microprocessor driven thermograph/hygrometer with inbuilt sensor powered by rechargeable batteries shall be provided. Suitable charger (inbuilt / standalone type) shall also be provided. This shall be able to display temperature and RH simultaneously, Maximum/Minimum memory for RH & temp. and Temperature Compensated RH measurement.

The Digital Thermograph/Hygrometer shall meet as a minimum the following requirements.

- a) Range : -20°C to + 50°C  
2% RH to 98% RH
- b) Temperature Sensor : Thermistor
- c) Humidity Sensor : Resistive Polymer
- d) Resolution : 0.1°C, 1% RH
- e) Accuracy : Temp.  $\pm 1^\circ\text{C}$   
Humidity  $\pm 5\%$

**2.14 Portable Flue Gas Analyser (PR0280000073, Qty.: 1 Set with each type of Sensor)**

The Bidder shall furnish one no. microprocessor based portable gas analyser for field determination of the individual quantities of carbon monoxide, oxygen, NO, NO<sub>2</sub>, SO<sub>2</sub> and hydrocarbons from flue gas samples. All hardware, Gas Cylinders for calibration and chemicals required for operation of the analyser shall be furnished.

- a) Accuracy : O<sub>2</sub> = Better than  $\pm 0.5\%$   
CO/SO<sub>2</sub>/NO/NO<sub>2</sub> = Better than  $\pm 2\%$
- b) Ranges : Following Gas Analyser ranges shall be provided:
  - CO = 0 – 2000 ppm
  - O<sub>2</sub> = 0 – 25% vol.
  - NO = 0 – 4000 ppm
  - NO<sub>2</sub> = 0 – 100 ppm
  - SO<sub>2</sub> = 0 – 2000 ppm
- c) Indication : Digital LCD display
- d) Power Requirement : 4 nos. 1.5 V rechargeable Ni Cd battery
- e) Accessories : Leather case probe filter aspirator  
data logger, 4 nos. rechargeable battery
- f) Interface : RS232, Galvanically isolated with Software & hardware for interfacing.



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**2.15 Aneroid Barometer (PR0680000240, Qty.: 1 No.)**

- a) Range : 660 to 800 mmHg
- b) Accuracy : 0.33% of full scale
- c) Sensitivity : 0.2% of full scale
- d) Scale Length : 16" through 1 pointer revolution
- e) Dial Diameter : 4"/6"
- f) Dial Calibration : Two sets of graduations / calibration on a single dial i.e. mm Hg and inches Hg
- g) Minimum Graduation : 0.5 mm and 0.02" respectively

**2.16 Miscellaneous Items (MECH-LAB-ITEMS, Qty.: 1 Set)**

**a) Aluminum Ladder (Qty. 1 No.)**

One no. 2 sided Folding Aluminum ladder (height 180 cm or better) for maintenance and mounting bracket for ladder shall be provided by bidder.

**b)** Bidder shall include the items given below as miscellaneous to be supplied for instruments shop. Minimum requirements are stipulated here under the following table:-

Sl. No.	Description	Size / Range	Qty.
1	Hand operated wire wrap tool	---	1 No.
2	Magnetic screw driver	---	1 No.
3	SS & copper tube cutter/blender	---	1 No.
4	Electrically operated wire wrap	0.2 mm to 1 mm	1 No.

**2.17 Standard Tool Box (PR0760000000, Qty.: 6 Set)**

Each set of Standard tool box must include the following tools:

- a) Mallet : 1 No.
- b) Hammer : 1 No. of each type
- c) Adjustable Spanner : 1 No.
- d) File : 1 No. each Flat, Semi-Circle, Round type
- e) Teflon Tape : 2 Nos.
- f) Insulation Tape : 2 Nos.
- g) Allen key (mm) : 2 Nos.
- h) Allen key (inches) : 2 Nos.
- i) Soldering Lead : 2 Nos.
- j) Vernier Calliper (digital indicator) : 1 No.
- k) Screw Gauge : 1 No.
- l) Spirit Level : 1 No.
- m) Thread Pitch Gauge : 1 No.  
for Male/Female thread

**2.18 Panel Wiring Tool Kit (PR0900003413, Qty.: 5 Set)**

Each set of Panel Wiring Tool Kit must include the following:

- a) Combination pliers (straight) : 1 No.
- b) Crimping tool (up to 6 sq. mm) : 1 No.



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- c) Stripping tool : 1 No.  
(up to 10 sq. mm)
- d) Stripping tool : 1 No.  
(up to 40 sq. mm)
- e) Insulation removal tool : 1 No.
- f) Cutting tool : 1 No.  
(up to 50 sq. mm)
- g) Flat bladed screw driver : 1 No.  
uninsulated,
- h) Flat bladed screw driver : 1 No.  
insulated
- i) Star type screwdriver : 1 No.
- j) Torque screw driver : 1 No.
- k) Universal control cabinet : 1 No.  
key
- l) Electrician plier (AC/DC) : 1 No.
- m) Tool kit bag : 1 No.
- n) Crimping Tool : 1 No.
- o) Stripping Tool : 1 No.

**2.19 Tool Maker Clamp Jaw (PR0760000018, Qty.: 2 Sets includes 1 No. of each Size)**

Tool Maker Clamp Jaw of total 2 Nos. of following sizes shall be provided:

- a) Size : 50 mm wide = 1 No.  
100 mm wide = 1 No.

**2.20 Trimmer & Alignment Tool Kit (PR0900004746, Qty.: 1 Set)**

Precision Plastic Trimmer Tool Set. Thermoplastic tip material.

**2.21 Coil Winding Machine (PR0680000259, Qty.: 1 No.)**

Coil winding machine, single phase motor driven, to wind wires of diameter 0.001" to 0.036".

**2.22 Pressure & Differential Pressure Calibrator–Portable (PR0680000828, Qty.:2 Nos.)**

- a) Type : Precision Electronic with digital display
- b) Ranges : Each calibrator shall be provided to measure following ranges  
(individual module for each range shall be provided for each Calibrator):
  - i. 0-500 mmwcl – Total 2 nos for 2 Calibrators
  - ii. 0-2500 mmwcl – Total 2 nos for 2 Calibrators
  - iii. 0-1.6 kg/cm<sup>2</sup> g– Total 2 nos for 2 Calibrators
  - iv. 1.6-10 kg/cm<sup>2</sup> g– Total 2 nos for 2 Calibrators
  - v. 0 – 250 Kg/cm<sup>2</sup> g– Total 2 nos for 2 Calibrators
  - vi. 0 – 400 Kg/cm<sup>2</sup> g– Total 2 nos for 2 Calibrators
- c) Accuracy :  $\pm 0.002\%$  F.S. + ( $\pm 0.05\%$  of Reading)
- d) Resolution : 1 mm
- e) Over Range Protection : 20 percent of span
- f) Pressure Sensing : Capacitive transducer element
- g) Display
  - Type : LCD
  - Digit : 5



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- h) Function : Display for actual value and percentage error
- i) Other Functions : 1. 24V DC supply for two wire transmitter  
2. Contact monitoring for switch devices  
3. Capability to read negative pressures upto (-) 0.8 kg/cm<sup>2</sup>
- j) Power Supply : 240/230 V AC, 50 Hz with rechargeable Ni-Cd batteries
- k) Operating Temperature : 60 deg.C
- l) Pressure Connection : 1/8 and 1/4 inch BSP and NPT
- m) Accessories : 1. Calibration pressure pump to meet complete range  
2. Current output modules  
3. Instruction Manuals  
4. Carrying case
- n) Application : Calibration of pressure/diff.pr. transmitters, pressure switches and converters etc.

**2.23 Pressure & Differential Pressure Calibrator-Table Mounted (PR0680000852, Qty.:2 Nos)**

- a) Type : Precision Electronic with digital display
- b) Ranges : Each calibrator shall be provided to measure following ranges:  
(individual module for each range shall be provided for each Calibrator):
  - i. 0-500 mmwcl- Total 2 nos for 2 Calibrators
  - ii. 0-2500 mmwcl - Total 2 nos for 2 Calibrators
  - iii. 0-1.6 kg/cm<sup>2</sup> g- Total 2 nos for 2 Calibrators
  - iv. 1.6-10 kg/cm<sup>2</sup> g- Total 2 nos for 2 Calibrators
  - v. 0 - 250 Kg/cm<sup>2</sup> g- Total 2 nos for 2 Calibrators
  - vi. 0 - 400 Kg/cm<sup>2</sup> g- Total 2 nos for 2 Calibrators
- c) Accuracy :  $\pm 0.002\%$  F.S. + ( $\pm 0.05\%$  of Reading)
- d) Resolution : 1 mm
- e) Over Range Protection : 20 percent of span
- f) Pressure Sensing : Capacitive transducer element
- g) Display :
  - Type : LCD
  - Digit : 5
- h) Function : Display for actual value and percentage error
- i) Other Functions : 1. 24V DC supply for two wire transmitter  
2. Contact monitoring for switch devices  
3. Capability to read negative pressures upto (-) 0.8 kg/cm<sup>2</sup>
- j) Power Supply : 240/230 V AC, 50 Hz with rechargeable Ni-Cd batteries
- k) Operating Temperature : 60 deg.C
- l) Pressure Connection : 1/8 and 1/4 inch BSP and NPT
- m) Accessories : 1. Calibration pressure pump to meet complete range  
2. Current output modules  
3. Instruction Manuals  
4. Carrying case
- n) Application : Calibration of pressure/diff.pr. transmitters, pressure switches and converters etc.



