| | TITLE :<br>TECHNICAL SPECIFICATION FOR<br>VIBRATION ISOLATION SYSTEM (VIS) | SPECIFICATION NO. PE-TS-485-667-C001 | |
|---|---|---|---|
| | | SECTION I | |
| | | REV. NO. 1 | DATE 12.10.2021 |
| | | SHEET 1 of 8 | |

# SECTION-I

## SPECIFIC TECHNICAL REQUIREMENTS

| | TITLE : TECHNICAL SPECIFICATION FOR VIBRATION ISOLATION SYSTEM (VIS) | SPECIFICATION NO. PE-TS-485-667-C001 | |
|---|---|---|---|
| | | SECTION I | |
| | | REV. NO. 1 | DATE 12.10.2021 |
| | | SHEET 2 of 8 | |

## 1.0 GENERAL

**1.01** This specification consists of Section-I and Section-II.

In the event of Contradictions between Section-I and Section-II, the requirements mentioned in the Section-I shall prevail.

**1.02** The details of the equipment to be supported on the foundation are as listed in Table-1.

Table-1

| Sl.No | TITLE | DRAWING NO. |
|---|---|---|
| 1 | GA DRAWING FOR FGD BOOSTER FAN WITH FOUNDATION PLAN AND LOADING DATA SAF 39/21.2-1 | 1-00-099-29429 |

**1.03** Bidder shall furnish the information about the entire range of spring units, damper units and spring cum damper units, manufactured/supplied by the bidder along with the offer. The information to be furnished should include the load carrying capacity, stiffness (vertical & horizontal), damping resistance, dimension of spring and damper units as well as the quality plan.

**1.04** All the services and supplies provided by the bidder shall be as per proven practices.

## 2.0 SCOPE

### 2.01 SUPPLY OF VIBRATION ISOLATION SYSTEM (VIS):

Supply of Vibration Isolation System shall consist of steel helical spring units and viscous dampers with required load carrying capacities for at least 90% isolation of dynamic loads including providing templates and adhesive pads for the following: -

- 2 No. of FGD Booster fan foundations.

Bidder shall provide the manuals for installation strategy of the VIS and maintenance indicating equipment, procedures etc. required for installation and replacement of vibration isolation system mentioning the required downtime involved.

Quantity specified in BOQ is the total vertical load carrying capacity of the VIS which is tentative. The actual total vertical load carrying capacity of the VIS shall be measured for the payment.

## 2.02 SUPPLY OF ASSOCIATED AUXILIARIES FOR INSTALLATION AND COMMISSIONING OF VIBRATION ISOLATION SYSTEM: -

Associated auxiliaries for installation and commissioning of vibration isolation system shall include the following:

- Frames for pre-stressing of spring elements.
- Suitable hydraulic jack system, high pressure tubes, manifold, lifting hook, packing plates, supporting stool, steel shims or any other minor tools as required for the pre-stressing, erection, release of pre-stress, alignment, commissioning and any other misc. works etc.

Supply shall include painting, packing and transportation as well.

## 2.03 SUPERVISION DURING INSTALLATION AND COMMISSIONING OF THE VIBRATION ISOLATION SYSTEM

Bidder shall deploy an experienced person for supervision during installation and commissioning of the vibration isolation system including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc.

Bidder shall provide the details of readiness to be ensured by BHEL at site prior to deploying the person to site for supervision. Bidder shall deploy the person to site for supervision after receiving invitation from BHEL.

## 2.04 CIVIL DESIGN ENGINEERING OF RCC DECK SUPPORTED ON VIBRATION ISOLATION SYSTEM

Civil Design engineering shall consist of the following:

**i) Selection of Vibration Isolation System:**

The selection of vibration isolation system shall be done by the bidder, such that the amplitude at bearing locations are within permissible limits, as per machine supplier recommendation or as per ISO 10816, whichever is stringent.

**ii) Dynamic analysis as per codes, manufacturer guidelines and specification:**

The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. The fundamental natural frequency shall be sufficiently above or below the frequency corresponding to operating speed of the machine. Transient analysis shall be carried out for the short circuit / blade failure condition with an appropriate force function, if required by the machine supplier.

**iii) Static analysis as per codes, manufacturer guidelines and specification:**

The following loads shall be considered: -

- Dead weight of machine stationary parts
- Dead weight of machine rotary parts
- Load due to machine power torque
- Load due to maximum allowable unbalance
- Temperature load
- Load due to blade unbalance/short circuit
- Erection load
- Seismic load
- Any other loads as given by the machine supplier.

Various load combinations must be investigated to obtain the most severe loads for foundation design purpose as per relevant IS codes or as per machine supplier recommendation, whichever is more critical.

**iv) Check for Shaft Misalignment**

Foundation deck must be adequately stiff to withstand all operating load combinations without excessively upsetting the rotor shaft alignment. The structural design must carefully be analysed for relative deflection of the members supporting machine shaft to satisfy the limits as given by machine supplier, if any.

**v) Design of RCC Deck supported on vibration isolation system**

Bidder shall provide general arrangement drawing of deck showing location and supporting detail of vibration isolation system, all embedment and their details as per the machine supplier drawing.
RCC design shall be done by working stress method for all machine foundations. Minimum reinforcement shall be governed by IS: 2974 and IS:456.
All documentation shall be in English language and all RCC/structural design shall be conforming to the relevant Indian Standard Code of practice.

Following calculations and details shall also be furnished by bidder: -

- Calculation of loads on substructure (below vibration isolation system) along with their points of application and deflection limitations.

**vi) Documentation**

Bidder shall furnish following documents for approval of BHEL/ BHEL's customer:

- Bill of materials of various elements included in the supply along with detailed specifications of system and various items including list of standards (local or international) to which they conform. In case bidder uses codes which are not in English, English translated copy shall be furnished by the bidder.
- General Arrangement (GA) drawing showing location and supporting details of vibration isolation system.

- GA and reinforced concrete details drawings for RCC deck (supported on vibration isolation system) including bar bending schedule.
- Embedment drawings showing location of all embedment and their details pertaining to RCC deck (supported on vibration isolation system).
- Analysis and Design document.
- The complete input (soft copy with editable format & hard copy) and output data (soft copy & hard copy) is to be submitted.
- Methodology of providing the shuttering and its removal, concreting of RCC deck (supported on vibration isolation system), installation of vibration isolation system and sequence of above operations.

## 3.0 DOCUMENTS TO BE SUBMITTED BY BIDDER

Document submission schedule after the award of contract shall be as below:

| BHEL DRG NO | DRG TITLE | Drg Submission schedule |
|---|---|---|
| **Primary Documents - affecting Manufacturing/ Delivery Directly** | | |
| PE-V0-485-667-C201 | Data sheet of VIS for Booster Fan Foundation | First submission within two (02) weeks from LOI/PO or receipt of inputs, whichever is later & subsequent revisions within 10 days of receipt of comments from BHEL / BHEL's customer. |
| PE-V0-485-667-C202 | QAP of VIS for Booster Fan Foundation | |
| PE-V0-485-667-C204 | Static & dynamic Analysis of VIS for Booster Fan Foundation | |
| PE-V0-485-667-C205 | Civil GA drawing of Booster Fan Foundation | |
| **Secondary Documents - NOT affecting Manufacturing / Delivery Directly** | | |
| PE-V0-485-667-C206 | RC details of Top Deck of Booster Fan Foundation | First submission within two (02) weeks of Cat-I(or)II approval on GA drawing & subsequent revisions within 10 days of receipt of comments from BHEL/ BHEL's customer. |
| **Other Documents** | | |
| PE-V0-485-667-C203 | Test certificate of VIS for Booster Fan Foundation | After inspection |

The documents shall be submitted as mentioned below:

i. Soft copy of all documents/drawings shall be furnished in soft (PDF) format.
ii. Hard copies shall be submitted.
iii. Submission of drawings/documents shall be as mentioned in the Table-2.

**Table-2**

| S.No. | Document | Total Copies |
|---|---|---|
| 1 | Data, drawings, documents, write-ups, calculation | |
| | -Preliminary | Soft copy + 12 nos. hard copies |
| | -Revised | Soft copy + 12 nos. hard copies |
| 2 | Approved drawings, documents etc. | Soft copy + 12 nos. hard copies |
| 3 | Instruction manuals for erection and O&M | Soft copy + 12 nos. hard copies |

## 4.0 SEISMIC LOADING:

The project site is in Zone-III as per IS: 1893. Importance factor shall be 1.75. Response reduction factor shall be taken from Table 7 of IS: 1893-2002. Ductile detailing in accordance with IS: 13920 shall be adopted for all concrete structures which is mandatory for Zone-III. Response spectrum method shall be used for seismic analysis using at least 5 modes of vibration. Damping factor shall be as per IS: 1893 (latest).

Zone factor - 0.16

## 5.0 WIND LOADING:

Wind loads for all structures shall be based on IS:875 (Part 3). Basic wind speed shall be 50 m/sec. A step function of pressure with height under different exposure conditions shall be used.

Wind loads to be considered for design of structures shall be based on the design wind speeds arrived at based on IS: 875 (Part -3) – Latest Edition

## 6.0 RCC DECK (SUPPORTED ON VIBRATION ISOLATION SYSTEM)

Minimum grade of concrete: M30.

Reinforcing bars shall be corrosion resistant thermo–mechanically treated (TMT) high strength deformed bars of grade Fe415 / Fe500 conforming to IS: 1786 (latest).

## 7.0 ADDITIONAL TECHINCAL REQUIREMENTS

- Surface preparation of all steel parts except springs, studs & nuts shall be done by means of blast cleaning which shall conform to SA 3 of Swiss standard e.g. SIS 055900. Steel structures to be blast cleaned have to be free of pitting and other severely corroded places in accordance with B.S. 4232 and SIS 055900. Painting schedule shall be followed as per Table-3.

**Table-3**

| Painting System | | | | | |
|---|---|---|---|---|---|
| **Cleaning, Protective Coating and Painting – Systems designed as per ISO 12944 with service life of 10 yrs.** | | | | | |
| **Surface/ Location** | **Surface Prep** | **Coat** | **No. of Coats** | **Generic Type** | **DFT/Coat (in microns)** |
| Structural Steel work | SA 3 | Primer | 1 | Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1 | 75 |
| | | Touch Up | 1 | Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2 | (75) |
| | | Mid Coat | 1 | 2 pack High build High Solid Lamellar MIO based Epoxy Mid coat. | 200 |
| | | Finish | 1 | 2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs. | 75 |
| | | | | **Total** | **350** |

- Painting of springs shall be as per proven practice for similar exposure conditions.

- Detailed static and dynamic analysis shall be carried out for the foundations of rotating/vibrating equipment. The static analysis shall include all operating conditions, load cases and abnormal loads like short circuit, loss of blade unbalance and seismic forces. Unbalance loads for normal operating condition as given by machine manufacturer and/or VDI 2060 whichever is more conservative shall be

used for calculating dynamic response. The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. Transient analysis shall be carried out for the short circuit condition with an appropriate force function. Frequency separation criteria and amplitude criteria as laid down in IS: 2974 and/or DIN 4024 and/or VDI 2056 and/or as required by the machine manufacturer, whichever is more stringent shall be satisfied. RCC design shall be done by the working stress method for all machine foundations. A fatigue factor of 2.0 shall be considered for dynamic forces. Minimum reinforcement shall be governed by IS: 2974 as well as IS: 456. However minimum reinforcement in bottom face of the foundation raft resting on soil or pile shall not be less than 0.2% of effective cross sectional area of the raft.

- In case steel helical springs are provided; the foundation arrangement shall be such that the spring units are located above the finished floor level by at least 200mm.

- The isolation efficiency of the foundation system comprising RCC deck and steel helical springs shall be at least 90%. At least 3% to 5% of critical damping shall be provided in the form of viscous dampers.

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| 00 | 18.08.2021 | Fresh Issue | PSN | TPK | TPK |
| REV | DATE | DESCRIPTION / NOTE | PRD | CHD | APD |

REVISIONS

TITLE:

# GA DRAWING OF BOOSTER FAN

OWNER/ PROJECT:

TANGEDCO NORTH CHENNAI STAGE-III
1X800 MW – FGD SYSTEM PACKAGE

CONSULTANT:

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Pvt Limited
Chennai, India

EPC CONTRACTOR:

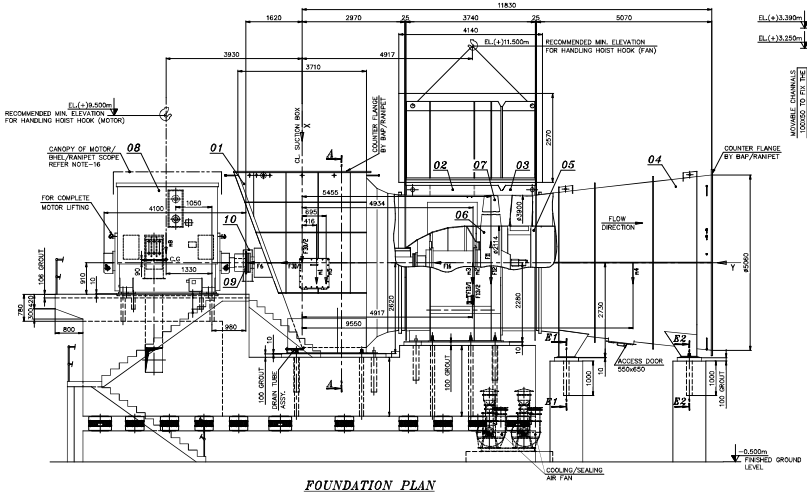
BHARAT HEAVY ELECTRICALS LTD.

BOILER AUXILIARIES PLANT, RANIPET-632406

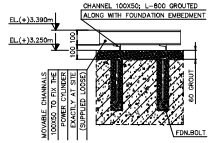
| | BHEL | Sign | |
|---|---|---|---|
| PREPARED BY | P. Saravanan | -sd- | STATUS : *FOR INFORMATION* |
| CHECKED BY | T. Prasanna kumar | -sd- | BHEL CUST NO : G802 |
| APPROVED BY | T. Prasanna kumar | -sd- | BHEL DOC NO : 1-00-099-29429 |
| | | | REV NO : 00 |

**BHEL DOC NO. : 1-00-099-29429**

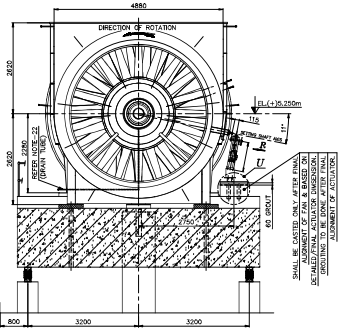
## ELEVATION



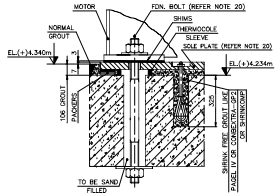

## DETAIL–U



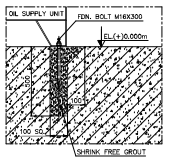

## SECTION–AA



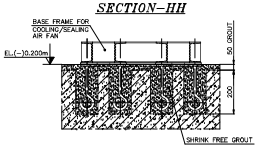

## SECTION–CC



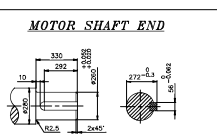

## SECTION–FF



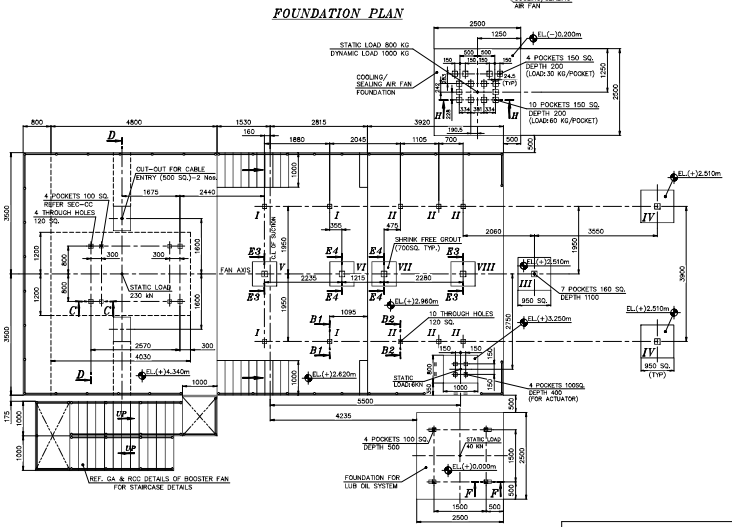

## SECTION–HH



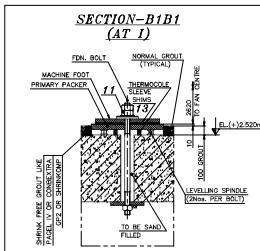

## MOTOR SHAFT END



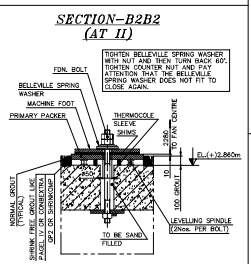

## FOUNDATION PLAN




## SECTION–B1B1 (AT I)

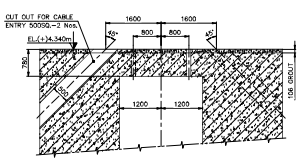



## SECTION–B2B2 (AT II)



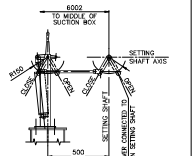

## SECTION–DD

(ON TOP DECK ONLY)




