

GENERAL STANDARD
FOR
PACKING & PACKAGES

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1. SCOPE

1.1 This General Standard covers the minimum requirements for packaging, packing, marking, testing and shipment of supplies and equipment for delivery to provide full protection against physical and mechanical damage during transit and multiple handling and possible long periods under adverse storage condition. It also provides for package quantities suitable for redistribution without additional repackaging or marking.

This Standard is for vendors guidance only. They shall remain fully responsible for selecting suitable packing material, and for efficiency of packaging.

Seller's own experience and practice should be used to decide whether certain items require more than the minimum requirements specified in this Standard.

1.2 Those (IPS) Standards that have packing arrangement, shall have precedence to this Standard.

2. REFERENCES

Throughout this Standard the following standards are referred to. The editions of these standards that are in effect at the time of publication of this Standard shall, be the extent specified herein, form a part of this Standard. The applicability of changes in standards that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

D-3951 "Standard Practice for Commercial Packaging" (1988)

BSI (BRITISH STANDARDS INSTITUTION)

BS 1133 "Packaging Code" (1985)

BS 2540 "Silica Gel for Use as Desiccant for Packages" (1960)

BS 3177 "Method of Determining the Permeability Materials Used for Packaging" (1969)

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

"Packaging-Complete, Filled Transport Packages"

ISO 3394 "Dimensions of Rigid Rectangular Packages-Transport Packages" (1984)

ISO 780 "Pictorial Marking for Handling of Goods" (1985)

ISO 4180 "General Rules for Compilation of Performance Test Schedules"
Part 2: "Quantitative Data" (1980)

ISO 7965/1 "Packaging Sacks-Drop Test"
Part 1: "Paper Sacks" (1984)

ISO 6591/1, 2 "Packaging-Sacks-Description and Method of Measurement" (1986)
Part 1: "Empty Paper Sacks"
Part 2: "Empty Sacks Made from Thermoplastic Flexible Film"

ISO 6599/1, 2 "Packaging-Sacks, Vocabulary and Types"
Part 1: "Paper Sacks" (1983)
Part 2: "Thermoplastic Sacks" (1986)

ISO 2233	"Conditioning for Testing" (1986)
ISO 2234	"Stacking Test Using Static Load" (1985)
ISO 2248	"Vertical Impact Test by Dropping" (1985)
ISO 2244	"Horizontal Impact Tests (Inclined Plane Test, Pendulum Test)" (1985)
ISO 2247	"Vibration Test at Fixed Low Frequency" (1985)
ISO 2872	"Compression Test" (1985)
ISO 2873	"Low Pressure Test" (1985)
ISO 2874	"Stacking Test using Compression Tester" (1985)
ISO 2875	"Water Spray Test" (1985)
ISO 2876	"Rolling Test" (1985)

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-TP-100 "Color Coding"

3. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

4. PACKING

4.1 General Requirements

4.1.1 Equipment must be carefully protected and packed to provide adequate protection during transit to destination and shall be in accordance with any special provision contained in the specification or purchase order. Special attention must be given for protection against corrosion during transit.

4.1.2 Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated.

Alternatively the ancillary items should be fixed securely to the equipment and adequate precaution should be taken to ensure that items do not come loose in transit or be otherwise damaged.

4.1.3 The packing of the equipments and other materials shall be carried out in order to comply with transport conditions.

4.1.4 Individual packages must be kept as small in bulk as possible, to avoid extra freight cost.

4.1.5 Individual packages exceeding a gross weight of 2000 kg should be avoided, if possible. Applicable for non-containerized cargo only.

4.1.6 Kind and dimensions of packages shall be chosen to suit overseas transport in containers so that the space in the containers can fully be utilized.

4.1.7 If required the contents of cases shall be protected by waterproof and suitable foil according to the nature of material, which shall be sealed properly. An adequate of moisture absorbent (silicagel) shall be added to protect the contents sufficiently a long time from corrosion.

4.1.8 Felt, cellophane paper, polyester cuttings, crepe-cellulose and some equally efficient material may be used for padding or cushioning. The addition of paddings weight shall not jeopardise the case and this shall be avoided.

Wood shavings and other paper shall not be used.

4.1.9 Materials shall be protected against corrosion during transit as necessary. All bright and machined parts shall be coated with a recognized rust preventative suited to the particular application concerned. All internal parts shall be treated with lubricant containing rust and oxidation inhibitors to protect equipment. Such lubricant shall be compatible with those which shall subsequently be used in service and should be identified by appropriate tagging. The coating used shall not deteriorate while material in service and manufacturer shall advise the removal of the coating if required.

4.1.10 When required, packages shall be painted in accordance with the particulars contained in the order and/or requisition.

For Color Coding of pipes, Fittings and Flanges reference is made to IPS-E-TP-100, Table 3 or the instructions shall be given with the Requisition for Purchase.

4.1.11 All machined working surfaces and threaded parts of all materials shall be suitably protected.

4.1.12 Units or parts belonging to main equipment but separately packed shall be clearly marked for easy identification with the main equipment to which they relate.

4.1.13 Packages containing "Fragile" articles shall be appropriately packed and in addition the words "Fragile" and "Handle With Care" stenciled on two opposite sides, as per Table No. 1 of internationally recognized symbols, page 18. Other packages shall also follow the recognized international symbols.

4.1.14 Spare parts for two years' operation shall be individually tagged. They shall be covered with a suitable preservative and wrapped with greaseproof paper and packed in separate cases from the prime item. The cases shall bear the markings as specified and in addition the words "Spare Parts for Two Years Operation".