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**2.24 Vacuum Calibrator Table Mounted (PR0680000844, Qty.: 1 No.)**

- a) Range : - 12 to 0 psi
- b) Accuracy :  $\pm 0.025\%$  FS
- c) Display : LCD Seven Segment
- d) mA Input : 4-20 mA
- e) Power Supply : 9V Alkaline Battery
- f) Accessories : 1. Charger/Adapter  
2. Calibration Vacuum Pump  
3. Test Leads  
4. Carrying Case  
5. Instruction Manual

**2.25 Pressure & Vacuum Air Pump (PR0680000470, Qty.: 1 Set)**

- a) Type : Double stage, combination Pressure and Vacuum Pump
- b) Range – Pressure : Upto 10 kg/cm<sup>2</sup> for continuous duty
- c) Range – Vacuum : Upto 760 mm of mercury
- d) Capacity : 0.03 mm<sup>3</sup> per minute at 1 kg/cm<sup>2</sup>
- e) Drive : Fan cooled motor suitable for 415V, 50 Hz,  
3 phase AC power supply with cable and starter.
- f) Accessories : 1. Bleeder valves in inlet outlet lines for desired vacuum or  
pressure setting  
2. 50 mm dial pressure gauge of range 0- 25 kg/cm<sup>2</sup>  
3. 50 mm dial vacuum gauge of range 0- 760 mm of mercury  
4. Lubricator exhaust trap  
5. Hose nipples  
6. Intake filters  
7. Other necessary accessories
- g) Application : Calibration of draft gauges, vacuum gauges / Transmitters  
and compound gauges.
- h) Other Particular : Pump seals shall be self-adjusting type without packing.

**2.26 Air Set (PR0680000232, Qty.: 2 Nos.)**

- a) Filter element : 5 micron sintered bronze filter element
- b) Max. primary pressure : 17.5 kg/cm<sup>2</sup>
- c) Secondary pressure : 0-4 kg/cm<sup>2</sup>
- d) Connection : 1/4" NPT (F)
- e) Accessory : O/P Gauge

**2.27 Portable Electro-Pneumatic Calibrator (PR0680000410, Qty.: 4 Nos. {1No. of each Range})**

- Ranges : Electro-Pneumatic Calibrator of below ranges shall be provided:
  - i. 0 – 2 bar
  - ii. 0 – 10 bar
  - iii. 0 – 40 bar
  - iv. 0 – 200 bar

The electro-pneumatic calibrator shall provide an accurate and convenient means for calibration of electronic and pneumatic instrumentation. Each calibrator shall have the following features as a minimum:





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- a) Measurement & indication of pressure signal with accuracy of  $\pm 1-0.05\%$  full scale.
- b) Generation of regulated pressure signal by using external air supply. In the absence of external air supply, the same shall be generated by a pressure and vacuum generator for low pressures. Suitable pressure generating unit (external) shall be provided for higher pressures.
- c) Measurement, generation and indication of current and voltage (mV, V and mA) signals.
- d) Digital read-out of electrical as well as pressure signals.
- e) Selection facility for reading pressure in five engineering units.
- f) Generation of DC supply voltage to electronic transmitters.
- g) Over pressure protection.
- h) The instrument shall have re-chargeable battery as power back-up and shall be complete with all accessories viz. Battery Charger etc.

**2.28 Portable Ultrasonic Flowmeter (PR0280000937, Qty.: 2 Nos.)**

This ultrasonic flow meter is used for non-intrusive flow measurement, indication, totalizing and transmitting of the flow in a full pipe.

- a) Sensors : Dual transmitting / receiving clamp-on, for pipes of size 50 mm to 1000 mm and other pipe size.
- b) Power : Built-in rechargeable battery and external charger.
- c) Data Storage : Internal data logger (which can be downloaded to a WORK STATIONS later).
- d) Measuring Range : 0 to  $\pm 0.3$  to  $\pm 12$  m/s
- e) Accuracy :  $\pm 1.0\%$  of rate
- f) Response : 1 second
- g) Temperature :  $-50$  deg.C to  $250$  deg.C
- h) Display : Graphic LCD, Flow in m<sup>3</sup>/Hr.  
Velocity in m/sec.
- i) Totaliser : 12-digit LCD
- j) Battery : Usable continuously for 5 hours (min.)
- k) Printer : Fixed – internal automatic printout of Measured data
- l) Accessories : Power Adapter  
SS Fastening belt  
Propagation medium gel  
Carrying case  
Instructions for use

**2.29 Surface Pyrometer (PR0680000445, Qty. 1 Set) Consisting of following:**

**a. Portable Infrared Radiation Thermograph (Qty.: 1 No.)**

Portable infrared thermometer shall be provided for detecting infrared radiated by all bodies above  $0^{\circ}\text{C}$ . The item shall be powered by 1.5V AA battery and emissivity control and display hold shall also be provided.

- a) Temperature Range :  $-30^{\circ}\text{C}$  to  $2000^{\circ}\text{C}$
- b) Resolution :  $0.1^{\circ}\text{C}$  (below  $200^{\circ}\text{C}$ )  
 $1^{\circ}\text{C}$  (above  $200^{\circ}\text{C}$ )
- c) Accuracy :  $\pm 1\%$  reading or  $\pm 3^{\circ}\text{C}$ , whichever is greater.



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- d) Repeatability : +/- 0.5/1% reading +/- 1 digit
- e) Spectral Response : 8 - 14 microns
- f) Response Time : 500 m. sec
- g) Emissivity : 0.95
  
- h) Power Source : 9V alkaline or lithium battery
  
- i) Accessories : Lens Cap  
Data Log facility  
Batteries  
Battery chargers  
Safety wrist straps  
Output interfacing cable  
Carrying Case  
Instruction Manual

**b. PORTABLE INFRARED RADIATION THERMOMETERS (Qty. 1 No.)**

Portable infrared thermometer shall be provided for detecting infrared radiated by all bodies above 0°C. The item shall be powered by 1.5V AA battery and emissivity control and display hold shall also be provided.

- a) Temperature Range : -30°C to 2000 °C
- b) Resolution : - 0.1°C (below 200°C) 1°C (above 200°C)
- c) Accuracy : +1% rdg or +3°C, whichever is greater
- d) Repeatability : +0.5/1% rdg +1 digit
- e) Spectral Response : 8-14 microns
- f) Response Time : 500 m.sec
- g) Emissivity : 0.95
- h) Power Source : 9V alkaline or lithium battery
- i) Accessories : Lens Cap  
Data Log facility  
Batteries  
Battery chargers  
Safety wrist straps  
Output interfacing cable  
Carrying Case  
Instruction Manual

**2.30 Portable H2 Gas Analyser (Microprocessor based) (PR0280000405, Qty.: 1 No.)**

- a) Case Purity : 0 to 100% H2 in Air
- b) Purge : 0 to 100% H2 in CO2  
0 to 100% air in CO2
- c) Hydrogen Flow Rate : 100 to 700 CC/min
- d) Output Signal : 4-20 m Amp
- e) Display : Digital with Gas Purity in real time.
- f) Power : With rechargeable battery
- g) Accessory : As required i.e Flowmeter, Flow Control Valve, Pump



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**2.31 Industrial Grade Portable Vacuum Cleaner (PR0680000461, Qty.: 6 Nos.)**

A compact, mains powered industrial grade Wet & Dry type portable vacuum cleaner designed for 240V AC, 50 Hz with all accessories shall be supplied.

- a) Application : Blowing and sucking facility for cleaning the control panels, C&I Lab instruments, housekeeping of C&I Lab etc.

**2.32 Averaging Pitot tube (PR0680000399, Qty. 2 Nos.)**

Type/Construction : Pitot tube with direct mounting type on pipe

**Materials**

Body : SS316  
Nipple : SS316  
Gaskets : Teflon  
Bolts & nuts : SS316  
Flange : SS316

Process Connection : 1 ½" Flanged  
Instrument connection : ½" NPT (F) through needle valve  
Length : To suit the PA/SA/FD Duct off line flow measurement  
Differential Pressure Range : To suit the accurate flow

Accessories : Bolts, Nuts, Cover plates, Adapter and Gaskets, SS tag plate as required

**2.33 Oil Condition Monitor (PR0540000051, Qty.: 1 No.)**

Oil Check Monitor (Portable) shall have following specifications:

- a) Suitable Oil types : Mineral and Synthetic oils  
b) Repeatability : +/-5%  
c) Readout : Green/red grading + numerical value (-999 to +999)  
d) Battery : 9V Alkaline type IEC 6LR61  
e) Battery lifetime : >150 hours or 3000 tests  
f) The monitor should track of mechanical wear and of any loss of the oil's lubricating properties.