## VIEW–R

(ON ACTUATOR & ITS LINKAGE)

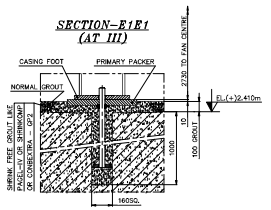



(FOR ACTUATOR ERECTION BHEL SITE SHALL REFER SETTING & INDICATING SHAFT DRAWING)

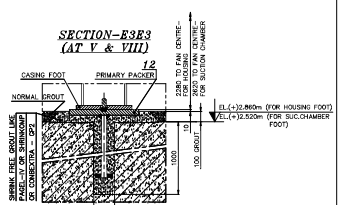
| | | | | | |
|---|---|---|---|---|---|
| VIII | | | ±2500 | ±12200 | ±12300 ±304200 |
| VII | | | +179200 −74200 | ±12200 | ±12300 ±304200 |
| VI | | | ±76200 | ±15000 | ±2700 |
| V | | | ±3000 | ±15000 | ±2700 |
| IV | +45100 | ±6700 | ±9100 | ±9100 | ±6700 |
| III | +66000 | ±5500 | ±13200 | ±11700 | ±5500 |
| II | +103500 | ±4800 ±124200 | ±20700 | ±20700 | ±4100 ±107100 |
| I | +91500 | ±2700 | ±18300 | ±18300 | ±2700 |
| Point Forces in [N] | Dead Load Vertical | Dynamic Load Vertical | Stat. horiz. Dead Load horiz. in axial Direction | Stat. horiz. Dead Load horiz. across to the axis | Dyn. horiz. Dyn. Load horiz. across to the axis |
| | + | + | + | + − | + − |

FOUNDATION LOAD DATA

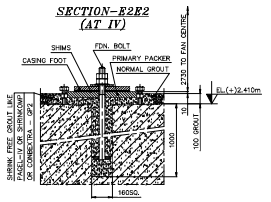
## SECTION–E1E1 (AT III)



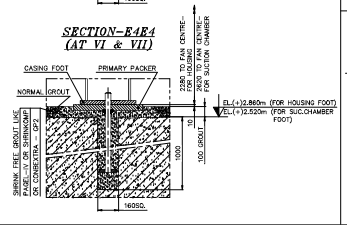

## SECTION–E3E3 (AT V & VIII)



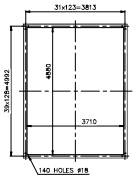

## SECTION–E2E2 (AT IV)



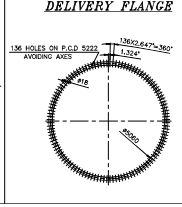

## SECTION–E4E4 (AT VI & VII)




## SUCTION FLANGE




## DELIVERY FLANGE

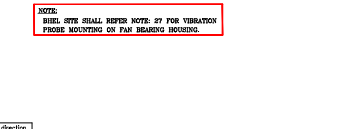



| SL NO | DESCRIPTION | MATERIAL | QTY. |
|---|---|---|---|
| 15 | BEARINGS (ANTIFRICTION) | NU 256 E.M1.C3 | 1 |
| | | 7256 B.MP.UA | 2 |
| 14 | FAN SHAFT | 42 CrMo4 | 1 |
| 13 | SHIMS | ASTM A240 | AS REQD. |
| 12 | PRIMARY PACKER | IS : 2062 | AS REQD. |
| 11 | FOUNDATION FASTENERS FOR FAN | ASTM A105 | 17 |
| 10 | COUPLING GUARD | IS : 1079 | 1 |
| 09 | SPACER COUPLING | CLASS 4/ IS 2004 | 1 |
| 08 | MOTOR WITH FNDN. FASTENERS | 5350 KW/747 RPM | 1 |
| 07 | BLADES | GGG 40 OR EQUIVALENT (NODULAR CAST IRON) | 20 |
| 06 | IMPELLER | PSOONH (FINE GRAIN STRUCTURAL STEEL) | 1 |
| 05 | HOUSING CORE (FAN HOUSING HUB) | IS : 2062 OR EQUIVALENT | 1 |
| 04 | DIFFUSER | IS : 2062 OR EQUIVALENT | 1 |
| 03 | OUTLET GUIDE VANE ASSY. | IS : 2062 OR EQUIVALENT | 1 |
| 02 | IMPELLER HOUSING | IS : 2062 OR EQUIVALENT | 1 |
| 01 | SUCTION CHAMBER | IS : 2062 OR EQUIVALENT | 1 |

BILL OF MATERIAL

| ID. NO. | (m) MASS IN (KG) | (F) FORCE IN (N) | DESIGNATION |
|---|---|---|---|
| 30/2 | | 12401 | Stat. and dyn. forces caused by air stream of suction box in vert. direction |
| 30/1 | | 52856 | Stat. and dyn. forces caused by air stream of suction box in horiz. direction |
| 16 | | 52495 | Axial thrust of the fan (due to pressure increase) |
| 13/2 | | 99680 | Max. load when lifting the fan housings upper part |
| 13/1 | | 103150 | Max. load when lifting the rotor assembly |
| 12 | | 608240 | Unbalance in case of damage |
| 11 | | 24522 | Max. rotating load due to unbalance of the fan rotor |
| 8 | 23000 | | Drive motor |
| 5 | 1810 | | Intermediate shaft with coupling |
| 4 | 12180 | | Diffuser with tail fairing |
| 3 | 10514 | | Complete rotor assembly |
| 2 | 22580 | | Fan housing with straightener vane section and nose fairing |
| 1 | 10700 | | Suction box with inlet nozzle and intermediate shaft cover |

## VIBRATION PICK–UP PAD DETAILS




**NOTE:**
**BHEL SITE SHALL REFER NOTE: 27 FOR VIBRATION PROBE MOUNTING ON FAN BEARING HOUSING.**

## NOTES:–

01. THE LOADS INDICATED ON FOUNDATION ARE WITHOUT ALLOWANCES FOR VIBRATIONS. CIVIL DESIGNERS ARE RESPONSIBLE FOR PROPER DESIGN OF FOUNDATION TAKING INTO ACCOUNT OF THE ALLOWANCES FOR VIBRATION ALSO.
02. THE DIFFERENT NATURAL FREQUENCY OF THE FOUNDATION HAVE TO BE 20% AWAY FROM THE SPEED FREQUENCY, fnmax = n/60 AND 15% AWAY FROM THE DOUBLE OF THE SPEED FREQUENCY, 2 x fnmax. THIS MEANS : 0.8xfn TO 1.2xfn AND 0.85x(2xfn) TO 1.15x(2xfn). SPEED FREQUENCY fnmax. = 12.42 HZ (2 * fnmax.) = 24.84 HZ
03. THE STIFFNESS OF THE FOUNDATION HAS TO BE ATLEAST CF>1.0E+06 N/mm IN LONGITUDINAL, TRANSVERSAL AND VERTICAL DIRECTIONS RELATING TO THE FAN AXIS, IT HAS TO BE TAKEN INTO CONSIDERATION THAT ON SETTLING OF THE FOUNDATION THE TOTAL NATURAL FREQUENCIES OF THE FOUNDATION CAN ARISE DUE TO THE SOIL COMPACTION AND THE RESULTING INCREASES OF THE ELASTIC MODULUS. AN UNEVEN SETTLING OF THE FOUNDATION HAS TO BE EXCLUDED.
04. THE RATIO OF THE FOUNDATION MASS TO THE ROTOR MASS HAS TO BE GREATER THAN 20.
05. ADOPT IS: 2974 / PART–IV FOR THE FOUNDATION DESIGN.
06. THE CONNECTING DUCTS AT INLET AND OUTLET OF FAN MUST BE SELF SUPPORTED AND SHOULD NOT BE WELDED WITH EXPANSION JOINTS.
07. FOUNDATION POCKETS SHOULD BE PERPENDICULAR TO THE FLAT SURFACES OF FOUNDATION.
08. ACCURATE TEMPLATES SHALL BE USED FOR LOCATING CORES FOR POCKET HOLES TO ENSURE THEIR DIMENSIONAL ACCURACY.
09. TOLERANCE BETWEEN ANY TWO POCKET CENTRES IS ±5 mm.
10. TOLERANCE ON CONCRETE LEVELS +0mm/–25mm.
11. IN AREAS WHERE SOLE PLATES AND ANCHOR PLATES ARE TO BE INCORPORATED IN FOUNDATION CONCRETE, THE SIZE OF THE COARSE AGGREGATE USED SHALL NOT EXCEED 20 mm AND DOWN GRADED TO FACILITATE CHIPPING AND SCRAPPING AND THEREBY ENSURING MAXIMUM CONTACT ON THE MATING AREAS.
12. NON–SHRINK GROUT SHALL BE USED AS MENTIONED IN SECTIONAL VIEWS. FOR PREPARATION OF PRIMARY PACKERS & SHIMS, LEVELLING OF PRIMARY PACKERS AND LOCATION OF LEVELLING SPINDLES, SITE SHALL REFER PROCEDURE FOR NON–SHRINK GROUTING & SHIMMING RELEASED BY BAP/RANIPET.
13. GROUTING SHOULD BE DONE ONLY AFTER FINAL ALIGNMENT OF FAN.
14. ELEVATION & POCKET DEPTHS SHOWN IN FOUNDATION PLAN ARE INCLUDING GROUTING THICKNESS.
15. GROUTING IS IN THE SCOPE OF ERECTION GROUP OF BHEL/AUTHORISED AGENCY.
16. HANDRAILS, STEEL PLATFORMS & CANOPY FOR MOTOR AND THEIR EMBEDMENTS ARE IN THE SCOPE OF BHEL/RANIPET.
17. FAN FOUNDATION SHOULD NOT BE USED AS SUPPORT FOR OTHER STRUCTURES OR EQUIPMENTS.
18. FOUNDATION CONFIGURATION SHOWN IN THIS DRAWING IS ONLY INFORMATIVE/TYPICAL. COMPLETE DETAILS OF FOUNDATION WILL BE FINALISED BY CIVIL DESIGNERS.
19. FOR MOTOR ERECTION, REFER MOTOR SUPPLIER'S ERECTION MANUAL.
20. BASE FRAME, SOLE PLATE, PACKER PLATE, SHIMS, FOUNDATION BOLTS & FASTENERS RELATED TO MOTORS WILL BE IN THE SCOPE OF MOTOR SUPPLIER (BHEL BHOPAL UNIT)
21. KEY PHASER MARKER REFERENCE SLOT OF DIMENSION 50X10x3mm IS PROVIDED IN COUPLING HUB ON MOTOR SIDE. SENSOR INSTALLATION (IF APPLICABLE) ON MACHINE AND DESIGN/FIXING THE BLOCKS FOR BRACKET MOUNTING ON MACHINE FACE/BEARING CASING OR ANY OTHER RECOMMENDED LOCATION SHALL BE DONE BY VMS SUPPLIER.
22. DRAIN LINE (TUBE 17.2x2.3) FROM THE FAN HOUSING & SUCTION CHAMBER SHALL BE ROUTED TO THE NEAREST DRAIN PIT.
23. BHEL BHOPAL'S DRAWING "OUTLINE AND GENERAL ARRGT. OF BOOSTER FAN MOTOR" WITH DRAWING NO. 1402004168I TO BE REFERRED FOR BOOSTER FAN MOTOR DETAILS.
24. MAXIMUM PERMISSIBLE NOISE LEVEL IS 85 dB(A) WHEN MEASURED AT 1 METRE FROM FAN CASING.
25. METALLIC EXPANSION JOINTS SHALL BE PROVIDED BY BHEL/TRICHY AT SUCTION AND DISCHARGE OF BOOSTER FAN.
26. LUBE OIL SYSTEM SCHEME DRAWING NUMBER 1–00–107–29430.
27. FAN BEARING HOUSING IS PROVIDED WITH REMOVABLE VIBRATION PAD (SCREWED TO BEARING HOUSING) FOR FIXING THE SENSOR MOUNTING BLOCK (40mmx40mmx40mm) SUPPLIED BY EDN/VMS SUPPLIER. BOTH X & Y DIRECTION VIBRATION MEASUREMENT PROBES SHALL BE FIXED TO SAME MOUNTING BLOCK AND THE BLOCK SHALL BE WELDED AT ITS EDGES ON THE VIBRATION PAD AND THE SAME SHALL BE THEN SCREWED TO BEARING HOUSING.
28. ALL ELEVATIONS ARE WITH RESPECT TO EL. (+)0.00m, FINISHED GROUND FLOOR LEVEL OF TG BUILDING, WHICH CORRESPONDS TO RL. (+)10.0M. FINISHED GROUND LEVEL IN BOOSTER FAN AREA IS EL. (–)0.500m, WHICH CORRESPONDS TO RL. (+)9.5M.

## FAN DETAILS:–

| | |
|---|---|
| TYPE | : AXIAL FAN |
| MODEL | : SAF 39/21.2–1 |
| NO. OF FANS PER BOILER | : TWO (IDENTICAL) |
| VOLUME FLOW | : 783 $m^3$/sec |
| HEAD | : 552 mmWC |
| DENSITY OF MEDIUM | : 0.835 Kg/$m^3$ |
| TEMPERATURE OF MEDIUM | : 150 Deg.C |
| WEIGHT OF ROTOR | : 9800 Kg |
| $GD^2$ OF FAN | : 21200 Kg.$m^2$ |
| SPEED OF FAN | : 745 RPM |
| MAX. WEIGHT TO BE HANDLED FOR MAINTENANCE | : 11000 Kg (FAN HOUSING UPPER PART) |
| BLADE PITCH ACTUATOR | : PNEUMATIC TYPE (REGULATING DUTY) |

## MOTOR DETAILS:–

| | |
|---|---|
| MAKE | : M/s BHEL/BHOPAL |
| TYPE | : 5350 KW /746 RPM/334 AMP/11 KV |
| CAPACITY | : 1RH1906–B, IP55 |
| WEIGHT OF MOTOR | : 23000 Kg |
| WEIGHT OF ROTOR | : 7400 Kg |
| $GD^2$ OF MOTOR | : 3756 Kg.$m^2$ |
| MOTOR DRG. NO. | : 1 402 00 41681 |
| METHOD OF COOLING | : IC 81W |
| MAX. WEIGHT TO BE HANDLED FOR MAINTENANCE | : 23250 Kg |

## LOADING ON MOTOR FOUNDATION

MAX. FORCE CALCULATED FROM THE MAX. IMPULSE TORQUE – FM = 446 kN
FORCE DUE TO WEIGHT ON EACH SIDE ---------- FG = 115 kN
FOUNDATION LOAD ON EACH SIDE COMPRESSION == FA = FM+FG = 561 kN
TENSILE FORCE ---------- FB = FM–FG = 331 kN
THE FORCE OCCUR ALTERNATIVELY INDEPENDENT OF THE DIRECTION OF ROTATION.