4.1.15 Commissioning spares shall be individually tagged and marked "Commissioning Spares" and shall be packed separately and shipped with the main item.

4.1.16 If required, all export cases, boxes, and bundles shall securely be strapped with a minimum of two suitable steel straps in each of two right angled and opposite directions, or where applicable wood reinforced.

Note:

Should consignments arrive visually damaged at the departure port, the shipping agent shall report and await instructions before onward shipping:

a) All bulk items, lighting fittings, cable glands, switches, etc. shall be packed in batches sufficient for a specific section of work.

b) Cases and crates shall depending on their weight and size, be provided with two or more steel straps made of un-annealed steel, applied with a stretching tool and secured with crimped steel seals.

4.1.17 Apparatus and vessels shall, if required, be packed on skid constructions and secured with adjustable steel straps. All unprotected surfaces are to be sprayed with TECTYL. Manholes and other major openings must be protected with either plastic caps or wooden lids, which are to be firmly secured. Smaller openings are to be closed with plastic plugs.

4.1.18 Should any materials be scheduled to be freighted as deck cargo, additional packing instructions may be required of which the Vendor will advise, for vessels and columns, shipment cradles will be used throughout the transportation. Cradles to be secured to vessels and columns, by strapping.

4.1.19 Paper bags (suitably boxed), or water tight Steel Drums will be used for shipping cement.

4.1.20 Fire bricks, and special tiles shall be boxed after sealing in a polyethylene liner.

Insulation refractories shall be boxed properly.

These boxes should be skid mounted. Instructions regarding storages prior to installation to be stenciled on each box with particular reference to adverse weather/temperature conditions.

4.1.21 All vessel internals and items not installed by the vendor at works including accessories such as small parts, bolts, nuts, gaskets etc. should be packed in wooden cases separately for each vessel or apparatus and marked with the same item number as the vessel/apparatus in order to protect all parts from loss or damage in transit. Internals, bolts and gaskets for service/testing operations shall be supplied with the vessels/item by the vendor for all internals, boxed separately, and marked according to marking procedures of this standard. Each item shall be supplied correctly and identified for field installation by others.

Note:

It is imperative that all these items be clearly listed on the packing-list.

4.1.22 All vessels/heat exchangers or items of such construction shall be dried, thoroughly cleaned inside and be free of all dirt and loose foreign materials.

4.1.23 Pipeline/vessel insulation shall be packed in double water-proof wooden plywood cases and secured to pallets.

4.1.24 All electrical equipment must be suitably protected to withstand 1 year transit conditions and Vendors should give recommendations for a further, 2 years storage under adverse site conditions. Batteries shall be shipped dry with electrolyte packed separately and shall include charging instructions.

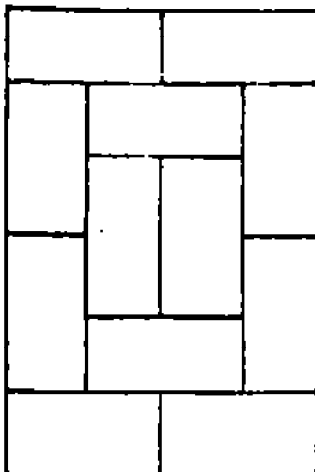
4.2 Dimensions of Packages

4.2.1 Dimensions for rigid rectangular transport packages shall be based on the standard plan dimension (module) of 600 mm × 400 mm. The common use configuration for transport packages is 1200 × mm × 1000 mm with a height of 1100 mm.

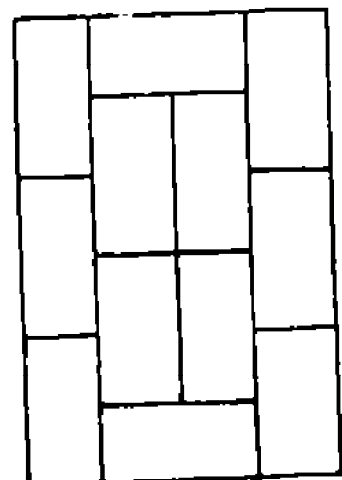
4.2.2 Examples of combination multiples and submultiples, arranged to interlock is shown as Fig. 1.