**2.34 Grinding Wheel (PR0900004568, Qty. 1 no of each type, Total 2 Sets)**

Material : i. Aluminium Oxide  
                  ii. Silicon Carbide  
Grain Size : Coarse, Medium, Fine, Very fine.  
Grade : Soft, Medium, Hard.  
Wheel Structure : Dense, Normal, Open.  
Bond type : Resinoid, Shellac, Rubber, Silicate, Vitrified.

**2.35 Furniture for C&I Lab (PR0490000878, Qty 1 Set)**

Three (3) nos. teak wooden work table with thick laminated top size 1x2 meters. Eight (8) nos. high adjustable wheeled swivel chairs. Four (4) nos. vertical cabinets 1000 x 480 x 2000 mm made of sheet steel (Sheet thickness of 18 gauge) and equipped with safety locks. Four (4) nos. open shelf 1000 x 200 x 2000 mm with partitions made of steel shall be provided.



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**3.0 BILL OF MATERIAL**

Sl. No.	ITEM DESCRIPTION	Spec. clause	Vendor List sl.	BHEL Material Code	Certification	Quantity
1	Pneumatic Test Bench	2.01	26	PR0800000030	Test Reports	1 No.
2	Portable Calibrator for Vacuum	2.02	1	PR0680000836	Calibration Certificate	1 No.
3	U-Tube Manometer	2.03	2	PR0680000372	Test Certificate	2 Sets
4	Inclined -Tube Manometer	2.04	3	PR0680000453	Test Certificate	2 Sets
5	Test Manometer	2.05	4	PR0680000364	Test Certificate	2 Nos.
6	Digital Manometer	2.06	5	PR0680000860	Test Certificate	2 Nos.
7	Dead Weight Tester	2.07	6	PR0680000267	Test Certificate	1 No.
8	Vacuum Tester	2.08	6	PR0680000488	Test Certificate	1 No.
9	Standard Pressure Gauges	2.09	7	PR0160000050	Test Certificate	2 Sets
10	Hydraulic Pressure Gauge Tester	2.10	6	PR0680000313	Test Certificate	2 Nos.
11	Mercury Thermometer	2.11	8	PR0680000380	Certificate of Conformity	2 Sets
12	Flowmeter Calibrator	2.12	9	PR0680000283	Certificate of Conformity	3 Nos.
13	Digital Thermograph / Hygrometer	2.13	10	PR0680000801	Certificate of Conformity	1 No.
14	Portable Flue Gas Analyzer	2.14	11	PR0280000073	Test Report	1 Set
15	Aneroid Barometer	2.15	12	PR0680000240	Certificate of Conformity	1 No.
16	Miscellaneous Items	2.16	13	MECH-LAB-ITEMS	Certificate of Conformity	1 Set
17	Standard Tool Box	2.17	13f	PR0760000000	Certificate of Conformity	6 Sets
18	Panel Wiring Tool Kit	2.18	13i	PR0900003413	Certificate of Conformity	5 Sets
19	Tool Maker Clamp Jaw	2.19	13a	PR0760000018	Certificate of Conformity	2 Sets
20	Trimmer & Alignment Tool Kit	2.20	13c	PR0900004746	Certificate of Conformity	1 Set
21	Coil Winding Machine	2.21	13g	PR0680000259	Certificate of Conformity	1 No.
22	Pressure & Differential Pressure Calibrator-Portable	2.22	14	PR0680000828	Calibration Certificate	2 Nos.
23	Pressure & Differential Pressure Calibrator-Table Mounted	2.23	14	PR0680000852	Calibration Certificate	2 Nos.
24	Vacuum Calibrator Table Mounted	2.24	15	PR0680000844	Calibration Certificate	1 No.
25	Pressure & Vacuum Air Pump	2.25	16	PR0680000470	Test Certificate	1 Set
26	Air Set	2.26	17	PR0680000232	Certificate of Conformity	2 Nos.



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Sl. No.	ITEM DESCRIPTION	Spec. clause	Vendor List sl.	BHEL Material Code	Certification	Quantity
27	Portable Electro-Pneumatic Calibrator (1 No. each Range)	2.27	18	PR0680000410	Calibration Certificate	4 Nos.
28	Portable Ultrasonic Flowmeter	2.28	19	PR0280000937	Certificate of Conformity	2 No.
29.a	Portable Infrared Radiation Thermograph	2.29.a	29	PR0680000445	Certificate of Conformity	1 No.
29.b	Portable Infrared Radiation Thermometers	2.29.b	20	PR0680000445	Certificate of Conformity	1 No.
30	Portable H2 Gas Analyser	2.30	21	PR0280000405	Test Certificate	1 No.
31	Industrial Grade Portable Vacuum Cleaner	2.31	22	PR0680000461	Certificate of Conformity	6 Nos.
32	Averaging Pitot Tube	2.32	25	PR0680000399	Certificate of Conformity	2 No.
33	Oil Condition Monitor	2.33	23	PR0540000051	Certificate of Conformity	1 No.
34	Grinding Wheel	2.34	24	PR0900004568	Certificate of Conformity	2 Sets.
35	Furniture for C&I Lab	2.35	28	PR0490000878	Certificate of Conformity	1 Set
36	Erection and Commissioning of supplied lab items			EC-001		1 Set

**Note:** Certificate for each instrument shall be submitted as per the list above; deviation, if any, shall be mentioned in the offer.

#### 4.0 ITEM WISE SUB – VENDOR / MANUFACTURER LIST

SL NO	Lab Instrument	MAKE
1	Portable Calibrator for Vacuum	Tinsley/ BEAMEX Scandura Eurotron Druck Time Electronics ITPL Wika - Germany AMETEK, DENMARK USA DH-BUDENBERG, FRANCE/UK
2	U-Tube Manometer	Dwyer/Meriam/Tinsley/Fitzer/ Yokogawa/ITPL
3	Inclined -Tube Manometer	Dwyer/Meriam/Tinsley/Fitzer/ Yokogawa/ ITPL
4	Test Manometer	Dwyer/Meriam/Tinsley/Fitzer/ Yokogawa/ITPL
5	Digital Manometer	Meriam /Tinsley/Fitzer/Yokogawa/ Cole Parmer/ Beamex/ Time Electronics / ITPL/AOIP AMETEK, DENMARK USA WIKA- Germany
6	a. Dead Weight Tester b. Vacuum Tester c. Hydraulic Pressure Gauge Tester	Tinsley/ Scandura/ BEAMEX/Budenberg/ Time Electronics / ITPL DH-BUDENBERG, FRANCE/UK AMETEK, DENMARK USA/ WIKA INSTRUMRNTS GERMANY
7	Standard Pressure Gauges	Ametek/Budenberg/Tinsley /Scandura/ Time Electronics / ITPL ASHCROFT INC ,USA/ WIKA INSTRUMRNTS GERMANY
8	Mercury Thermometers	Tinsley/Scandura/Brooklyn/Amarrell/ ITPL
9	Flow meter Calibrator	Tinsley/Odin/Ametek/E&H/Fuji/ITPL DWYER INSTRUMENTS INC, USA/YOKOGAWA JAPAN

10	Digital Thermograph/ Hygrometer	Extech/Rosemount/Brooklyn/Tinsley/ ITPL GE / COLE PARMER, USA/AMPROBE, USA
11	Portable Flue gas Analyser	Endee/Land/Bacharach/H & B/Eurotron TESTO GERMANY
12	Aneroid Barometer	Wallace/Tiernan/Brooklyn Novalynix/Transcat COLE PARMER, USA /GE
13	Miscellaneous Items	
a	Tool maker clamp jaw	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
b	Hand operated wire wrap tool	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
c	Trimmer & Alignment Tool Kit	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
d	Magnetic screw driver	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
e	SS & copper tube cutter/blender	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
f	Standard tool box	ITPL / Beamex/Scandura/RS components/Hitachi/Black& Decker/Phoenix
g	Coil winding machine single phase motor driven to wind wires of dia0.001" to 0.036".	ITPL / Beamex/Scandura/Taparia/RS components/BMP equipment's/Hitachi/Black& Decker
h	Electrically operated wire wrap (0.2 mm to 1 mm)	ITPL / Beamex/Scandura/Taparia/RS components/Hitachi/Black& Decker
i	Panel wiring tool Kit	WAGO / Phoenix / WEIDMULLER /ITPL
14	Pressure & Diff. Pressure Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/BEAMEX/Time Electronics / ITPL / FLUKE CORPORATION, USA/ DRUCK, USA/ ASHCROFT INC, USA/WIKA INSTRUMENT, GERMANY/AMETEK, DENMARK USA/DH-BUDENBERG, FRANCE/UK/ AOIP, FRANCE L
15	Vacuum Calibrator	Scandura/Tinsley/Eurotron/Yokogawa/ BEAMEX/Time Electronics / ITPL FLUKE CORPORATION, USA/ DRUCK, USA/ ASHCROFT INC, USA/WIKA INSTRUMENT, GERMANY/AMETEK, DENMARK USA/DH-BUDENBERG, FRANCE/UK/ AOIP, FRANCE