## MOTOR COOLER DATA:

WATER PRESSURE DROP ACROSS COOLER ---------- = 0.4 kg/$cm^2$
TEMP. RISE OF WATER ACROSS COOLER ---------- = 5 °C
WATER INLET TEMP. ---------- = 38 °C
MAX. OPERATING PRESSURE OF WATER ---------- = 6 kg/$cm^2$
TOTAL REQUIREMENT OF WATER ---------- = 590 LPM

## MOTOR BEARING LUBRICATION DETAILS:

| | DE | NDE |
|---|---|---|
| BEARING SIZE | 22–6225 | 22–6225 |
| OIL FLOW RATE | 7 LPM | 7 LPM |
| MAX. OIL INLET PRESSURE | 0.2 TO 0.5 kg/$cm^2$ | 0.2 TO 0.5 kg/$cm^2$ |
| MAX. OIL INLET TEMP. | 40°C | 40°C |
| OIL GRADE | ISO VG 68 OR EQUI. | ISO VG 68 OR EQUI. |
| LUBRICATION TYPE | FORCED OIL LUBRICATION | |

CUSTOMER No. : G802

CUSTOMER: **TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD. 5th Floor, Western Wing, NPKRR Maaligai 144, Anna salai, Chennai–600002**

CONSULTANT: FICHTNER INDIA — **Fichtner Consulting Engineers (India) Pvt Ltd.** Menon Eternity, 9th Floor, No.165, St. Mary's Road, Alwarpet, Chennai–600018

PROJECT: **Flue Gas Desulphurisation System & Auxiliaries for North Chennai TPP – Stage–III – 1x800 MW Supercritical Thermal Power Station Project**

**BHARAT HEAVY ELECTRICALS LTD. BOILER AUXILIARIES PLANT RANIPET – 632 406**



| DEPT CODE | DRN | NAME | SIGN | DATE |
|---|---|---|---|---|
| | DESN | P.SARAVANAN | Sd/– | 15.06.2021 |
| | CHD | PRASANNA | Sd/– | 15.06.2021 |
| | APPD | PRASANNA | Sd/– | 15.06.2021 |

TITLE: GA DRAWING FOR FGD BOOSTER FAN WITH FOUNDATION PLAN AND LOADING DATA SAF 39/21.2–1

DEPT. | SCALE N.T.S | DRAWING NO. 1–00–099–29429 | SIGN | SHEET – | REV. 00 | Size A1

| | TITLE : TECHNICAL SPECIFICATION FOR VIBRATION ISOLATION SYSTEM | SPECIFICATION NO. PE-TS-485-667-C001 | |
|---|---|---|---|
| | | SECTION II | |
| | | REV. NO. 1 | DATE 20.10.2021 |
| | | SHEET 1 OF 5 | |

**SECTION-II**

**STANDARD TECHNICAL SPECIFICATION**

## 1. GENERAL REQUIREMENTS

a. The total number of springs in a vibration isolation system module should be even.

b. The ratio of actual spring supported weight to the nominal spring capacity shall not be more than 0.8.

c. The vibration isolation system module should be structurally stable. Stability of the module in all direction needs to be ensured under maximum loads.

d. The springs shall conform to latest version of codes DIN EN 13906-1 and DIN 2096 or equivalent.

e. The damper units or spring cum damper units should be of viscous type offering velocity proportional damping.

f. The damper units shall be suitable for temperatures ranging from 0 to $50^0$ C.

g. The damping resistance of the individual damper units shall be such that the designed damping can be provided using reasonable number of units.

h. The size of the spring units, damper units, spring cum damper units should be such that groups of such units can be accommodated on column heads in case of elevated foundations and on pedestals/walls in case of foundations at ground level.

i. The vibration isolation system module in the same foundation should have same deflection under its rated load carrying capacity. The height of all the modules to be used in a foundation must be same.

j. Bidder shall furnish manufacturer's test certificate for the bought out items.

k. The steel helical springs and viscous dampers shall be designed for a minimum operating life of 30 years.

l. The material specification requirement has been mentioned in the reference Quality plan attached in this specification.

m. The system shall be capable of withstanding seismic/ wind forces.

n. All supplies, manufacturing and engineering shall be of proven practice.

## 2. MANUFACTURING & TESTING

2.1 The bidder shall submit the detailed programme for approval of BHEL/BHEL's customer and take up the manufacturing / testing after approval of such programme. The programme / quality plan shall include:

i. Manufacturing schedule and quality check exercised during manufacturing.

ii. Detail of tests to be carried out at the manufacturing shop with its schedule.

iii. Special requirements, if any, regarding concreting of RCC deck (supported on vibration isolation system).

iv. Complete step- by- step procedure covering the installation and commissioning of the spring system.

v. Manuals for installation, commissioning, testing and maintenance of the steel helical springs and viscous dampers.

vi. A checklist for confirming the readiness of the civil fronts for erection of steel helical springs and viscous dampers.

vii. Checklist for equipment/auxiliaries required at each stage of erection.

viii. Bill of materials (data sheet) of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.

ix. Bill of material (data sheet) for frames for pre-stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc. with their rating and numbers.

x. Any other details which may be necessary to facilitate design and construction of the foundations / structures.

2.2 The springs shall conform to codes DIN EN 13906-1 and DIN 2096. The quality assurance and inspection procedure shall be finalised on the basis of the above codes and the quality plans be drawn accordingly.

## 3. QUALITY PLAN AND INSPECTION REQUIREMENTS

3.1 Bidder shall furnish the quality plan and Test certificate for the material in their scope of supply. The quality plan shall be reviewed by BHEL/BHEL's Customer wherein the inspection and hold points shall be indicated. Bidder shall submit test certificate based on approved quality plan.

3.2 Quality requirements shall be as per quality plan attached in the specification. Quality plan shall be subject to approval during detail engineering. No additional price implication shall be admissible for conducting any additional tests as per Quality plan approved by BHEL/BHEL's Customer.

3.3 Quality plan will be subject to BHEL/BHEL's Customer approval & customer hold points for inspection/ testing shall be marked in the Quality plan at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.

3.4 Inspection for imported item shall be done by third party inspection agency (approved by BHEL) and certificate shall be submitted for review of BHEL. The charges for 3rd party inspection at foreign location for imported components shall be included by the bidder in the rate quoted for the VIS.

## 4. PACKING AND TRANSPORTATION

4.1 All supply items shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit and handling.

4.2 The bidder shall be responsible for any loss or damage during transportation, handling at site.

4.3 The packing and transportation of supply items shall be done as per the BHEL Corporate standard no. AA0490010. Packing shall be of type “CQ” as per BHEL corporate standard or equivalent. In case transportation involves sea route, the BHEL standard no. AA0490004 shall be followed for sea worthy packing and transportation.

## 5. ENVIRONMENTAL PROTECTION

Vibration isolation system shall be suitably protected against environmental damages viz. abrasion, discolouration, corrosion, oily water etc. to give a prolonged service matching the plant life.

## 6. PERFORMANCE GUARANTEE

Bidder shall guarantee the performance of the vibration isolation system for 24 months from the date of commissioning of machine which shall be termed as “Guarantee Period”.

## 7. CODES AND STANDARDS

Latest revision of following codes or equivalent international standard shall be used for the design of the spring-supported foundations:

| | | |
|---|---|---|
| 1) | IS: 456 | Codes practice for plain and reinforced concrete. |
| 2) | IS: 2974 | Code of practice for design and construction of machine foundations. |
| 3) | IS: 1893 | Criteria for earthquake resistant design of structures. |
| 4) | DIN: 4024 | Machine foundations; Flexible supporting structures for machine with rotating masses |
| 5) | DIN EN 13906-1: | Helical compression springs out of round wire and rod: calculation & design. |
| 6) | DIN: 2096 | Helical compression springs out of round wire and rod: Quality requirements for hot formed compression springs. |
| 7) | ISO 10816 (Part 1 to7) | Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts. |

**SECTION-II**

**REFERENCE QUALITY PLAN**

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| **1.0** | **Materials** | | | | | | | | | | | | | |
| 1.1 | For boxes of VIS module | Chemical/Mechanical | MA | Verification | One / Heat | - | IS 2062 / DIN EN 10025 or Equivalent | Same as column "7" | Certificate | √ | P | V | V | |
| 1.2 | For Springs | a) Chemical | MA | Verification | One / Heat | - | 51CrV4 as per EN10089 or equivalent | Same as column "7" | Certificate | √ | P | V | V | |
| | | b) Grain Size | MA | Verification | One / Heat | - | ASTME 112 | ASTM 6 or finer | Certificate | √ | P | V | V | |
| | | c) NMI | MA | Verification | One / Heat | - | IS 4163/ EN 10247 or Equivalent | As per EN10089 or equivalent | Certificate | √ | P | V | V | |
| **2.0** | **Component** | | | | | | | | | | | | | |
| 2.1 | Springs (at Manufacturers end) | a) Hardness | MA | Test | One/Lot | - | IS 1500 | As per vendor detail | Certificate | √ | P | V | V | |
| | | b) Decarburization | MA | Test | One/Lot | - | IS6396 | Max. depth 0.5% bar dia-partial | Certificate | √ | P | V | V | |
| | | c) NDE after compression (MPI) | MA | Test | 100% | - | IS3703 | No cracks | Certificate | √ | P | V | V | |
| | | d) Micro structure | MA | Verification | One/Lot | - | - | As per vendor detail | Certificate | √ | P | V | V | |
| 2.1.1 | Springs (at Supplier end) | Spring Rate | MA | Test | AQL 4.0 of Table 7.1 | - | DIN 2096 | Same as column "7" | Certificate | √ | P | V | V | |
| 2.2 | Viscoliquid (For visco damper) | Viscosity/Penetration speed | MA | Test | One/Lot | - | DIN 53019 or equivalent | Same as column "7" | Certificate | √ | P | V | V | |

| BHEL | | | | | |
|---|---|---|---|---|---|
| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
|---|---|
| Sign & Date | |
| Seal | |

| FOR CUSTOMER REVIEW & APPROVAL | | | |
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| Doc No: | | | |
| | Sign & Date | Name | Seal |
| Reviewed by: | | | |
| Approved by: | | | |

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| 2.3 | Studs & Nuts | Chemical/Mechanical | MI | Verification | One/Lot | - | IS1367 | As per Datasheet | Certificate | √ | P | V | V | |
| | | Dimensions(mm) | MI | Measure | 10% | - | IS 4218 (Tolerance Class 6G & 6H) | Same as column "7 | Internal Record | √ | P | V | V | |
| 3 | **In Process Inspection** | | | | | | | | | | | | | |
| 3.1 | Welding | Visual/Surface exam | MA | Visual/ Measure | 10% on welds | - | DIN EN 25817/D or BS EN ISO 5817 or Equivalent | Same as column "7 | Certificate | √ | P | V | V | |
| | | NDE | MA | DPT | 10% Random | - | ASTM/ E 165 | Same as column "7 | Certificate | √ | P | V | V | |
| 3.2 | Boxes | Dimensions | MA | Measure | 10% | - | Datasheet (data & dimensions) | EN ISO 13920 C | Internal Record | √ | P | V | V | |
| 3.3 | Adhesive pads, Steel shims | Dimensions | MI | Measure/ Visual | 10% | - | Datasheet (data & dimensions) | DIN 7168 Sg | Internal Record | √ | P | V | V | |
| 4 | **Final Inspection** | | | | | | | | | | | | | |
| 4.1 | Shot Blasting | Surface preparation | MA | Compare | 10% | - | EN ISO 12944-4 | As per Datasheet | Certificate | √ | P | V | V | |
| 4.2 | Painting | Thickness | MA | Measure | 10% | - | EN ISO 12944-5 | As per Datasheet | Certificate | √ | P | V | V | |
| 4.3 | Spring Unit | Dimensions (Except Height at nominal load & max pre-stressed | MI | Measure | 10% | 10% | Approved technical Data Sheet | EN ISO 13920 C | Internal Record | √ | P | W | W | |

| BHEL | | | | | |
|---|---|---|---|---|---|
| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
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| Sign & Date | |
| Seal | |

| FOR CUSTOMER REVIEW & APPROVAL | | | |
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| Doc No: | | | |
| | Sign & Date | Name | Seal |
| Reviewed by: | | | |
| Approved by: | | | |

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| 4.4 | Constant of Spring Units (Vertical) | Load Vs Displacement (kN/mm) | CR | Test | 10% | 10% | DIN 2096 | Datasheet (data & dimensions) | Certificate | √ | P | W | W | |
| 4.5 | Document Control | Verification of above documents(TC/IR) | MA | Compare | All | - | Approved Quality Plan | Application rows tick marked under col. 'D' | Certificate | √ | P | V | V | |
| 4.6 | Packing / Marking | Visual | MA | Visual/Compare | 100% | - | As per supplier's standard or BHEL Corporate standard | Same as column "7 | Certificate | √ | P | W | - | |

**NOTES:**

1. In the absence of MTC/ Testing shall be carried out in NABL Accredited Lab. Testing report shall be reviewed by TPIA/ BHEL.
2. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/ verified by supplier's TPIA.
3. BHEL reserves the right for conducting repeat test, if required and if possible.
4. After packing and prior to issue of MDCC, Photographs of Complete material (to be dispatched) with witness report of BHEL/ TPIA shall be sent to BHEL-Purchase group for review and clearance.
5. Material shall be packed suitably in order to avoid damage during transit and also during storage at site in tropical climate condition.
6. All BOIs document shall be provided as per manufacturer std. format of MTC.
7. The latest revision/ year of issue of all the standards (IS / ASME, etc. as applicable) indicated in the QP shall be referred.

**LEGENDS:**

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: BHEL'S CUSTOMER,
**P**: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
**MA**: MAJOR, **MI**: MINOR**, CR:** CRITICAL

| BHEL | | | | | |
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| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
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| Sign & Date | |
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| FOR CUSTOMER REVIEW & APPROVAL | | | |
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| | Sign & Date | Name | Seal |
| Reviewed by: | | | |
| Approved by: | | | |

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

## 1 GENERAL

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

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

## 2 SCOPE

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

## 3 CROSS REFERRED SPECIFICATION

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

## 4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

For export packing wood in addition to the above the following has to be met:

The standard requires the use of debarked wood in the construction of compliant wood packaging material. Debarked wood is defined in the ISPM 5.

## 5 TYPE OF PACKING

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

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

## 6 DESCRIPTION OF TYPES OF PACKING

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

### 6.1 'OP' - Open Type

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

### 6.2 'PP' - Partially Packed

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

### 6.3 'CP' - Crate Packing – General

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

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

a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.

b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.

c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.

d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

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

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

a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.

b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.

d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

### 6.6 Special Packing

Components requiring special packing (as per customer/contractual/ engineering requirements) not included in this specification shall be covered by product standards.

## 7 PREPARATION OF PACKING CASE

1) Cases and crates with gross weight up to 1,000 kgs. shall be provided with bottom cleats of min. 40 mm thicknesses to ensure clearance for handling by forklift. Cases and crates exceeding gross weight of 1,000 kgs. shall be provided with skid runners, number and size according to weight of package.
2) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.
3) In case of 'CR1 - Packing Viz. Electrical & Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.
4) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.

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

   It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
5) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
6) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
7) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.
8) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
9) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
10) The inner side of the top cover shall be lined with polyethylene sheet, of at least
11) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
12) For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

## 8 STEEL CONTAINERS

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

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

**Following precautions are to be taken during packing:**

– Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.

– To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.

– Put cover on steel, container and Bolt Properly.

## 9 SEALED PACKING

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

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

## 10 SLING PLATE

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

## 11 PACKING SLIP HOLDERS

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

## 12 Volatile Corrosion Inhibitor (VCI) Paper

a) Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.

b) 7 $m^3$ VCI paper is necessary for 1 $m^3$ of packed item approximately as per AA51406.

**Application Limitation:**

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

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

## 13 Moisture Absorber

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

## 14 GENERAL PRECAUTIONS

a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.

b) Sling protection brackets to be provided on cases wherever required.

c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.

d) The various caution signs shall be marked with stencil on both sides of the packing box.

e) Do not pack any other Mechanical items with this case (do not use any other non-permitted packing materials).

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

a) Address of consignee.

b) Purchase Order No./ SO No/WO No.

c) Description of item or title of packing list.

d) Case identification Number/ Packing List No.

e) Net Weight.

f) Gross Weight.

g) Dimensions of box

h) Marking showing upright position.