1200 mm × 800 mm Multiple, 400 mm × 200 mm Submultiple

First Layer



Second Layer



1200 mm × 1000 mm Multiple, 400 mm × 200 mm Submultiple

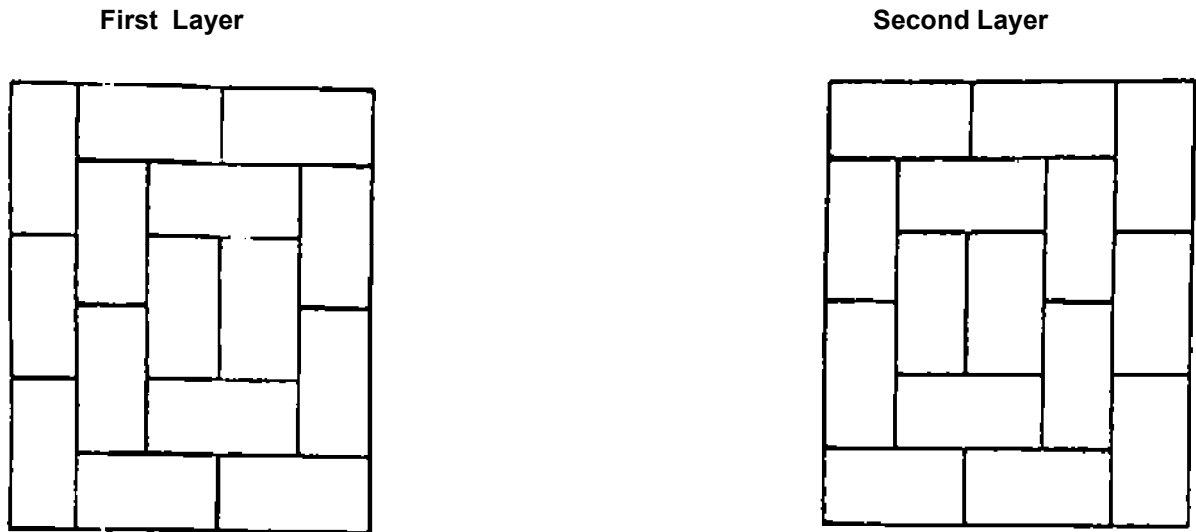


Fig. 1

4.3 Packing Case Materials

4.3.1 Cases and crates shall be made from new, sound and seasoned lumber. Sheathing shall be of min. 24 mm thickness.

If so required for static reasons, thicker sheathing shall be used, in accordance with size and weight of the package. Timber crates and boxes shall be strong enough to withstand vertical pressure when stacked without any damage to the materials during the transport on board of ocean steamers and numerous handlings, between the works and the port of departure.

4.3.2 All wood shall be thoroughly seasoned and thoroughly sound without knot, knot holes, shakes and checks. Wane and cross-grained wood shall not be used.

4.3.3 Woods which can cause metallic corrosion, such as oak, western red cedar and sweet chestnut shall not be used.

4.3.4 The case shall be of the sill base type. All sheathing shall be tongued and grooved.

4.4 Packing Case Lining

4.4.1 The packing case as necessitate or required shall be completely lined with multi-layer waterproof paper.

4.4.2 The lining shall have as a few joints as possible. If joints are necessary, the pieces shall be arranged so that any rain water which may penetrate the case is shed out when the case is upright. Over laps shall be 75 mm minimum. Joints shall be made with Bostik 'C'.

4.5 Treatment of Packaging Materials

4.5.1 Paper, fibreboard and timber can be effectively treated with anti-microbial agents. Insecticide and insect repellents can be applied to a variety of materials and specific treatments are available to improve the termite resistance timber.

The choice of proofing agents is a complex matter and expert guidance should always be sought in the selection and application of these special processes.

4.5.2 Many processes exist for the chemical treatment against deterioration of commodities and packaging materials. In the case of latter some are specially designed to prevent penetration by living organisms.

4.6 Packing Instruction for Panels and Instruments

4.6.1 All electronic and pneumatic instruments shall be packed in accordance with given instructions and must be suitably protected to withstand one year transit conditions and to give recommendation for a further two years storage under site conditions.

4.6.2 Electrical panels and instruments for export delivery shall be packed to provide full protection against physical damage and atmospheric attack during transit and possible min. 2 years under adverse storage conditions.

4.6.3 The package seller shall remain fully responsible for selecting suitable materials for packing and for the efficiency of the packaging.

4.6.4 The package seller shall provide written instruction for the removal before use of protective coatings devices.

4.7 Method of Packaging

4.7.1 Shroud

The instrument or panel which shall be thoroughly cleaned, dry and free from rust and shall be totally enclosed in a polyethylene shroud after sharp projections on the instrument or panel have been padded.

Silica gel or other approved desiccant shall be strapped inside the shroud, but shall not come into contact with the paintwork. After the desiccant is strapped into position, the open ends of the shroud shall be heat sealed, only leaving an opening large enough for the insertion of an air extracting pipe. After extraction, of the air from the shroud, the opening shall be completely sealed.

4.7.2 Securing instruments or panels inside packing case

- 1) the instrument or panel shall be completely secured by wooden battens faced with suitable rubber or other shock absorbing material.
- 2) Wood wool and other similar materials shall not be used.
- 3) Hay and straw shall not be used.

4.7.3 Sealing of packing case

After nailing, joints in the case shall be sealed with Bostick Sealing Compound and the outside bound with steel strapping if required.

4.8 Packing List

4.8.1 The packing lists shall be prepared on buyer's standard forms. The necessary number of forms will be made available to Seller, who shall advise of the quantity required.

4.8.2 The packing list forms shall be filled out in the English Language. Buyer shall supply seller with a specimen packing list showing how it shall be filled out.

At the same seller will be informed of the package numbers required for marking the packages.

4.8.3 One column of the packing list is to be filled out with buyer's item numbers. These item numbers are to be taken from the order form. Special attention must be paid to the order form that the item numbers are correctly attributed to the goods to which they belong. If any question should arise in this respect, seller shall contact the buyer's representative.

4.8.4 Special care shall be taken that all accessory parts, loose or detachable, belonging to the main item under dispatch, shall also individually be listed in the packing list. In the event these accessory parts are not listed in the packing list, they shall be considered by buyer as not delivered.

4.8.5 Two copies of the packing list in a water-proof plastic envelope shall securely be put under a galvanized steel sheet on the outer surface of the package. One copy shall be put inside the case.

4.8.6 The final packing list in 3-fold must be available in buyer representative's office 14 (Fourteen) working days prior to dispatch of the goods from the manufacturer's representative Seller's premises.

4.9 Liability and Guarantee

4.9.1 The packing contractor shall be fully responsible for proper, sufficient and adequate packing, completeness of the contents and shall guarantee the packing for a storage time of Twelve (12) months, and the correct preparation of the packing list.

4.9.2 All cost whatever deriving from inadequate or insufficient packing or discrepancies between the contents and the packing list shall be fully charged to the packing contractor.