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16	Pressure & Vacuum Air Pump	Scandura/Tinsley/Eurotron/Yokogawa/ BEAMEX/Time Electronics / ITPL/AOIP KNF NEUBERGER, USA/ BHARATH VACUUM PUMPS, INDIA /ELGI,INDIA
17	Air Set	Shavo-Norgen/ Placka/SMC Pneumatic FAIRCHILD INDUSTRIAL PRODUCTS/ ABB
18	Portable Electro-Pneumatic Calibrator	Tinsley/SMC Pneumatic/H&B (ABB)/MTL/P&F/Time Electronics / ITPL/AOIP
19	Portable Ultrasonic Flow meter	Fuji/E&H/ITPL/Dynasonic/Micronics/ GE / TESCO COMPUFLOW, USA
20	Portable Infrared Radiation Thermometers	ITPL/Extech/RAYTEK(Fluke) / MIKRON/ COLE – PARMER/Impac MINOLTA,USA/TESTO, GERMANY/FLUKE CORPORATION, USA
21	Microprocessor based Portable H2 Gas Analyser	Hach Ultra/Ametek/Codel/e one/Eurotron/ BACHARACH/ENDEE
22	Industrial portable Vacuum Cleaner	LG, Electrolux, Godrej, Morphy Richards, Panasonic. EUREKA FORBES, INDIA/BOSCH, GERMANY,INDIA/KARCHER, GERMANY
23	Oil Condition Monitor	Eaton/Precision Filtration/KITTIWAKE
24	Grinding Wheel	BOSCH/ REX
25	Averaging Pitot Tube	Dietrich (Fisher Rosemount), Micro-precision, Technomatic, DWYER/ VERIS INSTRUMENTS

26	Pneumatic Test bench	Tinsley / Scandura-Italy / Beamex/ Isothermal Technology Pvt Ltd(ITPL)
27	Oil Condition Monitor (additional vendor)	SKF
28	Furniture for C&I Lab	Pyrotech Workspace Solutions Pvt Ltd, Godrej and Boyce Manufacturing Co., Cosmos Media Products Pvt Ltd, Harmony Systems, Adarsha Control Systems Pvt Ltd., Featherlite Products Pvt Ltd.
29	Portable Infrared Radiation Thermograph	ITPL/Extech/RAYTEK(Fluke) / MIKRON/ COLE – PARMER/Impac/Nippon.

Note:

- 1.0 Vendors to offer items from above approved makes only.
- 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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## 5.0 PROCEDURE FOR PACKING OF CONTROL EQUIPMENTS USING PLYWOOD.

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 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 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 shook's , and also at top portion of both corner shook'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 shook'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:

-----		-----
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 <sup>2</sup>
3.	Discoloration	Nil
4.	Dote	5cm/m <sup>2</sup>
5.	Insect hole	Scattered up to 12 holes/m <sup>2</sup>
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 <sup>2</sup>
8.	Pin knots(dead)	2/m <sup>2</sup>
9.	Pin knots(live)	No restriction
10.	Knots(tight)	6 up to 25mm dia/m <sup>2</sup>
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 <sup>2</sup>
3.	Discoloration	5 %
4.	Dote	15cm/m <sup>2</sup>
5.	Insect hole	Scattered up to 24 holes/m <sup>2</sup>
6.	Joints	: No restrictions
7.	Knots (dead)	4 up to 20mm dia/m <sup>2</sup>
8.	Pin knots (dead)	: 6/m <sup>2</sup>
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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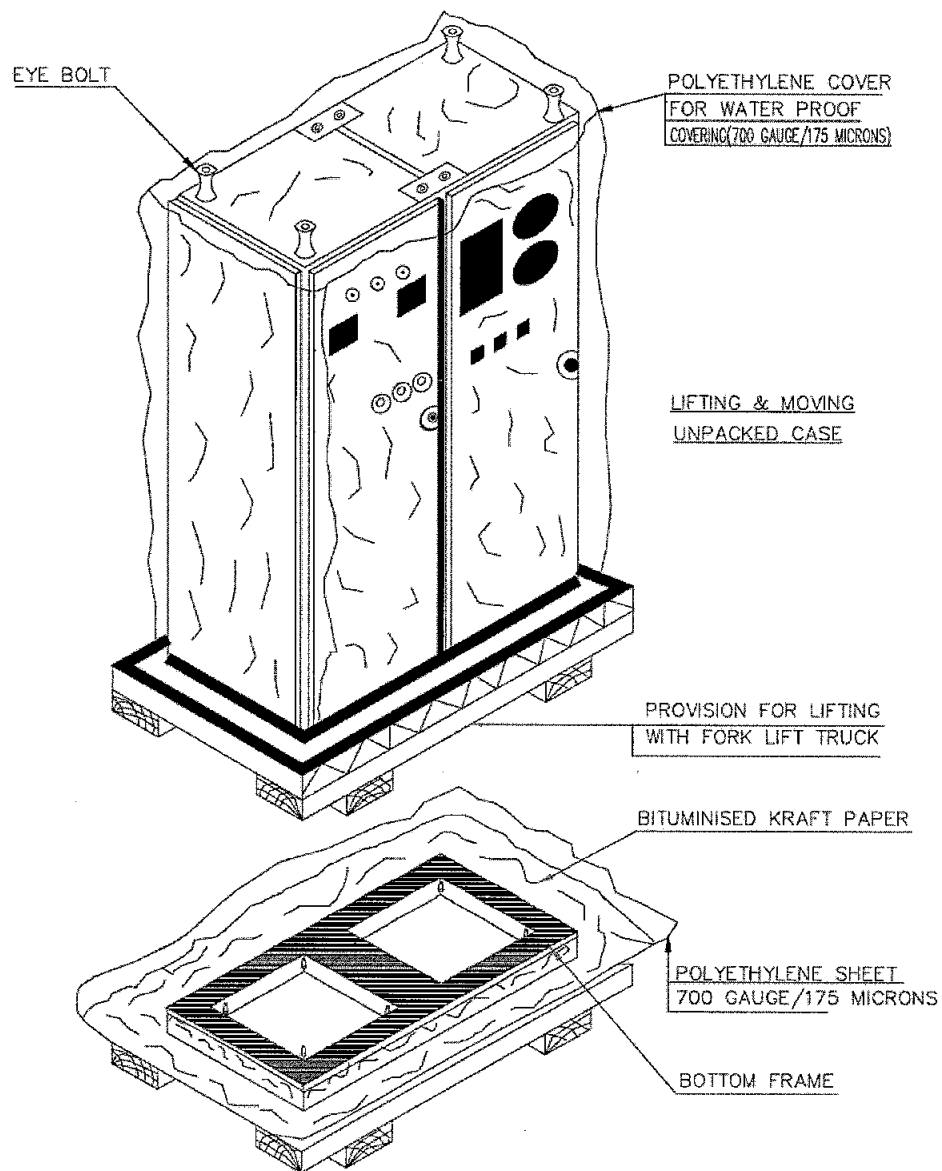