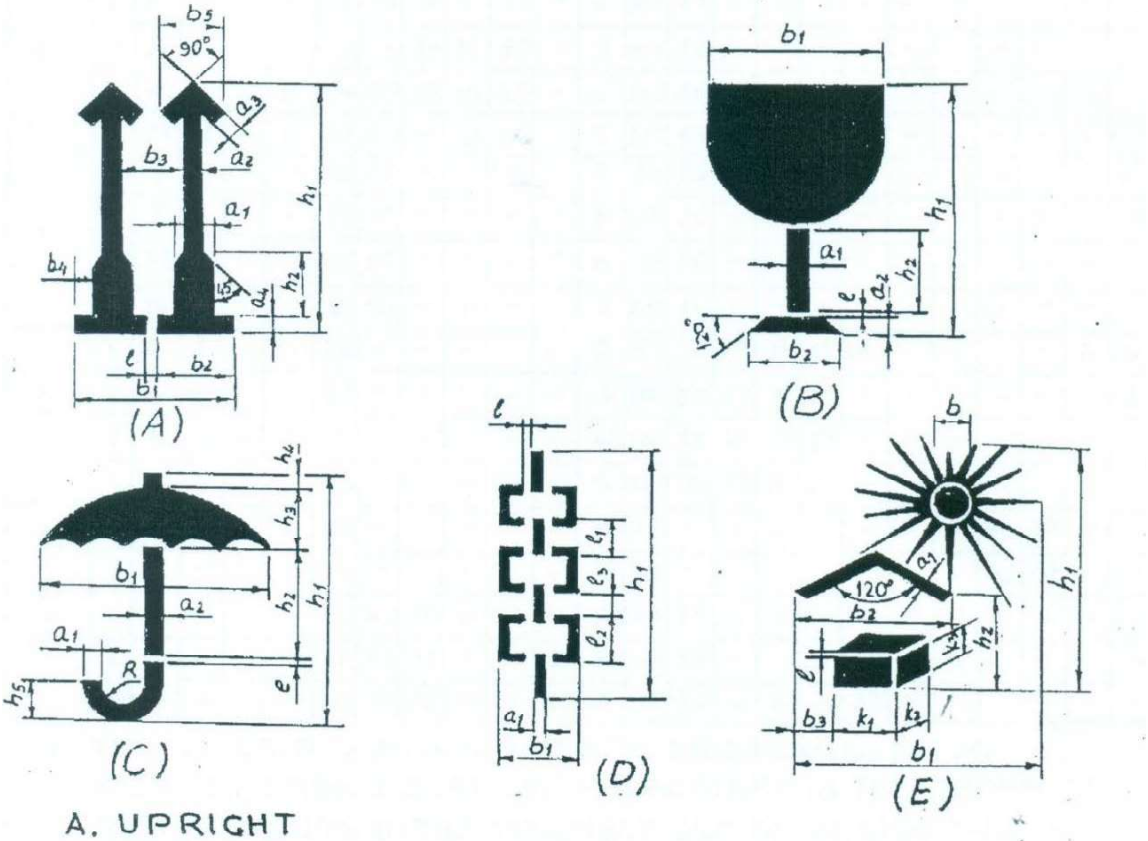
i) Marking showing sling position.

j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.

k) Loading and unloading precautions

## MARKINGS ON PACKING CASES

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




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

**Figure 1**

**CENTER OF GRAVITY**

**Figure 2**

**Table 1**

| DESIGNATION | | DIMENSIONS IN mm. | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $a_1$ | $a_2$ | $a_3$ | $a_4$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ | b | l | $h_1$ | $h_2$ | $h_3$ | $h_4$ | $h_5$ | $K_1$ | $K_2$ | $K_3$ | $l_1$ | $l_2$ | $l_3$ | R |
| A | 1 | 12 | 5 | 5 | 4 | 52 | 25 | 19 | 8 | 21 | – | 2 | 84 | 23 | – | – | – | – | – | – | – | – | – | – |
| | 2 | 17 | 7 | 7 | 6 | 75 | 36 | 29 | 11 | 30 | – | 3 | 119 | 33 | – | – | – | – | – | – | – | – | – | – |
| | 3 | 24 | 10 | 10 | 8 | 104 | 50 | 38 | 16 | 42 | – | 4 | 168 | 46 | – | – | – | – | – | – | – | – | – | – |
| | 4 | 34 | 14 | 14 | 11 | 147 | 71 | 59 | 23 | 60 | – | 5 | 239 | 65 | – | – | – | – | – | – | – | – | – | – |
| B | 1 | 5 | 5 | – | – | 50 | 33 | – | – | – | – | 2 | 84 | 25 | – | – | – | – | – | – | – | – | – | – |
| | 2 | 7 | 7 | – | – | 71 | 47 | – | – | – | – | 3 | 119 | 36 | – | – | – | – | – | – | – | – | – | – |
| | 3 | 10 | 10 | – | – | 100 | 66 | – | – | – | – | 4 | 168 | 50 | – | – | – | – | – | – | – | – | – | – |
| | 4 | 14 | 14 | – | – | 142 | 94 | – | – | – | – | 5 | 239 | 71 | – | – | – | – | – | – | – | – | – | – |
| C | 1 | 4 | 3 | – | – | 66 | – | – | – | – | – | 2 | 80 | 39 | 19 | 5 | 11 | – | – | – | – | – | – | 6 |
| | 2 | 6 | 4 | – | – | 85 | – | – | – | – | – | 3 | 114 | 55 | 27 | 7 | 16 | – | – | – | – | – | – | 9 |
| | 3 | 8 | 6 | – | – | 120 | – | – | – | – | – | 4 | 160 | 78 | 38 | 10 | 22 | – | – | – | – | – | – | 12 |
| | 4 | 11 | 9 | – | – | 170 | – | – | – | – | – | 5 | 227 | 110 | 54 | 14 | 31 | – | – | – | – | – | – | 17 |
| D | 1 | 6 | – | – | – | 30 | – | – | – | – | – | 4 | 148 | – | – | – | – | – | – | – | 30 | 30 | 10 | – |
| | 2 | 9 | – | – | – | 42 | – | – | – | – | – | 5 | 209 | – | – | – | – | – | – | – | 42 | 42 | 14 | – |
| E | 1 | 3 | – | – | – | 69 | 47 | 10 | – | – | 16 | 2 | 91 | 26 | – | – | – | 17 | 8 | 11 | – | – | – | – |
| | 2 | 4 | – | – | – | 98 | 67 | 15 | – | – | 23 | 3 | 128 | 33 | – | – | – | 24 | 11 | 16 | – | – | – | – |
| | 3 | 6 | – | – | – | 138 | 94 | 20 | – | – | 32 | 4 | 182 | 62 | – | – | – | 34 | 16 | 22 | – | – | – | – |

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

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

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

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

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

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

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

## 15 PROCEDURE FOR HANDLING OF COMPONENTS

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

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

**15.2** Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.

**15.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.

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

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

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

**15.7** Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

**15.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:**

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

– The markings showing the upright position.

– The markings showing the sling position

– Markings showing the fragile contents.

– Other required markings as per Clause No. 12

**15.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

**15.8.2** Handling and lifting should be done without jerks or impacts.

**15.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

**15.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

**15.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

**15.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

## 16 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3 (GI sheet covering is applicable for all closed type of wooden packing).

## 17 Treatment of Wood & Application and use of the mark

For seaworthy export packing, treatment of wood has to be carried out as below subject to BHEL Engg & QC approval.

As per customer requirement for export packing, wood to be treated as applicable should be done as per International Standards for Phytosanitary Measures ISPM: 15 to control the growth stages viz. egg to adult of structural insects (beetles, borers, bugs, fleas, flies, lice, moths, roaches, termites) and other pests (mice, rats, spiders) etc. in stored products.

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in Annex 2 of ISPM 15.

### 17.1 Heat treatment using a conventional steam or dry kiln heat chamber (treatment code for the mark: HT)

When using conventional heat chamber technology, the fundamental requirement is to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core).

This temperature can be measured by inserting temperature sensors in the core of the wood. Alternatively, when using kiln-drying heat chambers or other heat treatment chambers, treatment schedules may be developed based on a series of test treatments during which the core temperature of the wood at various locations inside the heat chamber has been measured and correlated with chamber air temperature, taking into account the moisture content of the wood and other substantial parameters (such as species and thickness of the wood, air flow rate and humidity). The test series must demonstrate that a minimum temperature of 56 °C is maintained for a minimum duration of 30 continuous minutes throughout the entire profile of the wood.

Treatment schedules should be specified or approved by the National Plant Protection Organisation (NPPO). Treatment providers should be approved by the NPPO.

### 17.2 Heat treatment using dielectric heating (treatment code for the mark: DH)

Where dielectric heating is used (e.g. microwave), wood packaging material composed of wood not exceeding 20 cm when measured across the smallest dimension of the piece or the stack must be heated to achieve a minimum temperature of 60 °C for 1 continuous minute throughout the entire profile of the wood (including its surface). The prescribed temperature must be reached within 30 minutes from the start of the treatment.

Treatment schedules should be specified or approved by the NPPO.

### 17.3 Methyl bromide treatment (treatment code for the mark: MB)

Wood packaging material containing a piece of wood exceeding 20 cm in cross-section at its smallest dimension must not be treated with methyl bromide.

The fumigation of wood packaging material with methyl bromide must be in accordance with a schedule specified or approved by the NPPO (National Plant Protection Organisation) that achieves the minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in Table 1. This CT must be achieved throughout the profile of the wood, including its core, although the concentrations would be measured in the ambient atmosphere. The minimum temperature of the wood and its surrounding atmosphere must not be less than 10 °C and the minimum exposure time must not be less than 24 hours. Monitoring of gas concentrations must be carried out at a minimum at 2, 4 and 24 hours from the beginning of the treatment. In the case of longer exposure times and weaker concentrations, additional measurement of the gas concentrations should be recorded at the end of fumigation.

If the CT is not achieved over 24 hours, corrective action needs to be taken to ensure the CT is reached; for example, the treatment is restarted or the treatment time extended for a maximum of 2 hours without adding more methyl bromide to achieve the required CT (see the footnote to Table 2).

**Table 2 – Minimum CT over 24 hours for wood packaging material fumigated with methyl bromide**

| Temperature (°C) | CT (g·h/m$^3$) over 24 h | Minimum final concentration (g/m$^3$) after 24 h# |
|---|---|---|
| 21.0 or above | 650 | 24 |
| 16.0 – 20.9 | 800 | 28 |
| 10.0 – 15.9 | 900 | 32 |

# In circumstances when the minimum final concentration is not achieved after 24 hours, a deviation in the concentration of ~5% is permitted provided additional treatment time is added to the end of the treatment to achieve the prescribed CT.

One example of a schedule that may be used for achieving the specified requirements is shown in Table 3.

**Table 3 – Example of a treatment schedule that achieves the minimum required CT for wood packaging material treated with methyl bromide (initial doses may need to be higher in conditions of high sorption or leakage)**

| Temperature (°C) | Dosage (g/m$^3$) | Minimum concentration (g/m$^3$) at: | | |
|---|---|---|---|---|
| | | 2 h | 4 h | 24 h |
| 21.0 or above | 48 | 36 | 31 | 24 |
| 16.0 – 20.9 | 56 | 42 | 36 | 28 |
| 10.0 – 15.9 | 64 | 48 | 42 | 32 |

Treatment providers should be approved by the NPPO.

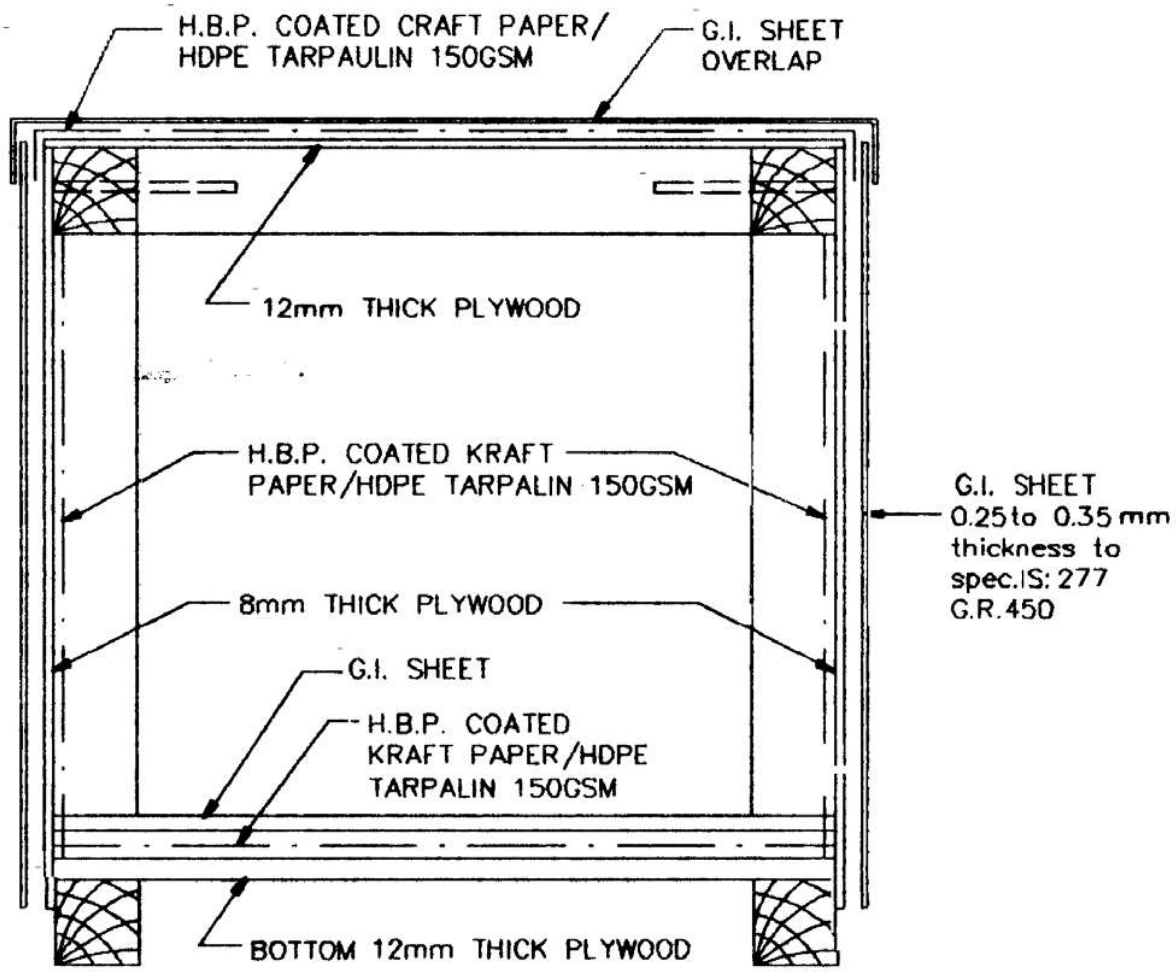
### 17.4 Marking

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in ISPM 15.

## 18 PROVISION FOR INSPECTION

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

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




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

**Figure 3**

# DOMESTIC PACKING

***COMMON GUIDELINES***

## 1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

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

## 2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

## 3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

## 4 TYPES OF PACKING:

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

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

## 5 DESCRIPTION OF TYPES OF PACKING:

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

### 5.1 'OP' - Open Type

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

### 5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

**5.3 'CP' - Crate Packing**

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

**5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment**

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

**5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies**

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

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

## 6 PREPARATION OF PACKING CASES

**6.1 DIMENSIONS:**

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

**6.2 JOINTING OF PLANKS**

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

### 6.3 TONGUE AND GROOVE JOINTS

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

### 6.4 PERMISSIBLE DEFECTS

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

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

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

### 6.5 OTHER MATERIALS

#### 6.5.1 NAILS

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

#### 6.5.2 BLUE NAILS

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

#### 6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

#### 6.5.4 CLIPS

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

#### 6.5.5 BRACKETS

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

#### 6.5.6 FASTENERS

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

#### 6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

#### 6.5.8 RUBBERISED COIR:

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

#### 6.5.9 FOAM RUBBER / 'U' FOAM:

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

**6.5.10 MARKING PLATE:**

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

**6.5.11 PACKING SLIP HOLDER:**

This shall be of galvanized iron tinned sheet /Aluminium sheet

**6.5.12 SILICA GEL:**

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

**6.5.13 COTTON BAGS:**

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

---

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

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**6.5.14 COTTON/ PLASTIC TAPE:**

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

**6.5.15 MARKING INK:**

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

**6.5.16 POLYETHYLENE BAGS:**

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

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

**6.5.18 Mechanical Latching clamps:**

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

**6.5.19 STICKERS**

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

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

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

## 7 PACKING OF CUBICLES:

**7.1** The packing is to be done as per clause 5 in all respects.

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

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

### 7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

### 7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

### 7.6 LOOSE PARTS:

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

### 7.7 WOODEN BATTENS:

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

### 7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

### 7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

### 7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

### 7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

### 7.12 CASE MOUNTING:

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

**7.13 Different types (Typical) of Cubicles with sizes for Packing**

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

**7.14 PACKING OF CUBICLES FOR EXPORT**

Refer Corporate Standard AA0490009.