5. PAPER AND THERMOPLASTIC SACKS

5.1 Definition

A container made essentially from one or more flattened tubular piles of paper, or thermoplastic flexible film closed at least at one end, possibly in combination with other flexible material to provide the properties required for filling at the chain of distribution of goods.

5.2 Type of Paper and Thermoplastic Sacks

Various designs of sack containing a combination of pasted and sewn ends can be produced. The types are as follows:

- | | |
|-----------------------------|--|
| a) Flat sacks: | From a flat tube |
| b) Gusseted sacks: | From a gusseted tube |
| c) Sewn sacks: | Closed at one or both ends by sewn. |
| d) Pasted sacks: | Closed at one or both ends by pasting. |
| e) Open mouth sacks: | Tube closed at one end only. |

For description of parts and construction details of each type of sacks and their variations, reference should be made to ISO-6590/1,2.

5.3 Description and Method of Measurement

5.3.1 Sacks are described by an indication of their type (Open-mouth sewn flat sack, valved sewn flat sack, etc.) followed by the dimensions as indicated in section 4.1 and 4.2 of ISO-6591/1.

5.3.2 The dimension of the sacks shall be expressed in millimeters to the nearest 1 mm. Unless otherwise stated, all dimensions are external.

5.3.3 For measurement of dimensions of sacks, each sack shall be placed on flat horizontal surface, and smoothed out any wrinkles.

The dimensions at the measuring points shall be measured for the type of sack concerned, to an accuracy of 1 mm. A ruler or instrument graduated in millimeters, and capable of measuring dimensions of the sack, shall be used.

5.4 Drop Testing of Paper Sacks

5.4.1 The filled sack shall be raised above a rigid plane surface and released to strike this surface after a free fall. The atmospheric conditions, the height of drop and the position of the package shall be set in advance, according to ISO 7965/1.

5.4.2 The various drop test methods as described in ISO 7965/1 shall be carried out in the same atmospheric conditions as used for conditioning of empty sacks.

5.5 Dropping Procedure

5.5.1 The sack shall be placed under test centrally on the platform which is then raised to a height that is within $\pm 2\%$ of the predetermined drop height as defined by the distance between the lowest point of the sack at the time of release and the nearest point of the impact surface.

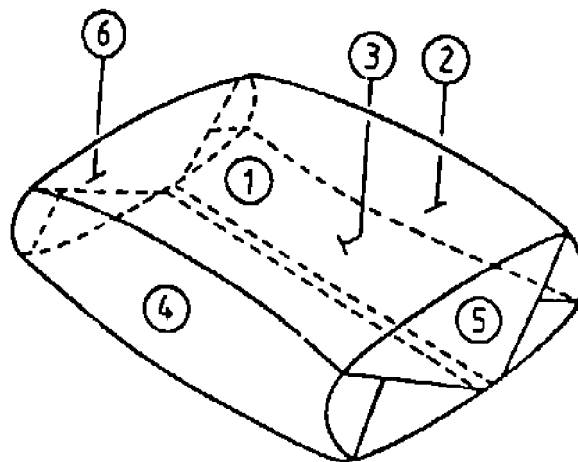
5.5.2 The sack shall be released from its predetermined position within the following tolerances:

- **For drops on any side or edge:** there shall be no variation of more than 2° between the impacting surface of the sack, and the horizontal surface;
- **For edge or corner drops:** the angle between a prescribed surface of the sack and the horizontal surface shall be $45 \pm 5^\circ$;
- the velocity at impact shall be within $\pm 1\%$ of that which would be achieved by a free fall.

5.6 Identification of Surfaces of Filled Sacks for Testing

5.6.1 The sack shall be placed on the back side (3) (i.e., the side containing the longitudinal seam) downwards, and the top (6) (i.e., the filling end) of the sack positioned away from the observer, as Fig. 2 The different surfaces are identified as:

Surface 1:	Face side
Surface 2:	Right side
Surface 3:	Back side (longitudinal seam)
Surface 4:	Left side
Surface 5:	Bottom
Surface 6:	Top (filling end)



SURFACE IDENTIFICATION

Fig. 2

5.7 Dropping Types of Sacks

5.7.1 The following types of dropping shall be carried out and the sacks shall be dropped successively on the various surfaces of the filled sacks (Fig. 2).