FIGURE-1



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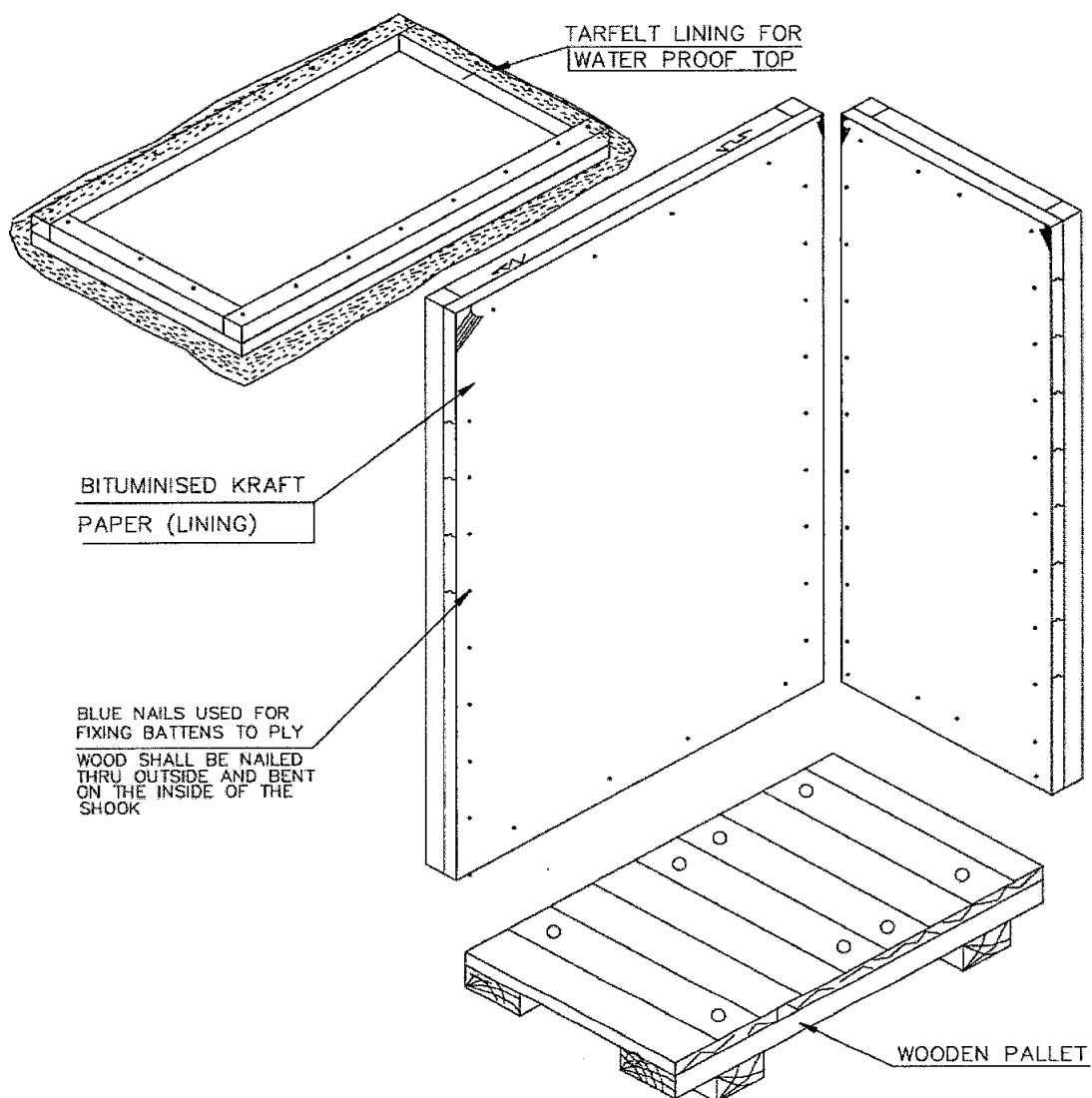


FIGURE-2



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

FIG-3 : MARKING PLATE



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### PLYWOOD SHOOKS BOLT TYPE WITH SILVER OAK BATTONS

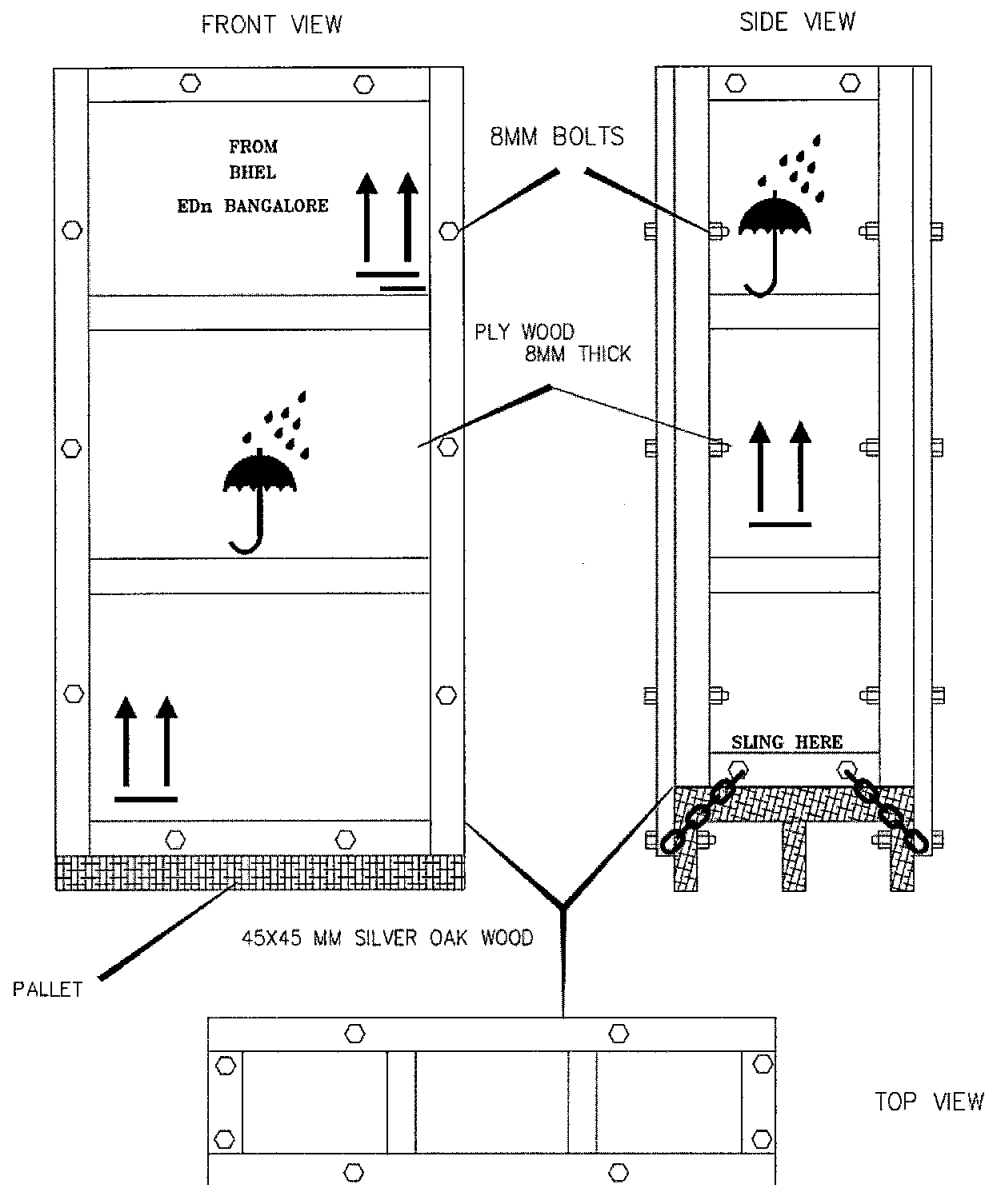


FIG-4





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LAP JOINTS

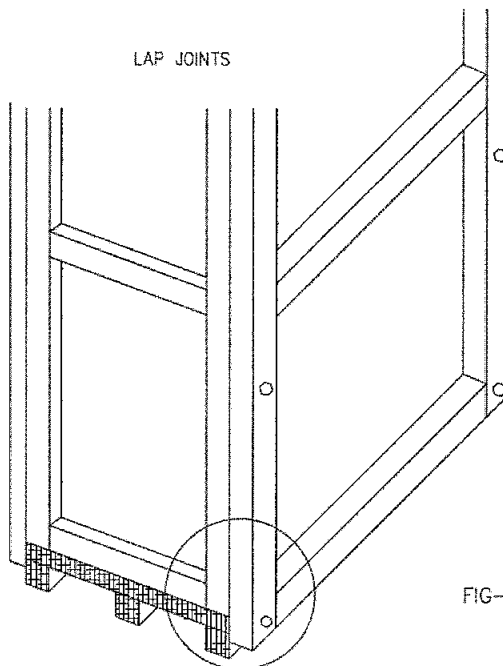
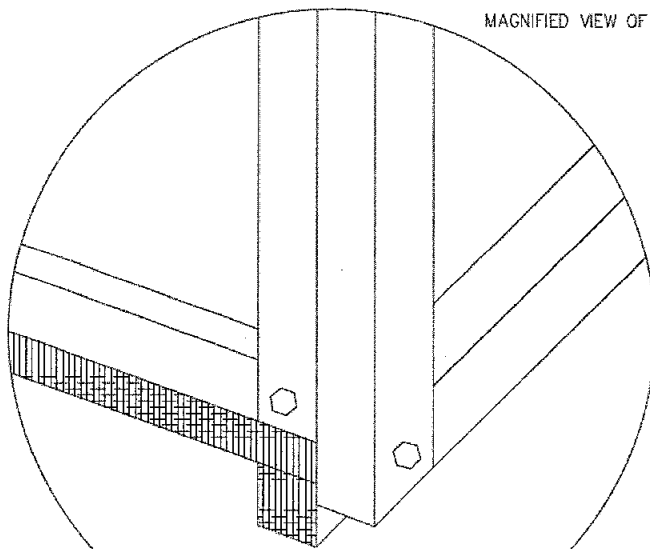