## 8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

## 9 BOX SIZES

**9.1 BOX SIZES**

**Table 1 – SPARES WOODEN BOX DETAILS**

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

**Table 2 – WOODEN BOX DETAILS**

| BOX TYPE | BOX SIZE (in MM) | BOX Wt (in KG) | Carrying Capacity |
|---|---|---|---|
| 1 | 320X250X260 | 10 | |
| 2 | 320X250X430 | 15 | |
| 3 | 430X370X430 | 25 | |
| 4 | 670X670X470 | 65 | |
| 5 | 720X630X600 | 75 | |
| 6 | 1000X770X660 | 100 | |
| 7 | 1100X430X670 | 80 | |
| 8 | 1200X1200X900 | 80 | |
| 9 | 1300X770X1050 | 155 | |
| 10 | 2500X850X800 | 225 | |
| 11 | 2000X1500X1200 | 305 | |
| 12 | 1850X1050X1250 | 260 | |
| 13 | 2000X800X800 | 180 | |
| 14 | 2600X1500X1600 | 470 | |
| 15 | 250X250X600 | 20 | |
| 16 | 250X250X880 | 30 | |
| 17 | 300X300X700 | 25 | |
| 18 | 380X380X880 | 45 | |
| 19 | 510X510X1400 | 60 | |
| 20 | 570X570X1400 | 80 | |
| 21 | 575X575X1875 | 105 | |
| 22 | 3600X1100X1100 | 390 | |
| 23 | 900X500X800 | 110 | |
| 24 | 2000X950X740 | 225 | |
| 25 | 1600X1120X700 | 220 | |
| 26 | 2500X2000X1200 | 490 | |
| 27 | 2900X1900X1400 | 525 | |
| 28 | 3000X1000X900 | 370 | |
| 29 | 3200X2200X950 | 450 | |
| 30 | 2150X1100X750 | 325 | |
| 31 | 2000X2000X700 | 130 | |
| 32 | 700X1200X1325 | 130 | |

**Table 3 – STEEL BOXES**

| SL NO | TYPE | DIMENSION IN MM | | | WEIGHT | CARRYING CAPACITY (KGS) |
|---|---|---|---|---|---|---|
| | | LENGTH | BREADTH | HEIGHT | | |
| 1 | I | 2480 | 1680 | 1500 | 339 | 4500 |
| 2 | II | 1200 | 900 | 600 | 061 | 2000 |
| 3 | IIB | 1800 | 850 | 950 | 115 | 2500 |
| 4 | III | 900 | 600 | 600 | 029 | 1000 |
| 5 | IV | 600 | 450 | 500 | 019 | 750 |
| 6 | V | 400 | 350 | 300 | 011 | 500 |

**TYPICAL PATTERN OF WOODEN BOX**

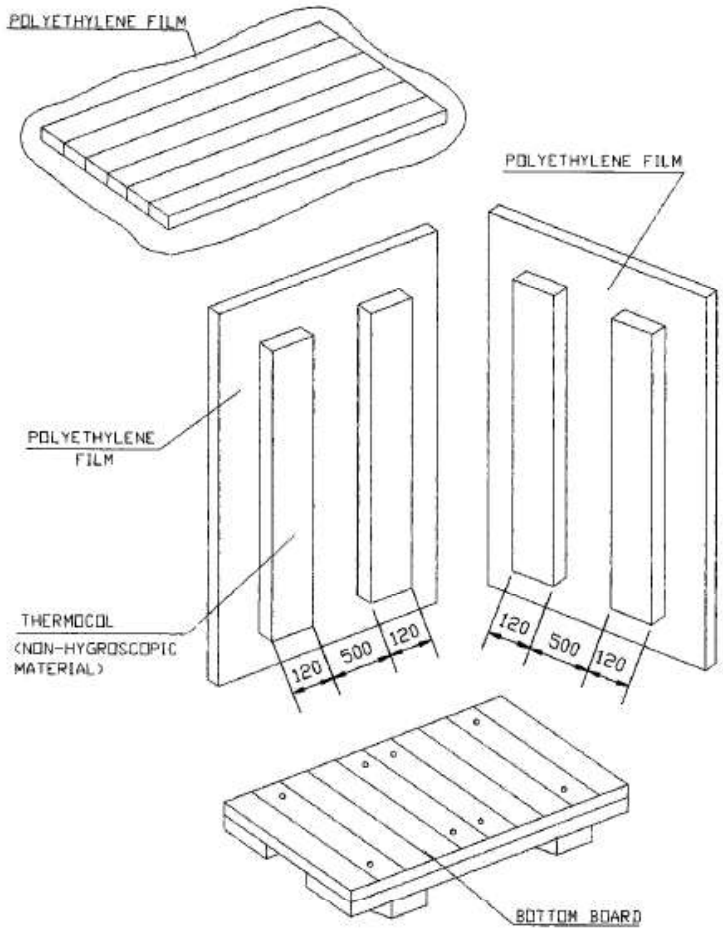



**Figure 1**

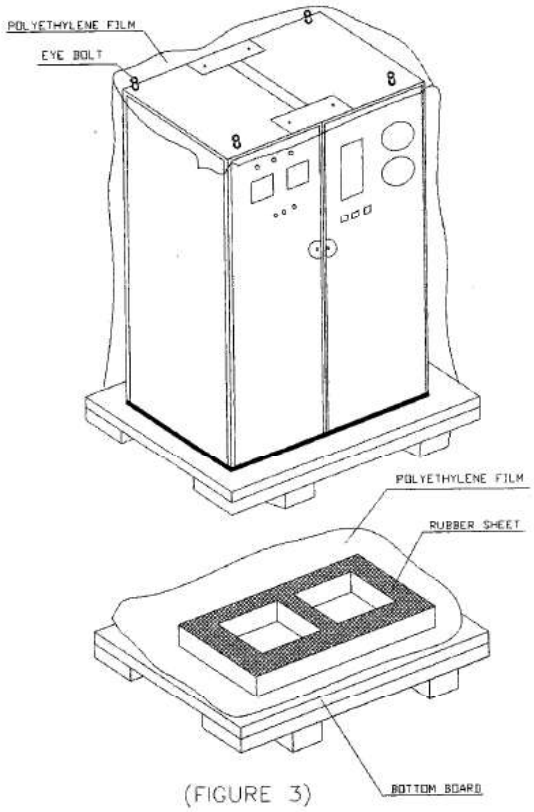



**Figure 2**

**9.2 STEEL CONTAINERS:**

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

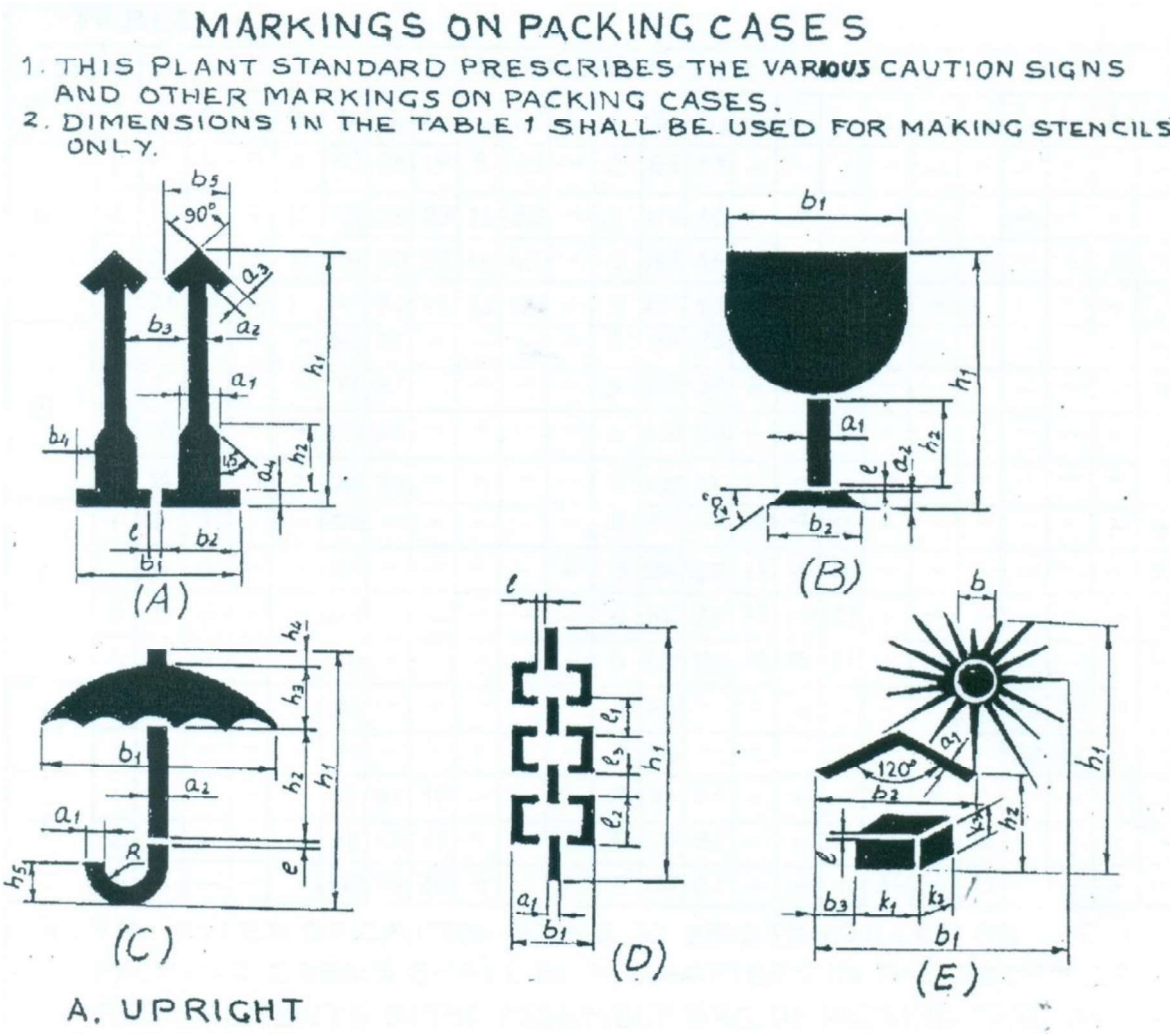
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

**9.3 SEALED PACKING:**

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

## 10 MARKINGS/STENCILINGS




Center of Gravity

**Figure 3**

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

**Table 4**

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

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

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

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

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

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

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

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

| | | | | | |
|---|---|---|---|---|---|
| | BHEL – <unit> - <location> - <pin> | | | | |
| CONSIGNEE | | | | | |
| MATERIAL | | | | | |
| CUSTOMER REF. | | | | MO. NO. | |
| DESPATCH ADVICE NOTE NO | | | | CASE NO | |
| DIMENSIONS(MM) L x B x H | | | | NET WT –KGS | GROSS WT –KGS |
| | | | | | |
| SPECIAL INSTRUCTIONS | HANDLE WITH CARE - KEEP DRY<br>DO NOT DROP - DO NOT TILT | | | | |

**Figure 4 – TYPICAL MARKING PLATE (225 X 170)**

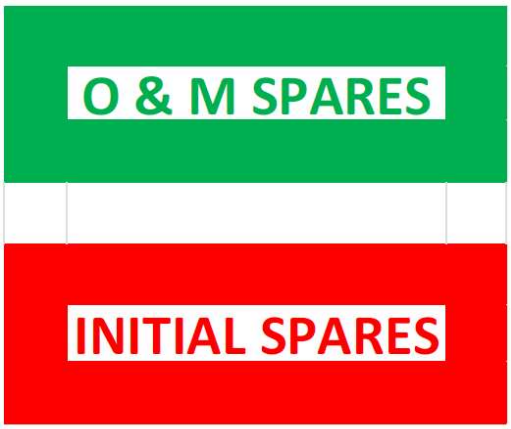



**Figure 5**

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

## 11 RECYCLING OF INCOMING WOODEN PACKING CASES

**OBJECTIVES**

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

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

## 12 STANDARD METHOD OF PACKING

**Table 5 - Standard Method of Packing**

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| PRESSUE VESSELS | | | | | | | | |
| TOWERS | | | | | O | | | |
| TANKS | | | | | O | | | |
| VESSELS | | | | | O | | | |
| GASKETS | O | | | | | | | |
| FASTENERS | O | | | | | | | |
| COVERS | | O | | | | | | |
| EXCHANGERS | | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| HEAT EXCHANGERS | | | | | O | | | |
| TUBE BUNDLE | O | | | | | | | |
| SHELL | | | | | O | | | |
| AIR FIN COOLERS | | | | | O | | | |
| COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC | | | | | O | | | |
| BEARING BLOCKS | O | | | | | | | |
| FANS | O | O | | | | | | |
| MOTORS | O | | | | | | | |
| GASKETS | O | | | | | | | |
| FASTENERS | O | | | | | | | |
| TEST FLANGES | | | O | | | | | |
| TEST RINGS | | | O | | | | | |
| COVERS | | | O | | | | | |
| CRYOGENIC VESSELS | | | | | | | | |
| COLD CONVERTERS | | | | | O | | | |
| HORIZONTAL STORAGE TANKS | | | | | O | | | |
| TRANSPORTATION TANK | | | | | O | | | |
| COLD BOX | | | | | O | | | |
| DRYING UNIT | | | | | O | | | |
| DRYING BOTTLES | | | | | O | | | |
| MOISTURE SEPARATORS | | | | | O | | | |
| SILENCERS | | | | | O | | | |
| ONGC SKIDS | | | | | O | | | |
| VAPORISER | | O | | | | | | |
| SPECIAL PRODUCTS | | | | | | | | |
| SI/VI PIPING | | O | | | | | | |
| CRO BIO CONTAINERS | O | | | | | | | |
| AIR BOTTLES | O | | | | | | | |
| TITANIUM BOTTLE | O | | | | | | | |
| WAR HEAD CONTAINER | O | | | | | | | |
| MISSILE CONTAINER | O | | | | | | | |
| FUEL CONTAINER | O | | | | | | | |
| AIR LOCK ASSEMBLY | O | | | | | | | |
| BOILER DRUMS | | | | | O | | | |
| BOILER ITEMS | | | | | | | | |
| COILS | | | O | | | | | |
| PANELS | | | | | O | | | |
| HEADERS | | | O | | O | | | |
| FEEDERS | | | | | | | | |
| MACHINED ITEMS | | | | | | | | |
| SHELL SEGMENTS | | | | | O | | | |
| | | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| SHELL SEGMENTS IN STACKS | | | | | O | | | |
| SPHERE PETALS | | | | | | | | |
| COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC. | | | | | O | | | |
| ROLLERS | O | | | | | | | |
| VALVE TRAYS | | | | | | | | |
| VALVE TRAY COMPONENTS | O | | | | | | | |
| LATTICE GIRDERS | | O | | | | | | |
| FASTENERS | O | | | | | | | |
| GASKETS | O | | | | | | | |
| SUB CONTRACTS | | | | | | | | |
| FAB STRUCTURALS | | | | | O | | | |
| SUPPORTING STRUCTURALS | | | | | O | | | |
| STRUCTURE SUB ASSEMBLY | | | | | O | | | |
| FAB PIPES | | | | | O | | | |
| GRATINGS | | | | | O | | | |
| STAIR CASES | | | | | O | | | |
| HANDRAILS/ PLATFORMS | | | | | O | | | |
| BOUGHT OUT COMPONENTS | | | | | | | | |
| IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.) | | | | | O | | | |
| PIPE FITTINGS | | | | | | | | |
| CS PIPES, TUBES | | | | | O | | | |
| SS PIPES, TUBES | | | | | O | | | |
| FIN TUBES | O | | | | | | | |
| ELBOWS | | O | | | O | | | |
| FLANGES | O | O | | | | | | |
| VALVES | O | | | | | | | |
| GAUGES | O | | | | | | | |
| DEMISTERS | | O | | | | | | |
| ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID) | | | | | | O | | |
| PAINT TINS | | O | | | | | | |
| PAINT DRUMS | | | | | | O | | |
| IGNITORS | O | | | | | | | |
| SPRAY NOZZLES | O | | | | | | | |
| ELECTRICAL INSTRUMENTATION | | | | | | | | |
| MOTORS, PUMPS, COMPRESSORS, TURBINES | O | | | | | | | |
| SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES | | O | | | | | | |
| INDICATORS, VIBRATOR SWITCHES | O | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| CABLE BUNDLES, CABLE DRUMS | | | | | O | | | |
| CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL | | O | | | | | | |
| OPERATIONAL SPARES | O | | | | | | | |