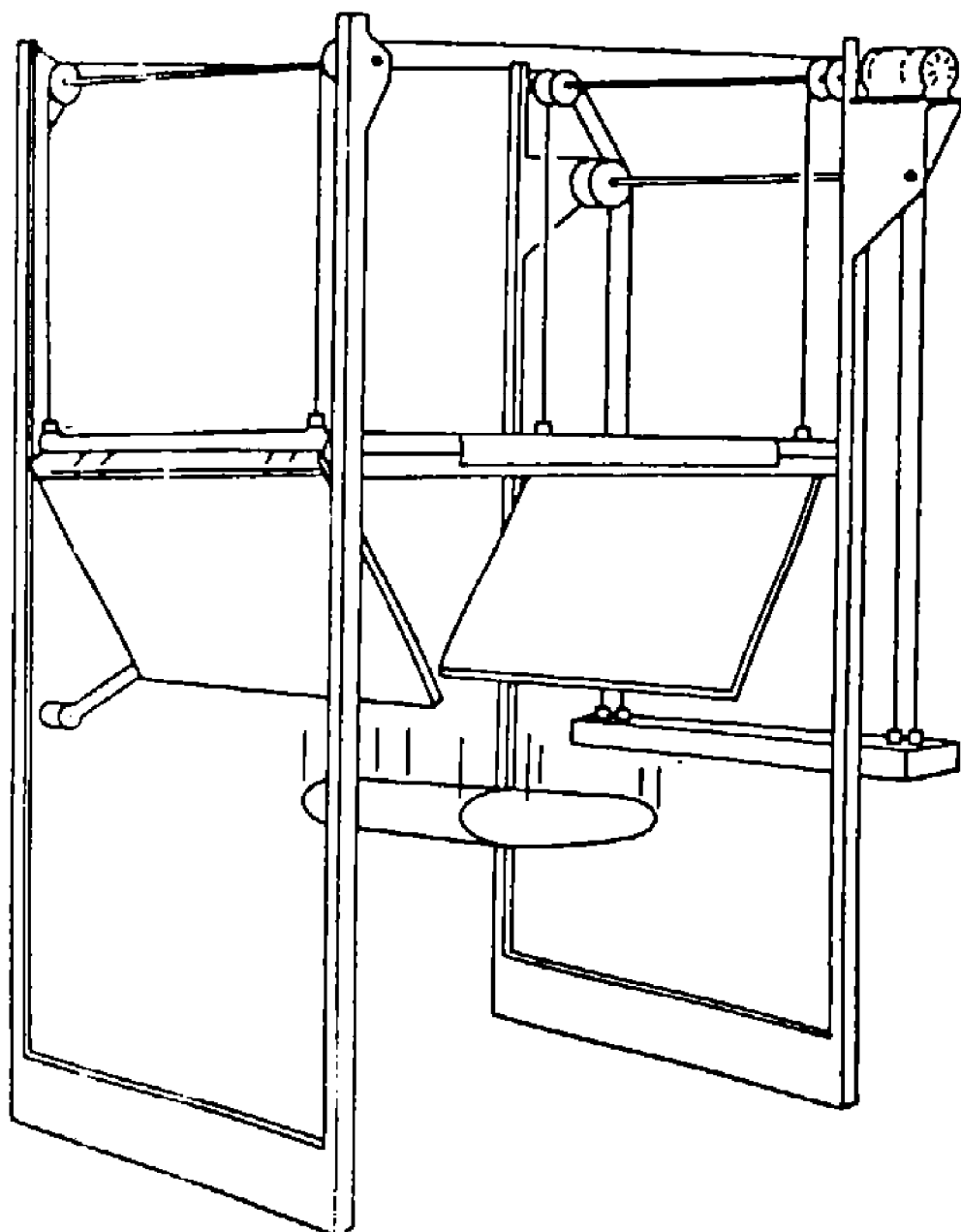
- | | |
|-----------------------------|-------------------------|
| - Flat dropping: | Surfaces (1), (3) |
| - Side dropping: | Surfaces (2), (4) |
| - Butt dropping: | Surface (5) |
| - Edge and corner dropping: | Any corner or any edge. |

5.7.2 For dropping height, number of drops to breakage and the type of drops (i.e. flat, side or butt drops) shall be calculated as per ISO-7965/1.

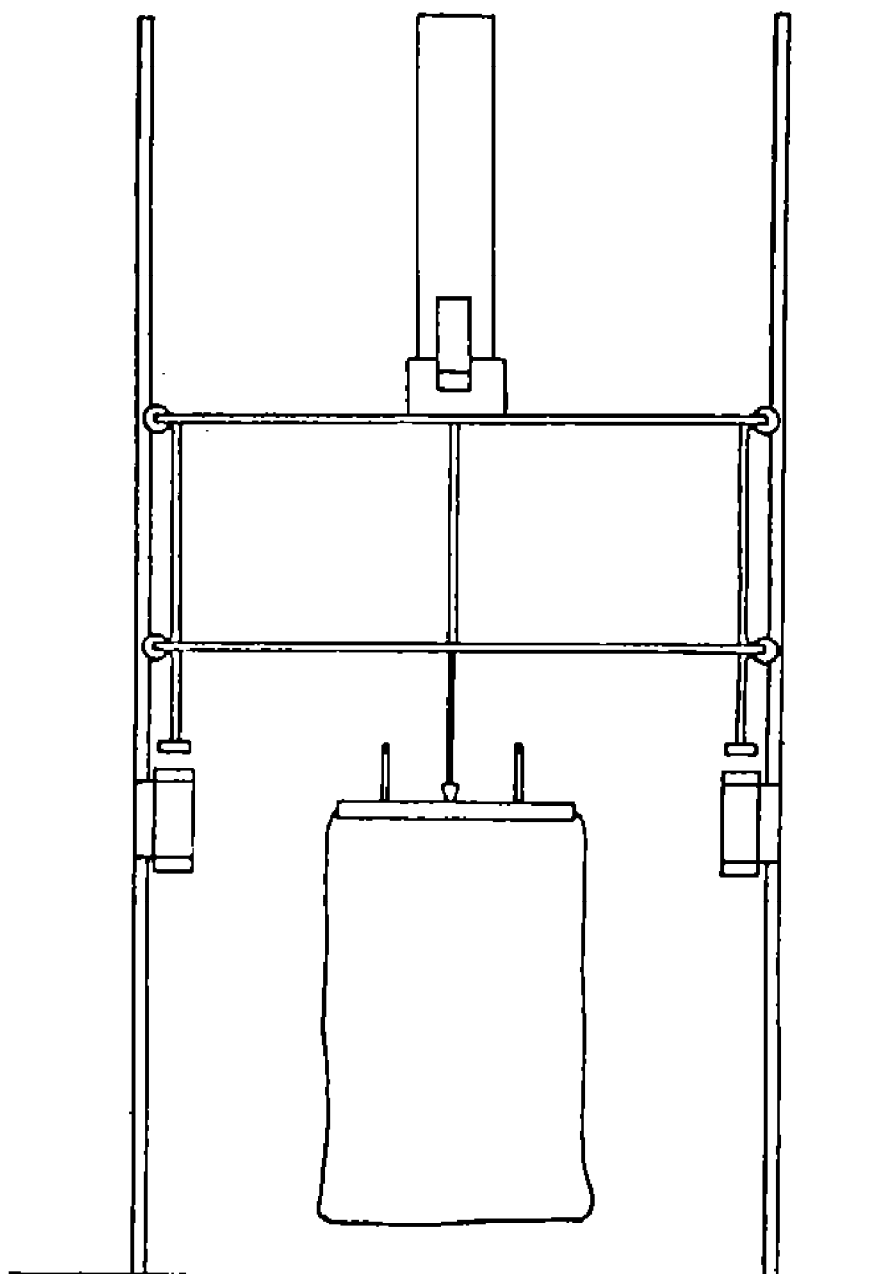
5.7.3 The test report shall include full details of size, construction and type of all sacks tested together with information on type and weight of contents and type of closure.