FIG-5

MAGNIFIED VIEW OF THE LAP JOINT





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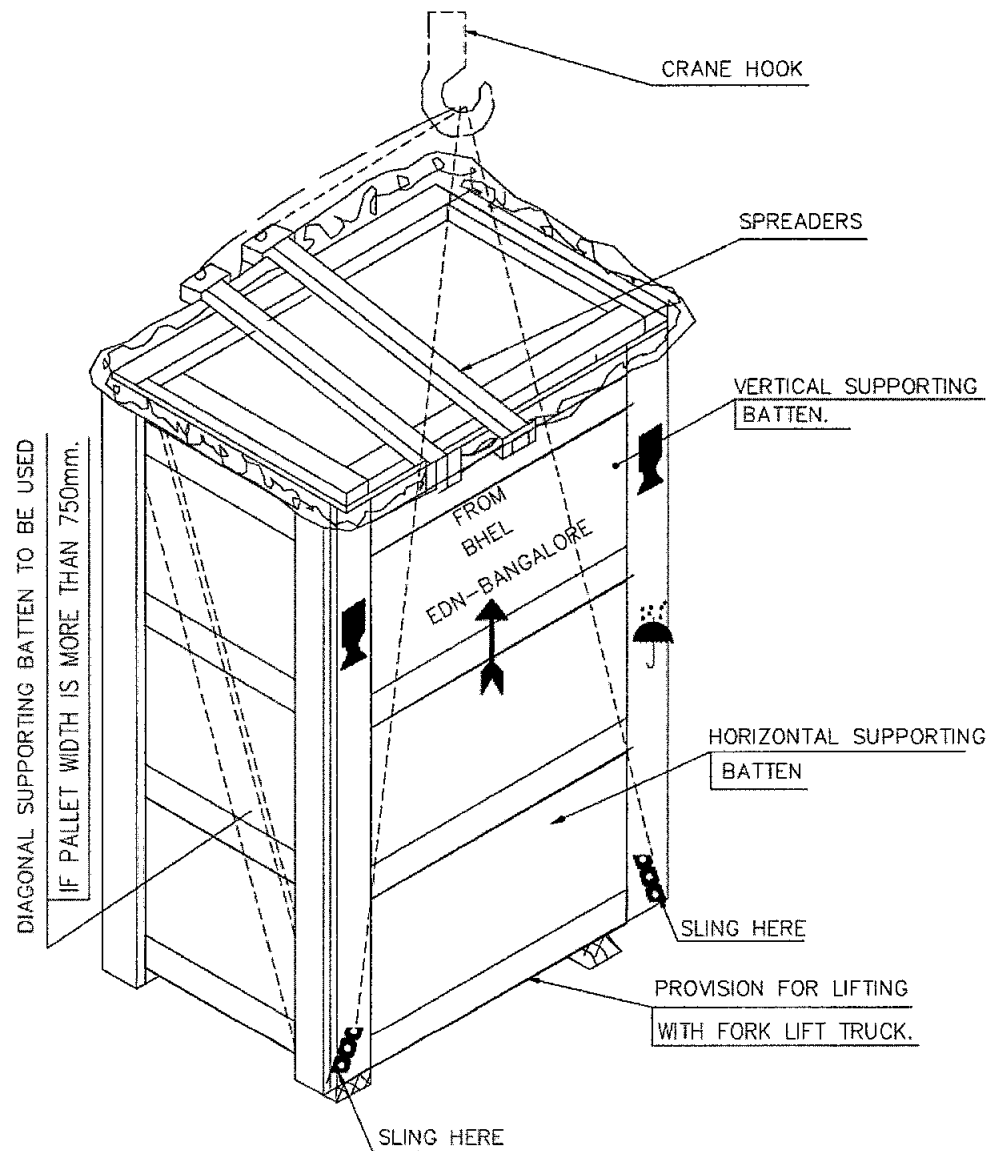


FIG-6 : LIFTING OF PACKED CASE





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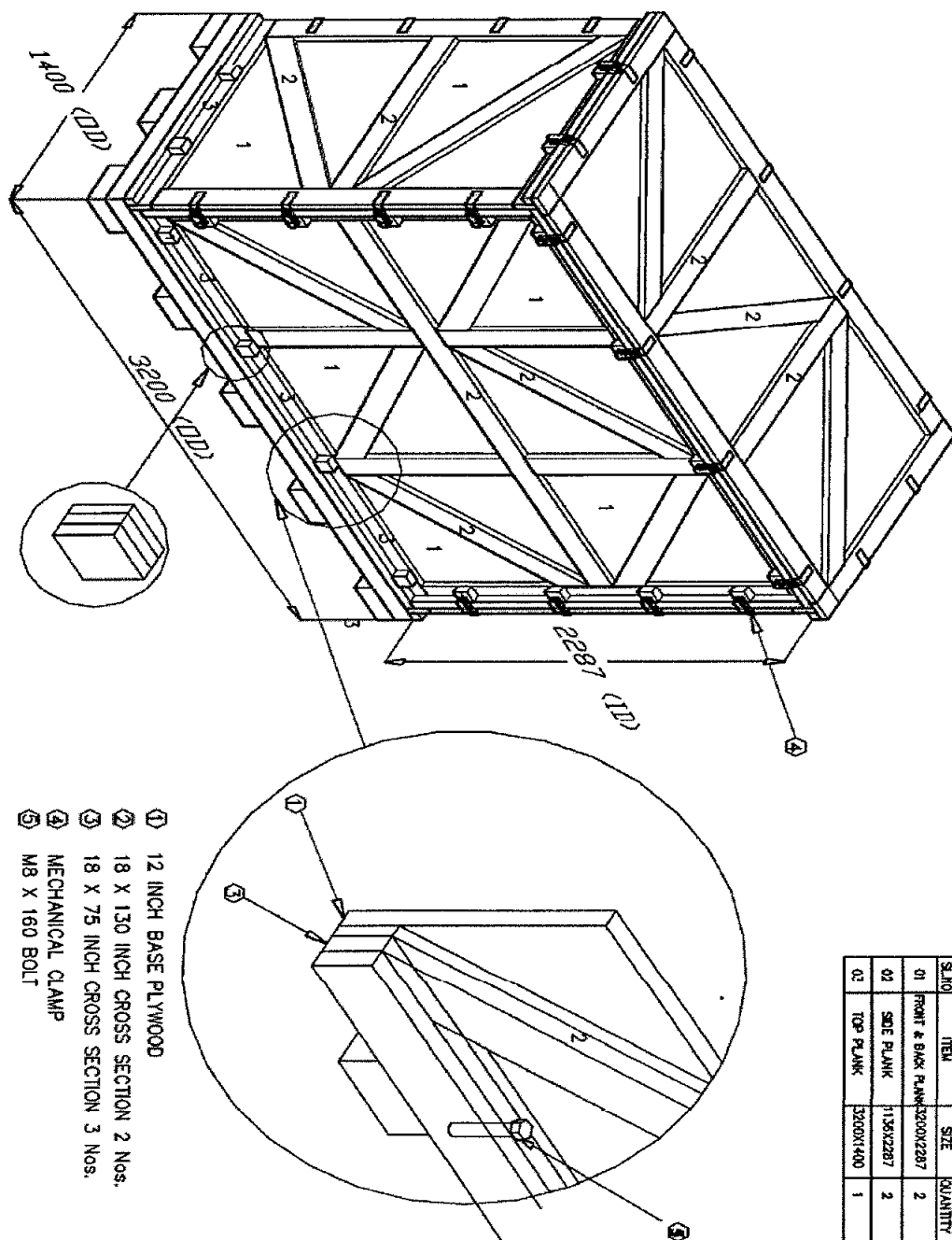