## 13 PROCEDURE FOR HANDLING OF COMPONENTS

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

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

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

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

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

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

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

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

### 13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

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

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

**13.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

**13.8.2** Handling and lifting should be done without jerks or impacts.

**13.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

**13.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

**13.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

**13.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

## 14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

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

### 14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

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

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

### 14.2 PACKING:

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

| Wooden Saddles | For Diameter up to 4000mm | For Diameter above 4000mm |
|---|---|---|
| Length: | 1836/2743mm (6'0"/9'0") | 3353mm (11'0") |
| Width: | 300mm (1'0") | 300mm (1'0") |
| Height: | Saddle + one/two wedges a top | Saddle + three/four wedges a top |

| Number of Saddles: | |
|---|---|
| Minimum | 3 in case of Loading inside Well<br>+1 when loaded on Gooseneck |
| Maximum: | 4 in case of Loading inside Well<br>+2 when loaded on Gooseneck |

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

### 14.3 NUMBER OF LASHINGS:

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

## 15 GUIDELINES FOR HANDLING/LOADING/LASHING

### 15.1 HANDLING


**Figure 6**

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

Pipes with split type end cover will be checked


**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

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


**Figure 10**

**15.2 LOADING**

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


**Figure 11**

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


**Figure 12**

No component loaded over the crating.


**Figure 13**

Headers supported with wooden V blocks at 3 meters interval.


**Figure 14**

Spacers in between each coil assembly.

**Figure 15**

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

**Figure 16**

### 15.3 LASHING

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

**Figure 17**

Nylon Belts used for lashing the beams.


**Figure 18**

## 16 PRODUCT WISE SPECIAL INSTRUCTION

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

## 17 REFERRED STANDARDS (Latest publications including amendments):

| | | | | |
|---|---|---|---|---|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 | 5) AA10108 |
| 6) AA56126 | 7) AA51402 | 8) AA51401 | 9) IS:1234 | |

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| **1.0** | **Materials** | | | | | | | | | | | | | |
| 1.1 | For boxes of VIS module | Chemical/Mechanical | MA | Verification | One / Heat | - | IS 2062 / DIN EN 10025 or Equivalent | Same as column "7" | Certificate | √ | P | V | V | |
| 1.2 | For Springs | a) Chemical | MA | Verification | One / Heat | - | 51CrV4 as per EN10089 or equivalent | Same as column "7" | Certificate | √ | P | V | V | |
| | | b) Grain Size | MA | Verification | One / Heat | - | ASTME 112 | ASTM 6 or finer | Certificate | √ | P | V | V | |
| | | c) NMI | MA | Verification | One / Heat | - | IS 4163/ EN 10247 or Equivalent | As per EN10089 or equivalent | Certificate | √ | P | V | V | |
| **2.0** | **Component** | | | | | | | | | | | | | |
| 2.1 | Springs (at Manufacturers end) | a) Hardness | MA | Test | One/Lot | - | IS 1500 | As per vendor detail | Certificate | √ | P | V | V | |
| | | b) Decarburization | MA | Test | One/Lot | - | IS6396 | Max. depth 0.5% bar dia-partial | Certificate | √ | P | V | V | |
| | | c) NDE after compression (MPI) | MA | Test | 100% | - | IS3703 | No cracks | Certificate | √ | P | V | V | |
| | | d) Micro structure | MA | Verification | One/Lot | - | - | As per vendor detail | Certificate | √ | P | V | V | |
| 2.1.1 | Springs (at Supplier end) | Spring Rate | MA | Test | AQL 4.0 of Table 7.1 | - | DIN 2096 | Same as column "7" | Certificate | √ | P | V | V | |
| 2.2 | Viscoliquid (For visco damper) | Viscosity/Penetration speed | MA | Test | One/Lot | - | DIN 53019 or equivalent | Same as column "7" | Certificate | √ | P | V | V | |

| BHEL | | | | | |
|---|---|---|---|---|---|
| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
|---|---|
| Sign & Date | |
| Seal | |

| FOR CUSTOMER REVIEW & APPROVAL | | | |
|---|---|---|---|
| Doc No: | | | |
| | Sign & Date | Name | Seal |
| Reviewed by: | | | |
| Approved by: | | | |

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| 2.3 | Studs & Nuts | Chemical/Mechanical | MI | Verification | One/Lot | - | IS1367 | As per Datasheet | Certificate | √ | P | V | V | |
| | | Dimensions(mm) | MI | Measure | 10% | - | IS 4218 (Tolerance Class 6G & 6H) | Same as column "7 | Internal Record | √ | P | V | V | |
| 3 | **In Process Inspection** | | | | | | | | | | | | | |
| 3.1 | Welding | Visual/Surface exam | MA | Visual/ Measure | 10% on welds | - | DIN EN 25817/D or BS EN ISO 5817 or Equivalent | Same as column "7 | Certificate | √ | P | V | V | |
| | | NDE | MA | DPT | 10% Random | - | ASTM/ E 165 | Same as column "7 | Certificate | √ | P | V | V | |
| 3.2 | Boxes | Dimensions | MA | Measure | 10% | - | Datasheet (data & dimensions) | EN ISO 13920 C | Internal Record | √ | P | V | V | |
| 3.3 | Adhesive pads, Steel shims | Dimensions | MI | Measure/ Visual | 10% | - | Datasheet (data & dimensions) | DIN 7168 Sg | Internal Record | √ | P | V | V | |
| 4 | **Final Inspection** | | | | | | | | | | | | | |
| 4.1 | Shot Blasting | Surface preparation | MA | Compare | 10% | - | EN ISO 12944-4 | As per Datasheet | Certificate | √ | P | V | V | |
| 4.2 | Painting | Thickness | MA | Measure | 10% | - | EN ISO 12944-5 | As per Datasheet | Certificate | √ | P | V | V | |
| 4.3 | Spring Unit | Dimensions (Except Height at nominal load & max pre-stressed | MI | Measure | 10% | 10% | Approved technical Data Sheet | EN ISO 13920 C | Internal Record | √ | P | W | W | |

| BHEL | | | | | |
|---|---|---|---|---|---|
| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
|---|---|
| Sign & Date | |
| Seal | |

| FOR CUSTOMER REVIEW & APPROVAL | | | |
|---|---|---|---|
| Doc No: | | | |
| | Sign & Date | Name | Seal |
| Reviewed by: | | | |
| Approved by: | | | |

| MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS | QUALITY PLAN | | SPEC. NO : | DATE: |
|---|---|---|---|---|
| | CUSTOMER : | | QP NO.: | DATE: |
| | PROJECT: | | PO NO.: | DATE: |
| | ITEM: VIBRATION ISOLATION SYSTEM | SYSTEM: | SECTION: | SHEET OF |

| SL NO | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | | 7 | 8 | 9 | | 10** | | | 11 |
| | | | | | M | C/N | | | | *D | M | C | N | |
| 4.4 | Constant of Spring Units (Vertical) | Load Vs Displacement (kN/mm) | CR | Test | 10% | 10% | DIN 2096 | Datasheet (data & dimensions) | Certificate | √ | P | W | W | |
| 4.5 | Document Control | Verification of above documents(TC/IR) | MA | Compare | All | - | Approved Quality Plan | Application rows tick marked under col. 'D' | Certificate | √ | P | V | V | |
| 4.6 | Packing / Marking | Visual | MA | Visual/Compare | 100% | - | As per supplier's standard or BHEL Corporate standard | Same as column "7 | Certificate | √ | P | W | - | |

**NOTES:**

1. In the absence of MTC/ Testing shall be carried out in NABL Accredited Lab. Testing report shall be reviewed by TPIA/ BHEL.
2. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/ verified by supplier's TPIA.
3. BHEL reserves the right for conducting repeat test, if required and if possible.
4. After packing and prior to issue of MDCC, Photographs of Complete material (to be dispatched) with witness report of BHEL/ TPIA shall be sent to BHEL-Purchase group for review and clearance.
5. Material shall be packed suitably in order to avoid damage during transit and also during storage at site in tropical climate condition.
6. All BOIs document shall be provided as per manufacturer std. format of MTC.
7. The latest revision/ year of issue of all the standards (IS / ASME, etc. as applicable) indicated in the QP shall be referred.

**LEGENDS:**

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: BHEL'S CUSTOMER,
**P**: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
**MA**: MAJOR, **MI**: MINOR**, CR:** CRITICAL

| BHEL | | | | | |
|---|---|---|---|---|---|
| ENGINEERING | | | QUALITY | | |
| | Sign & Date | Name | | Sign & Date | Name |
| Prepared by: | | | Checked by: | | |
| Reviewed by: | | | Reviewed by: | | |

| BIDDER/ SUPPLIER | |
|---|---|
| Sign & Date | |
| Seal | |

| FOR CUSTOMER REVIEW & APPROVAL | | | |
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| Doc No: | | | |
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| Reviewed by: | | | |
| Approved by: | | | |

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

## 1 GENERAL

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

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

## 2 SCOPE

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

## 3 CROSS REFERRED SPECIFICATION

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

## 4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

For export packing wood in addition to the above the following has to be met:

The standard requires the use of debarked wood in the construction of compliant wood packaging material. Debarked wood is defined in the ISPM 5.

## 5 TYPE OF PACKING

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

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

## 6 DESCRIPTION OF TYPES OF PACKING

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

### 6.1 'OP' - Open Type

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

### 6.2 'PP' - Partially Packed

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

### 6.3 'CP' - Crate Packing – General

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

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

a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.

b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.

c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.

d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

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

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

a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.

b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.

d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

### 6.6 Special Packing

Components requiring special packing (as per customer/contractual/ engineering requirements) not included in this specification shall be covered by product standards.

## 7 PREPARATION OF PACKING CASE

1) Cases and crates with gross weight up to 1,000 kgs. shall be provided with bottom cleats of min. 40 mm thicknesses to ensure clearance for handling by forklift. Cases and crates exceeding gross weight of 1,000 kgs. shall be provided with skid runners, number and size according to weight of package.
2) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.
3) In case of 'CR1 - Packing Viz. Electrical & Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.
4) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.

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

   It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
5) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
6) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
7) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.
8) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
9) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
10) The inner side of the top cover shall be lined with polyethylene sheet, of at least
11) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
12) For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

## 8 STEEL CONTAINERS

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

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

**Following precautions are to be taken during packing:**

– Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.

– To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.

– Put cover on steel, container and Bolt Properly.

## 9 SEALED PACKING

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

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

## 10 SLING PLATE

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

## 11 PACKING SLIP HOLDERS

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

## 12 Volatile Corrosion Inhibitor (VCI) Paper

a) Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.

b) 7 $m^3$ VCI paper is necessary for 1 $m^3$ of packed item approximately as per AA51406.

**Application Limitation:**

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

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

## 13 Moisture Absorber

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

## 14 GENERAL PRECAUTIONS

a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.

b) Sling protection brackets to be provided on cases wherever required.

c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.

d) The various caution signs shall be marked with stencil on both sides of the packing box.

e) Do not pack any other Mechanical items with this case (do not use any other non-permitted packing materials).

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

a) Address of consignee.

b) Purchase Order No./ SO No/WO No.

c) Description of item or title of packing list.

d) Case identification Number/ Packing List No.

e) Net Weight.

f) Gross Weight.

g) Dimensions of box

h) Marking showing upright position.

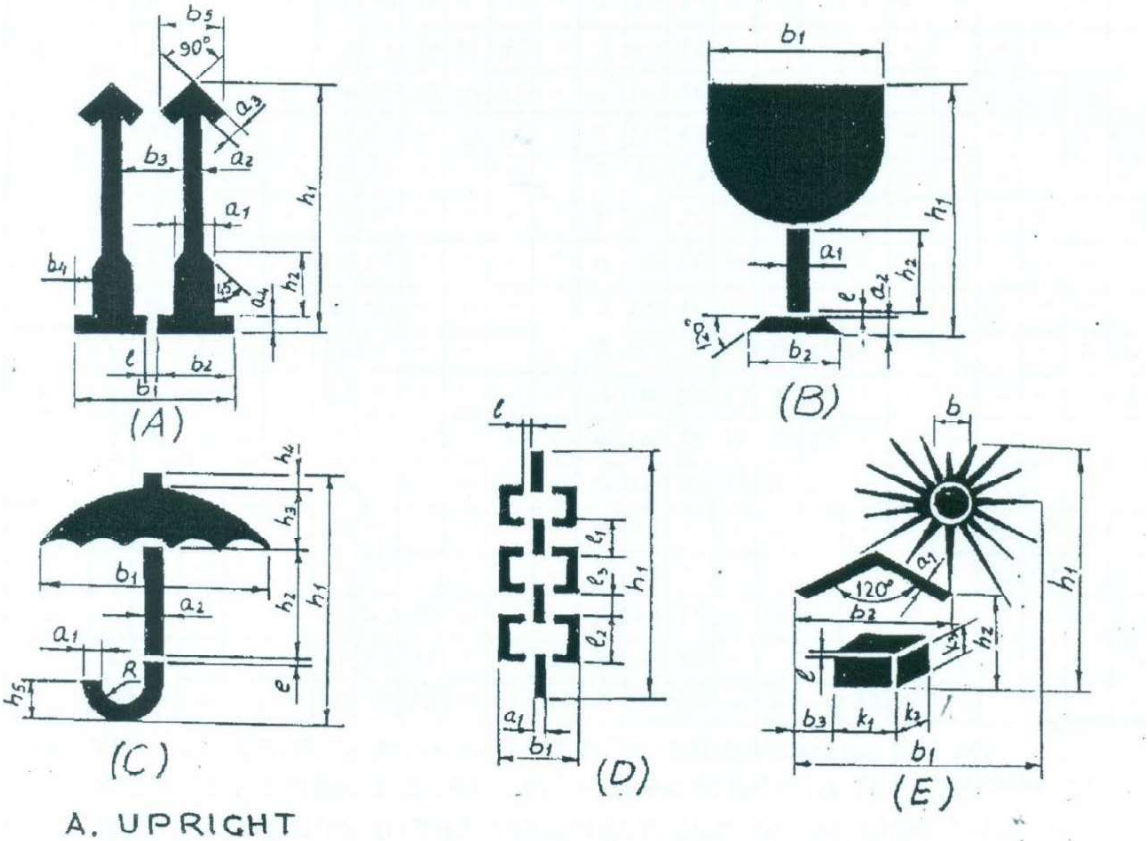
i) Marking showing sling position.

j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.