All results shall be given and shall include details of position and type of failures.

5.7.4 Typical examples of apparatus for drop testing as shown in the following Figures 3 and 4.



EXAMPLE OF APPARATUS SUITABLE FOR FLAT AND SIDE DROPPING
Fig. 3



EXAMPLE OF APPARATUS SUITABLE FOR BUTT DROPPING
Fig. 4

6. MARKING

6.1 Marking of Packages

6.1.1 Minimum markings shall include the name and address of manufacturer and purchaser and any applicable precautionary markings. The indent number, port of destination and project number shall also be marked on the packages.

6.1.2 Marking shall be adequate for identifying a particular equipment in the event that a recall or inspection becomes necessary.

6.1.3 Identification should remain intact from the time of initial dispatch at work to the final destination.

6.1.4 The marking and labels of products should be legible, durable and in accordance to specification.

6.1.5 All packages are to be clearly stenciled on three sides with black, indelible and sea waterproof paint. Whenever possible, the stenciled character should be 80 mm high.

In case the surface of a package are too small to permit stenciling, sheet metal tags are to be embossed with the above marking and to be securely fixed on two opposite upright sides of package.

6.1.6 If necessary, packages are to be additionally marked with cautionary symbols on two opposite ends. These symbols are to be in accordance with the specification, as per section 6.3 of this Standard Page 16.

6.1.7 Packages which may be stored in the open, but under a tarpaulin, shall be marked with a red "single roof" symbol.

6.1.8 Packages which are to be stored in closed and dry places must be marked with a red "double roof" symbol.

6.1.9 The gross weight shall be determined by the Seller who is responsible for the packing.

6.1.10 Spare-parts for two years operation shall be marked:

"Spare Parts for Two Year Operation"

6.1.11 Commissioning spare parts shall be marked:

"Commissioning Spare Parts"

6.1.12 Equipment items, exceeding a grossweight of 1000 kg each shall be marked with the international Centre of Gravity symbol as per Table 1, Page 18.

6.2 Marking of Packing Cases

6.2.1 Cases which are for carriage by sea shall be marked "Hold Storage".

6.2.2 All cases which are carried by sea shall be marked to indicate the correct way up and bear the marking "Hold Storage" plus the general marking as mentioned in 6.3.

6.2.3 Cases and crates with a gross weight up to 1000 kg shall be provided with bottom cleats of min. 40 mm thickness to ensure clearance for handling by fork-lift.

Cases and crates exceeding a gross weight of 1000 kg shall be marked with numbers and sizes and weights of packages and the marking symbols indicating how and where package can be lifted.

6.3 Pictorial Marking for Handling of Goods

6.3.1 This Standard specifies a set of symbols, conventionally used for marking of transport packages to convey handling instructions.

6.3.2 Symbols may appear on a label or should preferably be stenciled directly on the package. It is recommended that the symbols be painted, printed or otherwise reproduced as specified in the followings.

6.3.3 The overall size of the symbols shall be 100, 150 or 200 mm, for normal purposes.

6.4 Number, Location, and Position of the Symbols

6.4.1 The number of identical symbols to be affixed to any package depends on its size and shape, for symbols numbering 1, 3, 6 and 8 (see the Table 1), the following rules are to be applied.

- Symbol 1 "fragile" shall be shown near the left-hand upper corner on all four upright sides of the packages (see example of display No. 1 in the table).
- Symbol 3 "this way up" shall appear in the same position as required for symbol 1 [see example of display a) under No. 3 in the table]. Where both symbols are required, symbol 3 shall appear nearer to the corner [see example of display b) under No. 3 in the table].
- Symbol 6 "sling here" shall be placed on at least two opposite faces (see example of display No. 6 in the table).
- Symbol 8 "centre of gravity" shall be placed on all six sides relating to the real position of the centre of gravity (see example of display No. 8 in the table).

6.4.2 When transport packages are formed into a unit load, symbols should be located so as to ensure they are visible [(see example of display c) under No. 3 in the table].

6.4.3 Particular attention shall be paid to the correct application of the marks, as faulty application may lead to misinterpretation.