Fig - 8 : CLW Railway Panel Packing with Plywood & Plywood Support Battens

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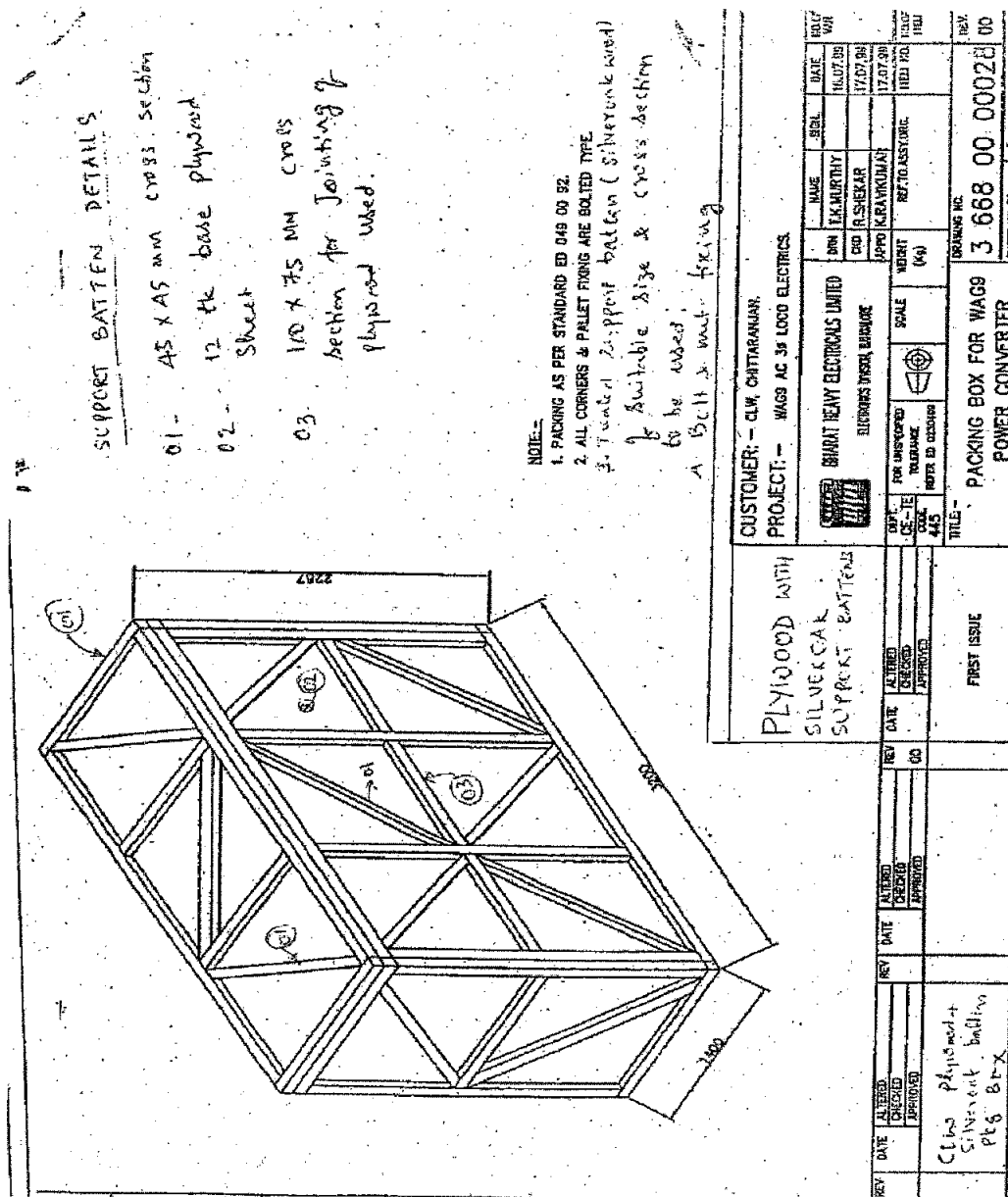


Fig – 9 : CLW Railways Panel Packing with Plywood & Silver Oak Battens



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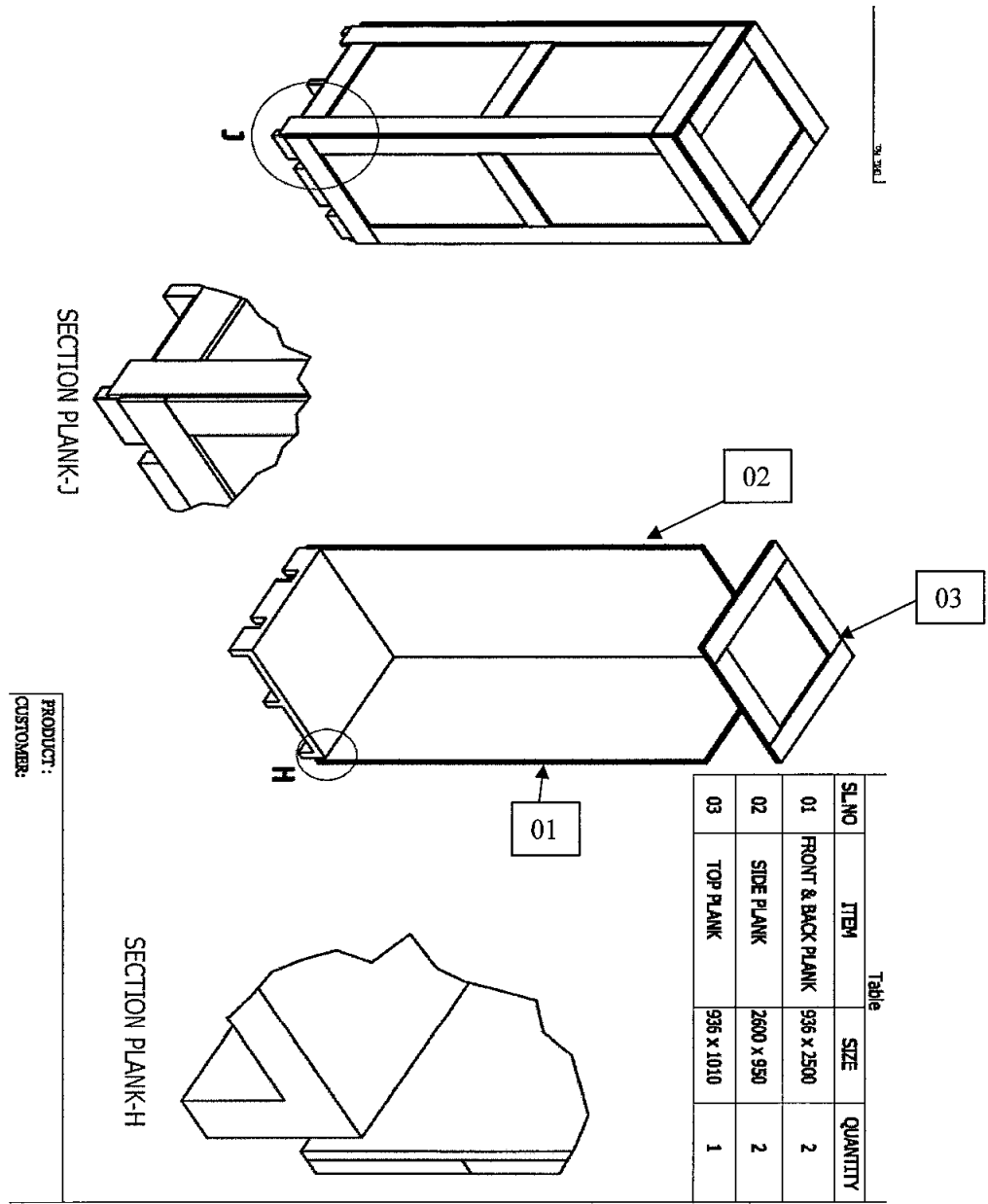


Fig-10 : Plywood Packing for Single Suit Panel.



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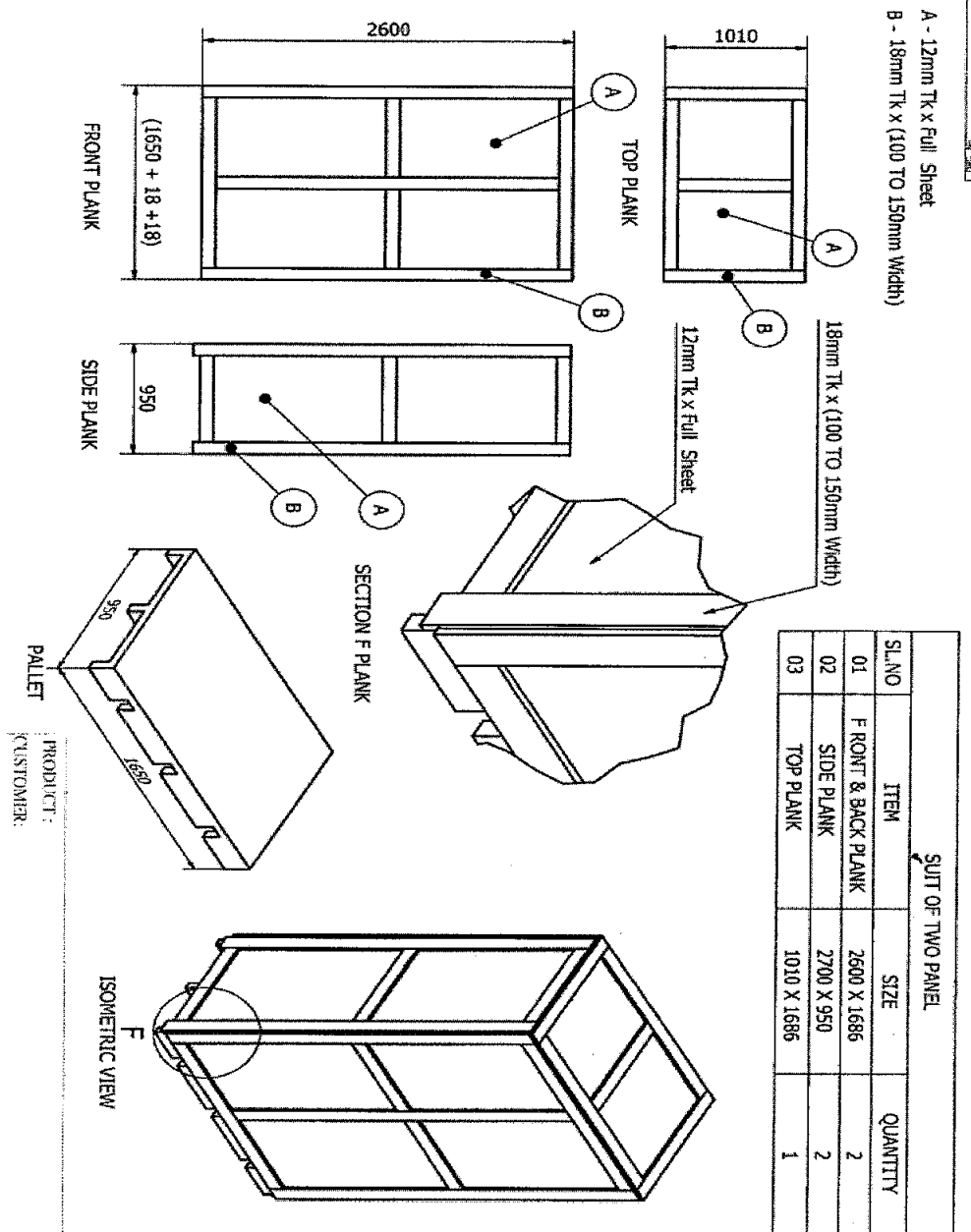


Fig - 11 : Plywood Packing for 2suit panel.