k) Loading and unloading precautions

## MARKINGS ON PACKING CASES

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




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

**Figure 1**

**CENTER OF GRAVITY**

**Figure 2**

**Table 1**

| DESIGNATION | | DIMENSIONS IN mm. | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $a_1$ | $a_2$ | $a_3$ | $a_4$ | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ | b | l | $h_1$ | $h_2$ | $h_3$ | $h_4$ | $h_5$ | $K_1$ | $K_2$ | $K_3$ | $l_1$ | $l_2$ | $l_3$ | R |
| A | 1 | 12 | 5 | 5 | 4 | 52 | 25 | 19 | 8 | 21 | – | 2 | 84 | 23 | – | – | – | – | – | – | – | – | – | – |
| | 2 | 17 | 7 | 7 | 6 | 75 | 36 | 29 | 11 | 30 | – | 3 | 119 | 33 | – | – | – | – | – | – | – | – | – | – |
| | 3 | 24 | 10 | 10 | 8 | 104 | 50 | 38 | 16 | 42 | – | 4 | 168 | 46 | – | – | – | – | – | – | – | – | – | – |
| | 4 | 34 | 14 | 14 | 11 | 147 | 71 | 59 | 23 | 60 | – | 5 | 239 | 65 | – | – | – | – | – | – | – | – | – | – |
| B | 1 | 5 | 5 | – | – | 50 | 33 | – | – | – | – | 2 | 84 | 25 | – | – | – | – | – | – | – | – | – | – |
| | 2 | 7 | 7 | – | – | 71 | 47 | – | – | – | – | 3 | 119 | 36 | – | – | – | – | – | – | – | – | – | – |
| | 3 | 10 | 10 | – | – | 100 | 66 | – | – | – | – | 4 | 168 | 50 | – | – | – | – | – | – | – | – | – | – |
| | 4 | 14 | 14 | – | – | 142 | 94 | – | – | – | – | 5 | 239 | 71 | – | – | – | – | – | – | – | – | – | – |
| C | 1 | 4 | 3 | – | – | 66 | – | – | – | – | – | 2 | 80 | 39 | 19 | 5 | 11 | – | – | – | – | – | – | 6 |
| | 2 | 6 | 4 | – | – | 85 | – | – | – | – | – | 3 | 114 | 55 | 27 | 7 | 16 | – | – | – | – | – | – | 9 |
| | 3 | 8 | 6 | – | – | 120 | – | – | – | – | – | 4 | 160 | 78 | 38 | 10 | 22 | – | – | – | – | – | – | 12 |
| | 4 | 11 | 9 | – | – | 170 | – | – | – | – | – | 5 | 227 | 110 | 54 | 14 | 31 | – | – | – | – | – | – | 17 |
| D | 1 | 6 | – | – | – | 30 | – | – | – | – | – | 4 | 148 | – | – | – | – | – | – | – | 30 | 30 | 10 | – |
| | 2 | 9 | – | – | – | 42 | – | – | – | – | – | 5 | 209 | – | – | – | – | – | – | – | 42 | 42 | 14 | – |
| E | 1 | 3 | – | – | – | 69 | 47 | 10 | – | – | 16 | 2 | 91 | 26 | – | – | – | 17 | 8 | 11 | – | – | – | – |
| | 2 | 4 | – | – | – | 98 | 67 | 15 | – | – | 23 | 3 | 128 | 33 | – | – | – | 24 | 11 | 16 | – | – | – | – |
| | 3 | 6 | – | – | – | 138 | 94 | 20 | – | – | 32 | 4 | 182 | 62 | – | – | – | 34 | 16 | 22 | – | – | – | – |

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

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

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

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

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

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

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

## 15 PROCEDURE FOR HANDLING OF COMPONENTS

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

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

**15.2** Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.

**15.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.

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

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

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

**15.7** Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

**15.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:**

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

– The markings showing the upright position.

– The markings showing the sling position

– Markings showing the fragile contents.

– Other required markings as per Clause No. 12

**15.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

**15.8.2** Handling and lifting should be done without jerks or impacts.

**15.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

**15.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

**15.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

**15.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

## 16 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3 (GI sheet covering is applicable for all closed type of wooden packing).

## 17 Treatment of Wood & Application and use of the mark

For seaworthy export packing, treatment of wood has to be carried out as below subject to BHEL Engg & QC approval.

As per customer requirement for export packing, wood to be treated as applicable should be done as per International Standards for Phytosanitary Measures ISPM: 15 to control the growth stages viz. egg to adult of structural insects (beetles, borers, bugs, fleas, flies, lice, moths, roaches, termites) and other pests (mice, rats, spiders) etc. in stored products.

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in Annex 2 of ISPM 15.

### 17.1 Heat treatment using a conventional steam or dry kiln heat chamber (treatment code for the mark: HT)

When using conventional heat chamber technology, the fundamental requirement is to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core).

This temperature can be measured by inserting temperature sensors in the core of the wood. Alternatively, when using kiln-drying heat chambers or other heat treatment chambers, treatment schedules may be developed based on a series of test treatments during which the core temperature of the wood at various locations inside the heat chamber has been measured and correlated with chamber air temperature, taking into account the moisture content of the wood and other substantial parameters (such as species and thickness of the wood, air flow rate and humidity). The test series must demonstrate that a minimum temperature of 56 °C is maintained for a minimum duration of 30 continuous minutes throughout the entire profile of the wood.

Treatment schedules should be specified or approved by the National Plant Protection Organisation (NPPO). Treatment providers should be approved by the NPPO.

### 17.2 Heat treatment using dielectric heating (treatment code for the mark: DH)

Where dielectric heating is used (e.g. microwave), wood packaging material composed of wood not exceeding 20 cm when measured across the smallest dimension of the piece or the stack must be heated to achieve a minimum temperature of 60 °C for 1 continuous minute throughout the entire profile of the wood (including its surface). The prescribed temperature must be reached within 30 minutes from the start of the treatment.

Treatment schedules should be specified or approved by the NPPO.

### 17.3 Methyl bromide treatment (treatment code for the mark: MB)

Wood packaging material containing a piece of wood exceeding 20 cm in cross-section at its smallest dimension must not be treated with methyl bromide.

The fumigation of wood packaging material with methyl bromide must be in accordance with a schedule specified or approved by the NPPO (National Plant Protection Organisation) that achieves the minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in Table 1. This CT must be achieved throughout the profile of the wood, including its core, although the concentrations would be measured in the ambient atmosphere. The minimum temperature of the wood and its surrounding atmosphere must not be less than 10 °C and the minimum exposure time must not be less than 24 hours. Monitoring of gas concentrations must be carried out at a minimum at 2, 4 and 24 hours from the beginning of the treatment. In the case of longer exposure times and weaker concentrations, additional measurement of the gas concentrations should be recorded at the end of fumigation.

If the CT is not achieved over 24 hours, corrective action needs to be taken to ensure the CT is reached; for example, the treatment is restarted or the treatment time extended for a maximum of 2 hours without adding more methyl bromide to achieve the required CT (see the footnote to Table 2).

**Table 2 – Minimum CT over 24 hours for wood packaging material fumigated with methyl bromide**

| Temperature (°C) | CT (g·h/m$^3$) over 24 h | Minimum final concentration (g/m$^3$) after 24 h# |
|---|---|---|
| 21.0 or above | 650 | 24 |
| 16.0 – 20.9 | 800 | 28 |
| 10.0 – 15.9 | 900 | 32 |

# In circumstances when the minimum final concentration is not achieved after 24 hours, a deviation in the concentration of ~5% is permitted provided additional treatment time is added to the end of the treatment to achieve the prescribed CT.

One example of a schedule that may be used for achieving the specified requirements is shown in Table 3.

**Table 3 – Example of a treatment schedule that achieves the minimum required CT for wood packaging material treated with methyl bromide (initial doses may need to be higher in conditions of high sorption or leakage)**

| Temperature (°C) | Dosage (g/m$^3$) | Minimum concentration (g/m$^3$) at: | | |
|---|---|---|---|---|
| | | 2 h | 4 h | 24 h |
| 21.0 or above | 48 | 36 | 31 | 24 |
| 16.0 – 20.9 | 56 | 42 | 36 | 28 |
| 10.0 – 15.9 | 64 | 48 | 42 | 32 |

Treatment providers should be approved by the NPPO.

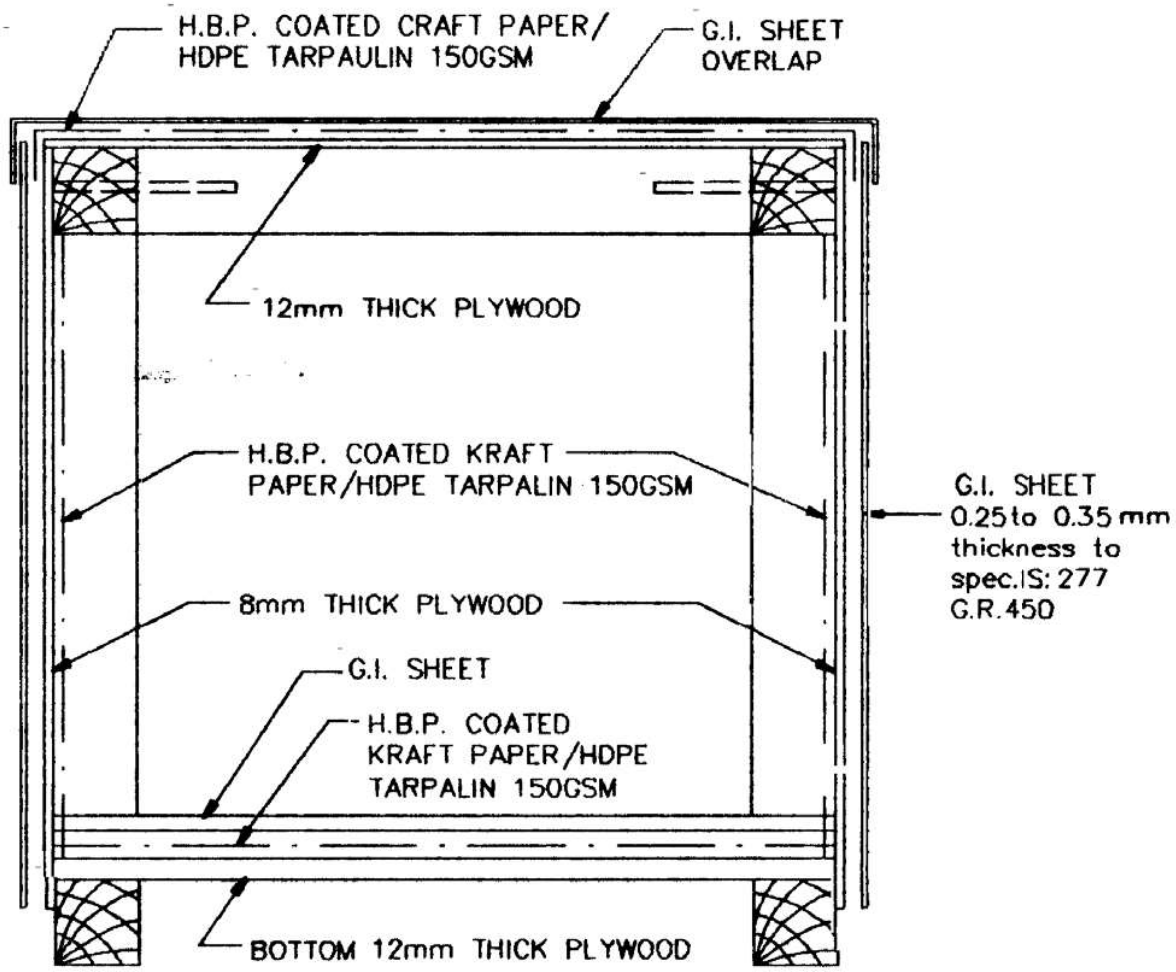
### 17.4 Marking

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in ISPM 15.

## 18 PROVISION FOR INSPECTION

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

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




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

**Figure 3**

# DOMESTIC PACKING

***COMMON GUIDELINES***

## 1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

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

## 2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

## 3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

## 4 TYPES OF PACKING:

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

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

## 5 DESCRIPTION OF TYPES OF PACKING:

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

### 5.1 'OP' - Open Type

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

### 5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

**5.3 'CP' - Crate Packing**

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

**5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment**

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

**5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies**

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

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

## 6 PREPARATION OF PACKING CASES

**6.1 DIMENSIONS:**

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

**6.2 JOINTING OF PLANKS**

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

### 6.3 TONGUE AND GROOVE JOINTS

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

### 6.4 PERMISSIBLE DEFECTS

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

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

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

### 6.5 OTHER MATERIALS

#### 6.5.1 NAILS

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

#### 6.5.2 BLUE NAILS

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

#### 6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

#### 6.5.4 CLIPS

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

#### 6.5.5 BRACKETS

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

#### 6.5.6 FASTENERS

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

#### 6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

#### 6.5.8 RUBBERISED COIR:

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

#### 6.5.9 FOAM RUBBER / 'U' FOAM:

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

**6.5.10 MARKING PLATE:**

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

**6.5.11 PACKING SLIP HOLDER:**

This shall be of galvanized iron tinned sheet /Aluminium sheet

**6.5.12 SILICA GEL:**

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

**6.5.13 COTTON BAGS:**

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

---

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

---

**6.5.14 COTTON/ PLASTIC TAPE:**

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

**6.5.15 MARKING INK:**

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

**6.5.16 POLYETHYLENE BAGS:**

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

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

**6.5.18 Mechanical Latching clamps:**

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

**6.5.19 STICKERS**

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

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

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

## 7 PACKING OF CUBICLES:

**7.1** The packing is to be done as per clause 5 in all respects.

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

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

### 7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

### 7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

### 7.6 LOOSE PARTS:

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

### 7.7 WOODEN BATTENS:

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

### 7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

### 7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

### 7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

### 7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

### 7.12 CASE MOUNTING:

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

**7.13 Different types (Typical) of Cubicles with sizes for Packing**

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

**7.14 PACKING OF CUBICLES FOR EXPORT**

Refer Corporate Standard AA0490009.

## 8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

## 9 BOX SIZES

**9.1 BOX SIZES**

**Table 1 – SPARES WOODEN BOX DETAILS**

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

**Table 2 – WOODEN BOX DETAILS**

| BOX TYPE | BOX SIZE (in MM) | BOX Wt (in KG) | Carrying Capacity |
|---|---|---|---|
| 1 | 320X250X260 | 10 | |
| 2 | 320X250X430 | 15 | |
| 3 | 430X370X430 | 25 | |
| 4 | 670X670X470 | 65 | |
| 5 | 720X630X600 | 75 | |
| 6 | 1000X770X660 | 100 | |
| 7 | 1100X430X670 | 80 | |
| 8 | 1200X1200X900 | 80 | |
| 9 | 1300X770X1050 | 155 | |
| 10 | 2500X850X800 | 225 | |
| 11 | 2000X1500X1200 | 305 | |
| 12 | 1850X1050X1250 | 260 | |
| 13 | 2000X800X800 | 180 | |
| 14 | 2600X1500X1600 | 470 | |
| 15 | 250X250X600 | 20 | |
| 16 | 250X250X880 | 30 | |
| 17 | 300X300X700 | 25 | |
| 18 | 380X380X880 | 45 | |
| 19 | 510X510X1400 | 60 | |
| 20 | 570X570X1400 | 80 | |
| 21 | 575X575X1875 | 105 | |
| 22 | 3600X1100X1100 | 390 | |
| 23 | 900X500X800 | 110 | |
| 24 | 2000X950X740 | 225 | |
| 25 | 1600X1120X700 | 220 | |
| 26 | 2500X2000X1200 | 490 | |
| 27 | 2900X1900X1400 | 525 | |
| 28 | 3000X1000X900 | 370 | |
| 29 | 3200X2200X950 | 450 | |
| 30 | 2150X1100X750 | 325 | |
| 31 | 2000X2000X700 | 130 | |
| 32 | 700X1200X1325 | 130 | |

**Table 3 – STEEL BOXES**

| SL NO | TYPE | DIMENSION IN MM | | | WEIGHT | CARRYING CAPACITY (KGS) |
|---|---|---|---|---|---|---|
| | | LENGTH | BREADTH | HEIGHT | | |
| 1 | I | 2480 | 1680 | 1500 | 339 | 4500 |
| 2 | II | 1200 | 900 | 600 | 061 | 2000 |
| 3 | IIB | 1800 | 850 | 950 | 115 | 2500 |
| 4 | III | 900 | 600 | 600 | 029 | 1000 |
| 5 | IV | 600 | 450 | 500 | 019 | 750 |
| 6 | V | 400 | 350 | 300 | 011 | 500 |