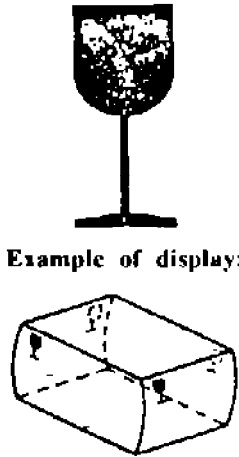

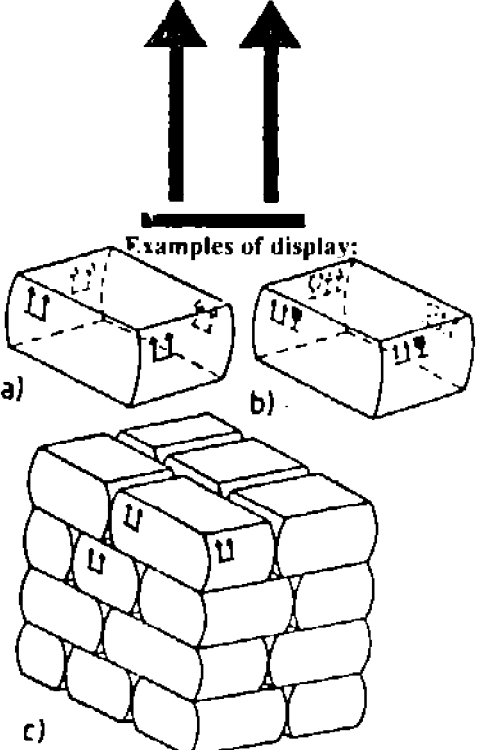
Symbols 6 and 8 shall be applied in their correct respective positions and in appropriate respective places in order to convey their meanings clearly and fully.

6.5 Handling Instructions

Handling instructions shall be indicated on transport packages by using the corresponding symbols given in the table. Symbol 1 contains two messages.

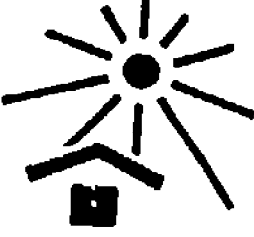
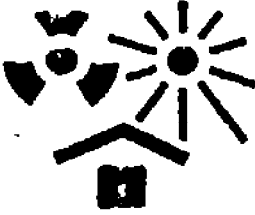

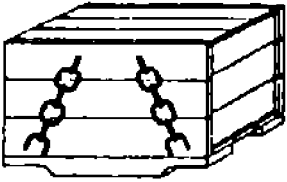

If necessary or required the cautionary basic text may appear below the symbol in the national language of the country of origin and/or destination. However, as far as possible, instructions should be written in languages commonly used in international trade (i.e. English).

TABLE 1 - SYMBOLS AND THEIR FUNCTIONS

No	IMPLICATION OF SYMBOL	SYMBOL	FUNCTION
1	FRAGILE HANDLE WITH CARE	 <p>Example of display:</p>	<p>To indicate:</p> <p>a) that the contents of the transport package are fragile;</p> <p>b) that it has to be handled with care.</p>
2	USE NO HOOKS		<p>To indicate that hooks are prohibited for lifting the transport package.</p>
3	THIS WAY UP	 <p>Examples of display:</p>	<p>To indicate the correct upright position of the transport package.</p>

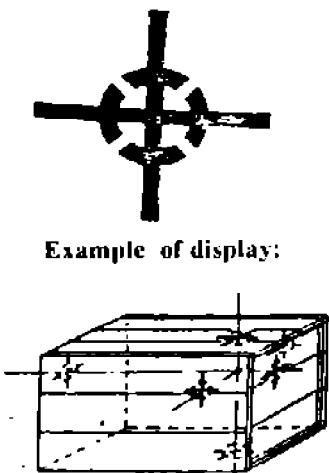




(to be continued)

TABLE 1 (continued)

No.	IMPLICATION OF SYMBOL	SYMBOL	FUNCTION
4	KEEP AWAY FROM HEAT		To indicate that the transport package shall be kept away from heat.
5	PROTECT FROM HEAT AND RADIOACTIVE SOURCES		To indicate that the contents of the package may deteriorate or be rendered totally unusable by heat or penetrating radiation.
6	SLING HERE	 <p data-bbox="699 1357 922 1384">Example of display:</p> 	To indicate where the slings shall be placed for lifting the transport package.
7	KEEP DRY		To indicate that the transport package shall be kept in a dry environment.


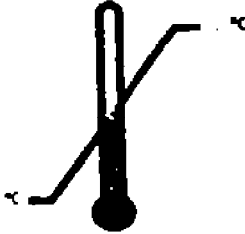
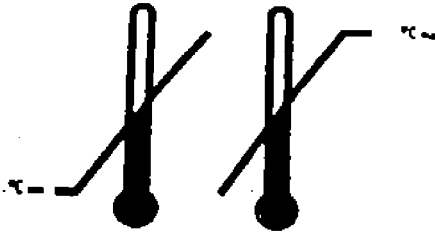
(to be continued)

TABLE 1 (continued)

No.	IMPLICATION OF SYMBOL	SYMBOL	FUNCTION
8	CENTRE OF GRAVITY		<p>To indicate the centre of gravity of the transport package.</p> <p>Note: Example for display of symbol 8 to indicate the centre of gravity of a transport package: In this case not identical with the centre of gravity assumed by the geometrical shape of package, but situated at the intersection points of the axes of the three symbols.</p>
9	DO NOT ROLL		<p>To indicate that the transport package shall not be rolled.</p>
10	NO HAND TRUCK HERE		<p>To indicate where hand trucks or dollies shall not be placed when handling the transport package.</p>
11	STACKING LIMITATION		<p>To indicate the limited stacking possibilities of the transport package.</p>
12	CLAMP HERE		<p>To indicate where clamps shall be placed for handling the transport package.</p>

(to be continued)

TABLE 1 (continued)

No.	IMPLICATION OF SYMBOL	SYMBOL	FUNCTION
13	TEMPERATURE LIMITATIONS	 <p>Examples:</p>  	To indicate the Temperature limitation within which the transport package shall be and handled



Symbol 8



Symbol 13

EXAMPLES FOR SYMBOLS WITH BARS FOR APPLICATION BY STANCILLING
Fig. 5

7. TESTING

7.1 General

For compilation of performance test schedules for complete field transport package within any distribution system whether transported by road, rail, sea or air or by combination of these modes of transport, the following shall be considered.