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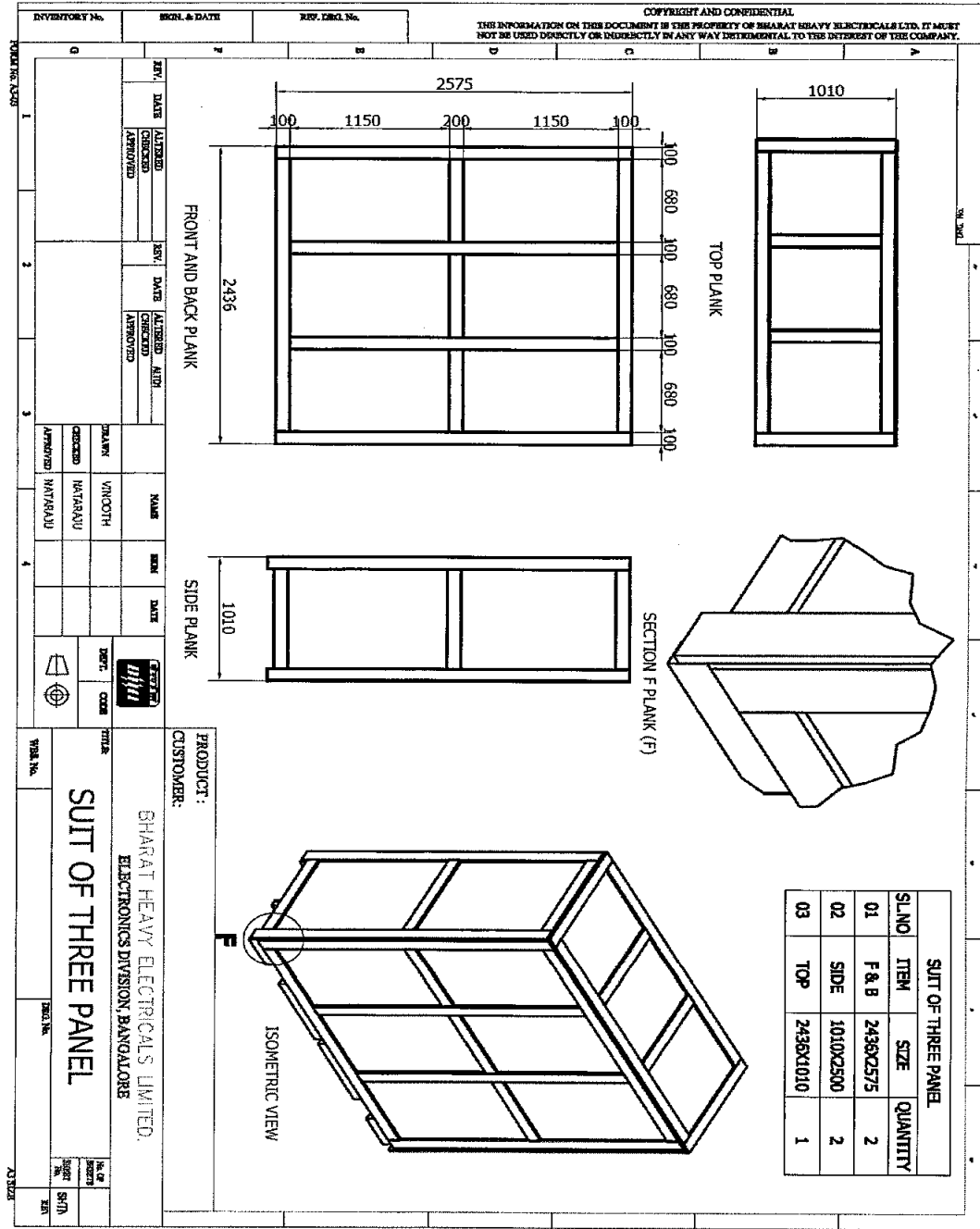
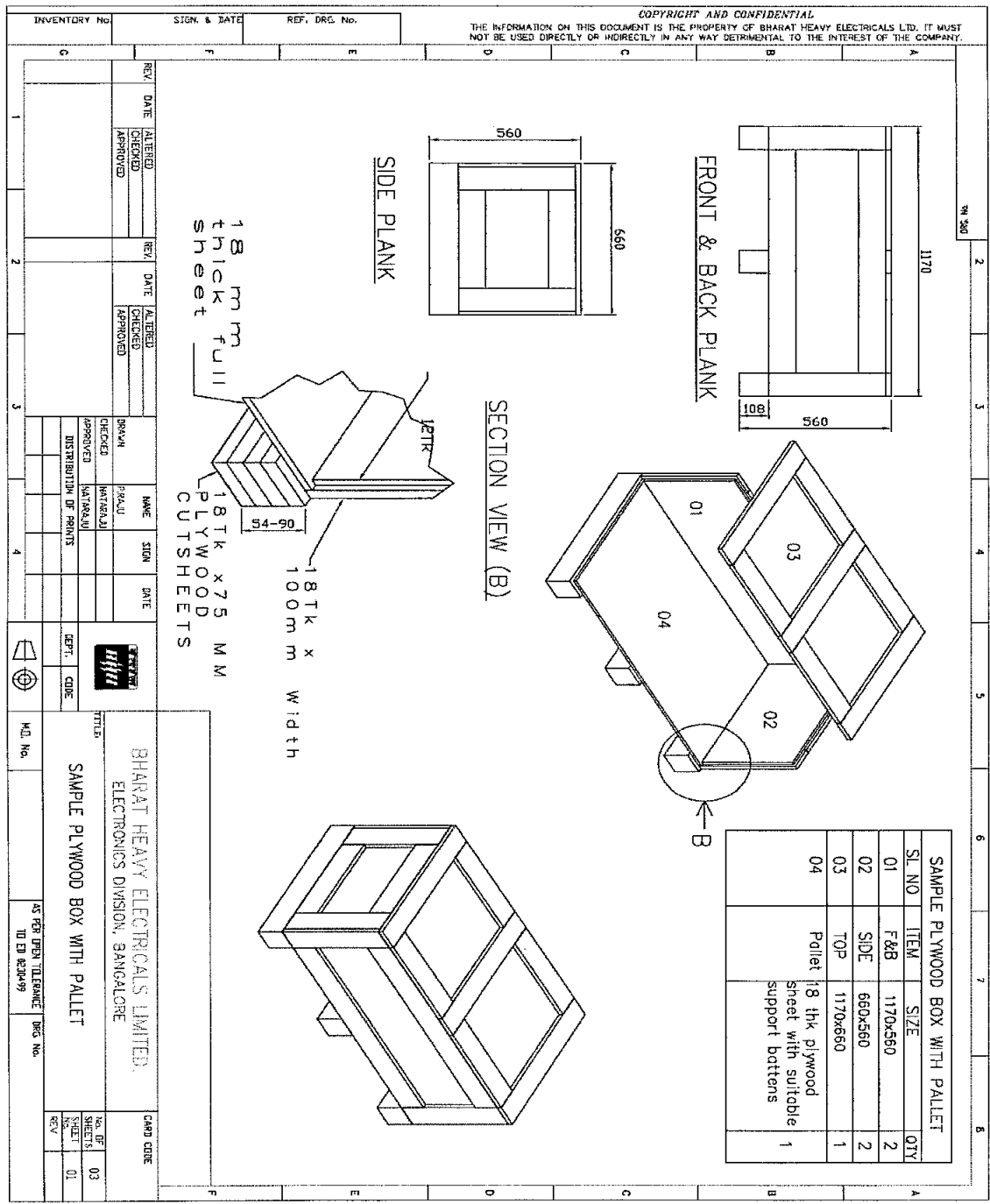


Fig - 12 : Three Suit Panel Packing




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SL NO	ITEM	SIZE	QTY
01	F&B	1170x560	2
02	SIDE	660x560	2
03	TOP	1170x660	1
04	Pallet	18 thk plywood sheet with suitable support battens	1

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