**TYPICAL PATTERN OF WOODEN BOX**

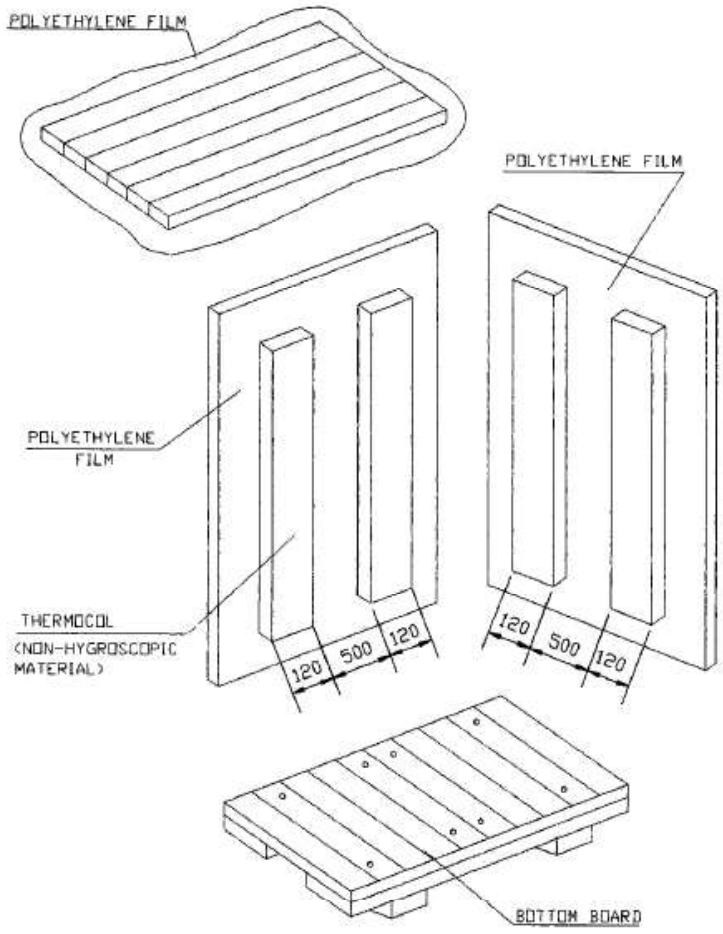



**Figure 1**

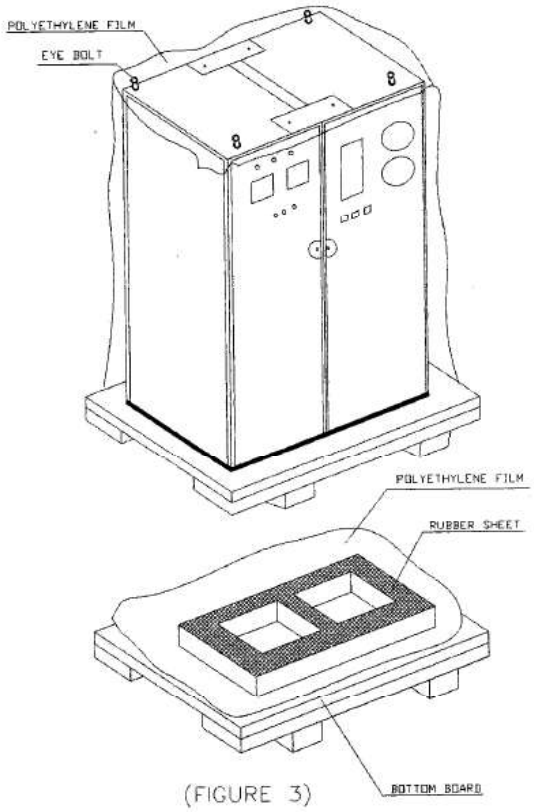



**Figure 2**

### 9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

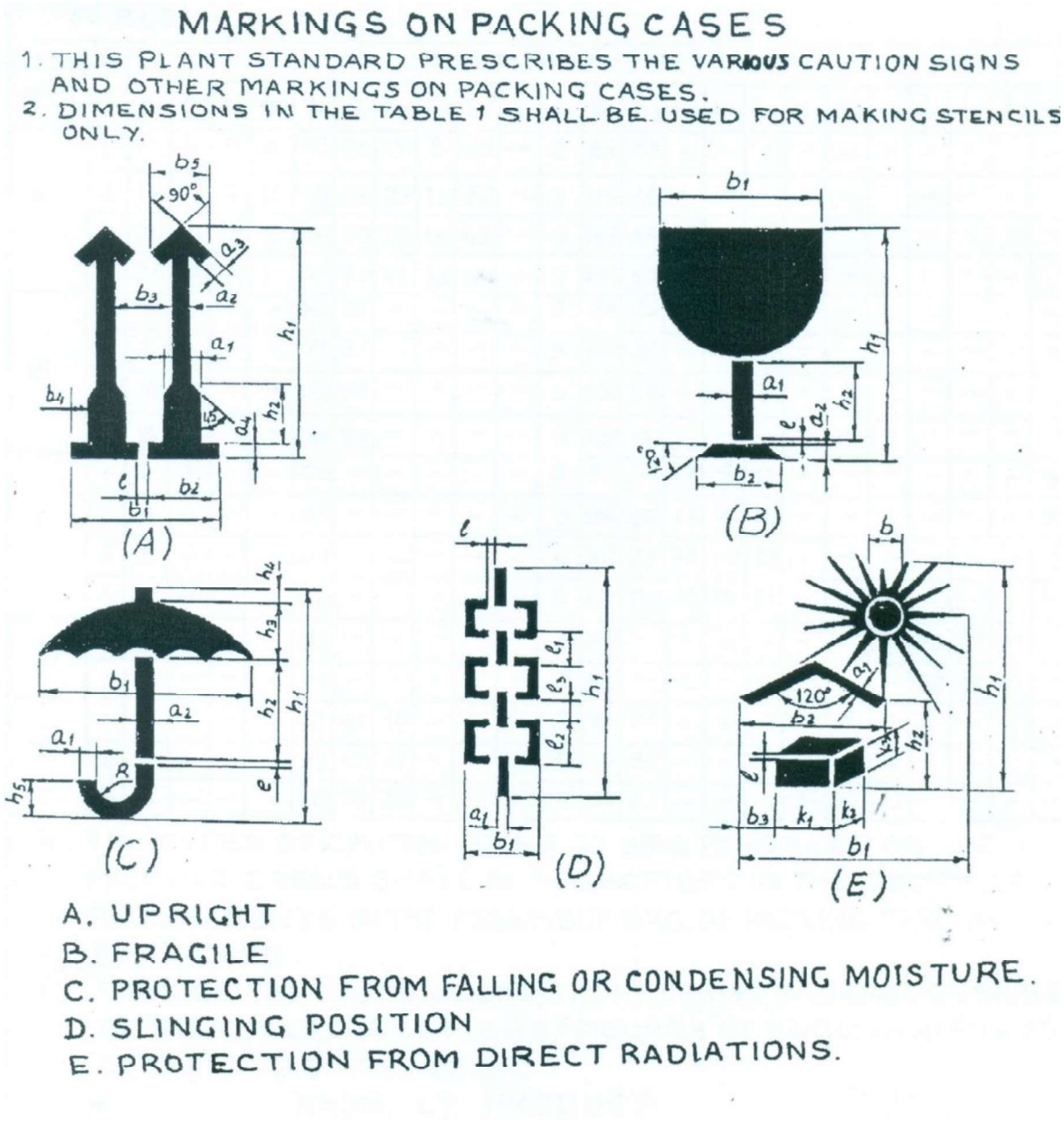
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

### 9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

## 10 MARKINGS/STENCILINGS




Center of Gravity

**Figure 3**

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

**Table 4**

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

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

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

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

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

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

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

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

| | | | | | |
|---|---|---|---|---|---|
| | BHEL – <unit> - <location> - <pin> | | | | |
| CONSIGNEE | | | | | |
| MATERIAL | | | | | |
| CUSTOMER REF. | | | | MO. NO. | |
| DESPATCH ADVICE NOTE NO | | | | CASE NO | |
| DIMENSIONS(MM) L x B x H | | | | NET WT –KGS | GROSS WT –KGS |
| | | | | | |
| SPECIAL INSTRUCTIONS | HANDLE WITH CARE - KEEP DRY<br>DO NOT DROP - DO NOT TILT | | | | |

**Figure 4 – TYPICAL MARKING PLATE (225 X 170)**

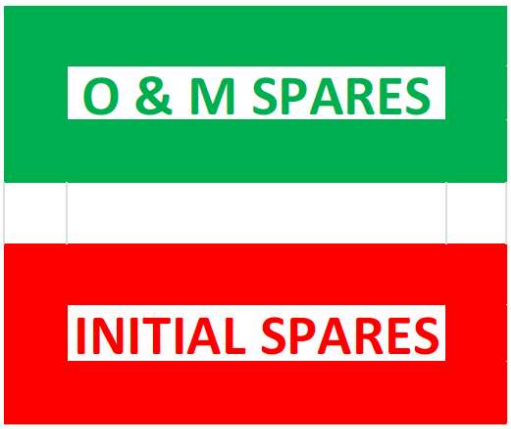



**Figure 5**

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

## 11 RECYCLING OF INCOMING WOODEN PACKING CASES

**OBJECTIVES**

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

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

## 12 STANDARD METHOD OF PACKING

**Table 5 - Standard Method of Packing**

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| PRESSUE VESSELS | | | | | | | | |
| TOWERS | | | | | O | | | |
| TANKS | | | | | O | | | |
| VESSELS | | | | | O | | | |
| GASKETS | O | | | | | | | |
| FASTENERS | O | | | | | | | |
| COVERS | | O | | | | | | |
| EXCHANGERS | | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| HEAT EXCHANGERS | | | | | O | | | |
| TUBE BUNDLE | O | | | | | | | |
| SHELL | | | | | O | | | |
| AIR FIN COOLERS | | | | | O | | | |
| COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC | | | | | O | | | |
| BEARING BLOCKS | O | | | | | | | |
| FANS | O | O | | | | | | |
| MOTORS | O | | | | | | | |
| GASKETS | O | | | | | | | |
| FASTENERS | O | | | | | | | |
| TEST FLANGES | | | O | | | | | |
| TEST RINGS | | | O | | | | | |
| COVERS | | | O | | | | | |
| CRYOGENIC VESSELS | | | | | | | | |
| COLD CONVERTERS | | | | | O | | | |
| HORIZONTAL STORAGE TANKS | | | | | O | | | |
| TRANSPORTATION TANK | | | | | O | | | |
| COLD BOX | | | | | O | | | |
| DRYING UNIT | | | | | O | | | |
| DRYING BOTTLES | | | | | O | | | |
| MOISTURE SEPARATORS | | | | | O | | | |
| SILENCERS | | | | | O | | | |
| ONGC SKIDS | | | | | O | | | |
| VAPORISER | | O | | | | | | |
| SPECIAL PRODUCTS | | | | | | | | |
| SI/VI PIPING | | O | | | | | | |
| CRO BIO CONTAINERS | O | | | | | | | |
| AIR BOTTLES | O | | | | | | | |
| TITANIUM BOTTLE | O | | | | | | | |
| WAR HEAD CONTAINER | O | | | | | | | |
| MISSILE CONTAINER | O | | | | | | | |
| FUEL CONTAINER | O | | | | | | | |
| AIR LOCK ASSEMBLY | O | | | | | | | |
| BOILER DRUMS | | | | | O | | | |
| BOILER ITEMS | | | | | | | | |
| COILS | | | O | | | | | |
| PANELS | | | | | O | | | |
| HEADERS | | | O | | O | | | |
| FEEDERS | | | | | | | | |
| MACHINED ITEMS | | | | | | | | |
| SHELL SEGMENTS | | | | | O | | | |
| | | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| SHELL SEGMENTS IN STACKS | | | | | O | | | |
| SPHERE PETALS | | | | | | | | |
| COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC. | | | | | O | | | |
| ROLLERS | O | | | | | | | |
| VALVE TRAYS | | | | | | | | |
| VALVE TRAY COMPONENTS | O | | | | | | | |
| LATTICE GIRDERS | | O | | | | | | |
| FASTENERS | O | | | | | | | |
| GASKETS | O | | | | | | | |
| SUB CONTRACTS | | | | | | | | |
| FAB STRUCTURALS | | | | | O | | | |
| SUPPORTING STRUCTURALS | | | | | O | | | |
| STRUCTURE SUB ASSEMBLY | | | | | O | | | |
| FAB PIPES | | | | | O | | | |
| GRATINGS | | | | | O | | | |
| STAIR CASES | | | | | O | | | |
| HANDRAILS/ PLATFORMS | | | | | O | | | |
| BOUGHT OUT COMPONENTS | | | | | | | | |
| IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.) | | | | | O | | | |
| PIPE FITTINGS | | | | | | | | |
| CS PIPES, TUBES | | | | | O | | | |
| SS PIPES, TUBES | | | | | O | | | |
| FIN TUBES | O | | | | | | | |
| ELBOWS | | O | | | O | | | |
| FLANGES | O | O | | | | | | |
| VALVES | O | | | | | | | |
| GAUGES | O | | | | | | | |
| DEMISTERS | | O | | | | | | |
| ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID) | | | | | | O | | |
| PAINT TINS | | O | | | | | | |
| PAINT DRUMS | | | | | | O | | |
| IGNITORS | O | | | | | | | |
| SPRAY NOZZLES | O | | | | | | | |
| ELECTRICAL INSTRUMENTATION | | | | | | | | |
| MOTORS, PUMPS, COMPRESSORS, TURBINES | O | | | | | | | |
| SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES | | O | | | | | | |
| INDICATORS, VIBRATOR SWITCHES | O | | | | | | | |

| DESCRIPTION | CASE | CRATE | SKID | BUNDLE | BARE | DRUM | METAL DRUM | FIBRE DRUM |
|---|---|---|---|---|---|---|---|---|
| CABLE BUNDLES, CABLE DRUMS | | | | | O | | | |
| CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL | | O | | | | | | |
| OPERATIONAL SPARES | O | | | | | | | |

## 13 PROCEDURE FOR HANDLING OF COMPONENTS

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

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

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

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

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

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

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

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

### 13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

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

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

**13.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

**13.8.2** Handling and lifting should be done without jerks or impacts.

**13.8.3** Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

**13.8.4** On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

**13.8.5** Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

**13.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

## 14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

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

### 14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

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

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

### 14.2 PACKING:

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

| Wooden Saddles | For Diameter up to 4000mm | For Diameter above 4000mm |
|---|---|---|
| Length: | 1836/2743mm (6'0"/9'0") | 3353mm (11'0") |
| Width: | 300mm (1'0") | 300mm (1'0") |
| Height: | Saddle + one/two wedges a top | Saddle + three/four wedges a top |

| Number of Saddles: | |
|---|---|
| Minimum | 3 in case of Loading inside Well<br>+1 when loaded on Gooseneck |
| Maximum: | 4 in case of Loading inside Well<br>+2 when loaded on Gooseneck |

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

### 14.3 NUMBER OF LASHINGS:

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

## 15 GUIDELINES FOR HANDLING/LOADING/LASHING

### 15.1 HANDLING


**Figure 6**

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

Pipes with split type end cover will be checked


**Figure 7**

All Coil Tubes to be provided with End Caps.

**Figure 8**

Neatly stacked Coil Assemblies.

**Figure 9**

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


**Figure 10**

**15.2 LOADING**

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


**Figure 11**

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


**Figure 12**

No component loaded over the crating.


**Figure 13**

Headers supported with wooden V blocks at 3 meters interval.


**Figure 14**

Spacers in between each coil assembly.

**Figure 15**

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

**Figure 16**

### 15.3 LASHING

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

**Figure 17**

Nylon Belts used for lashing the beams.


**Figure 18**

## 16 PRODUCT WISE SPECIAL INSTRUCTION

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

## 17 REFERRED STANDARDS (Latest publications including amendments):

| | | | | |
|---|---|---|---|---|
| 1) AA51420 | 2) AA55619 | 3) AA51414 | 4) IS:3401 | 5) AA10108 |
| 6) AA56126 | 7) AA51402 | 8) AA51401 | 9) IS:1234 | |