7.1.1 Distribution system exist in great variety and complexity, they may be considered to be combinations of a numbers of simple elements. These simple elements are:

- a) Transport of packages from one point to another, with or without change of mode of transport. Transport shall be considered to include the loading and unloading operations;
- b) storage.

7.1.2 During distribution, a transport package is subjected to a number of hazards which may cause damage.

These hazards are the result of number of factors, the most important of which are:

- a) the characteristics of the distribution system;
- b) the design of the package, i.e. its dimensions, mass and shape, and integral handling aids (for example handles).

7.1.3 Packaging used shall successfully pass the test levels of following test methods (6.3).

7.2 Test Schedules

7.2.1 Performance test schedules

Performance test schedules are used for a number of purposes:

- a) for functional evaluation-will the package be adequate in performance?
- b) for investigation-what causes damage and how can it be corrected?
- c) for comparison-is package A better than package B?
- d) for determination of compliance with statutes, regulations.

7.2.2 Multi-Test schedules

Multi-test schedules are generally used for functional evaluations in the context of a complete distribution system.

7.2.3 Single-Test schedules

Single test schedules are generally used for functional evaluations in the context of a particular hazard or for investigations.

Either type of schedule may be used for comparisons.

Note:

In carrying out multi-test schedules or single-test schedules, the schedules may be applied in their entirety to one or more of the packages under test or, alternatively, each test may be applied to separate replicates.

7.2.4 In compiling test schedules, in addition to the above factors, the following should be considered:

- a) the time available for conditioning and testing;
- b) the cost of testing relative to other factors;
- c) the number of packages available for test;
- d) past experience of the particular packages or of similar packages.

7.3 Method of Tests

For relevant test methods and the factors requiring quantification before each test, the Table 2 shall be considered.

Note:

In the following sections about the test methods, the load, atmospheric condition, period of time and attitude of the packages are predetermined.

TABLE 2 - METHODS OF TEST AND FACTORS REQUIRING QUANTIFICATION

	METHOD OF TEST	FACTORS REQUIRING QUANTIFICATION
7.3.1	Conditioning	Temperature, relative humidity, time, pre-drying conditions (if any)
7.3.2	Stacking test	Load, duration of time under load, attitude(s) of the package(s), atmospheric temperature and relative humidity, number or replicate packages.
7.3.3	Vertical impact test by dropping	Drop height, attitude(s) of the package(s), atmospheric temperature and relative humidity, number of replicate packages, number of impacts.
7.3.4	Horizontal impact tests (inclined plane test, pendulum test)	Horizontal velocity, attitude(s) of the package(s), atmospheric temperature and relative humidity, profiles of impacting surfaces and use (if any) of an interposed hazard, number or replicate packages.
7.3.5	Vibration test	Duration of test, attitude(s) of the package(s), atmospheric temperature and relative humidity, load (if any) superimposed on the package(s), number of replicate packages.
7.3.6	Compression test	Maximum load (where applicable), attitude(s) of the package(s), atmospheric temperature and relative humidity, upper platen rigidly mounted or free to tilt, number of replicate packages.
6.3.7	Low pressure test	Pressure, duration of time at reduced pressure, temperature within test chamber, number of replicate packages.
7.3.8	Stacking test using compression tester	Load applied, duration of time under load, attitude(s) of the package(s), atmospheric temperature and relative humidity, number of replicate packages.
7.3.9	Water spray test	Duration of time under spray, attitude(s) of the package(s), number of replicate packages.
7.3.10	Rolling test	Atmospheric temperature and relative humidity, number of replicate packages.

7.3.1 Conditioning for testing

Packages shall be exposed to the predetermined atmospheric conditions for a predetermined period of time. One of the conditioning class given in the Table 3 may be selected.

TABLE 3

CONDITIONING CLASS	TEMPERATURE ° °	RELATIVE HUMIDITY %
A	-55	—
B	-35	—
C	-18	—
D	+5	85
E	+20	65
F	+20	90
G	+23	50
H	+27	65
J	+40	Uncontrolled r.h.
L	+40	90
M	+55	30

The package shall be placed within the working space of conditioning chamber, and exposed to the specified conditions for a minimum period of time which shall be selected from 4-8-16-24-48 or 72 hours or from 1-2-3 or 4 weeks.

For more relevant information and complete test procedure reference should be made to ISO-2233.

7.3.2 Stacking tests using static load

The test shall be used to assess the performance of a package in terms of its strength or the protection that it offers to its contents when it is subjected to stacking.

The test package shall be placed on a flat, horizontal surface and subjected to an evenly distributed load applied from above, using one of three methods, as outlined in ISO-2234.

The top-to-bottom or the side-to-side deflection of the package during the test shall be measured.

7.3.3 Vertical impact test by dropping

This test shall be performed either as a single test to investigate the effect of vertical impact or as part of a sequence of test designed to measure the ability of package to withstand a distribution system that includes a vertical impact hazard. The test package shall be raised above a rigid plane surface and released it to strike this surface, after a free fall. The atmospheric conditions, the height of drop and attitude of the test package are predetermined.

For more details on test procedure, refer to ISO-2248.

7.3.4 Horizontal impact test

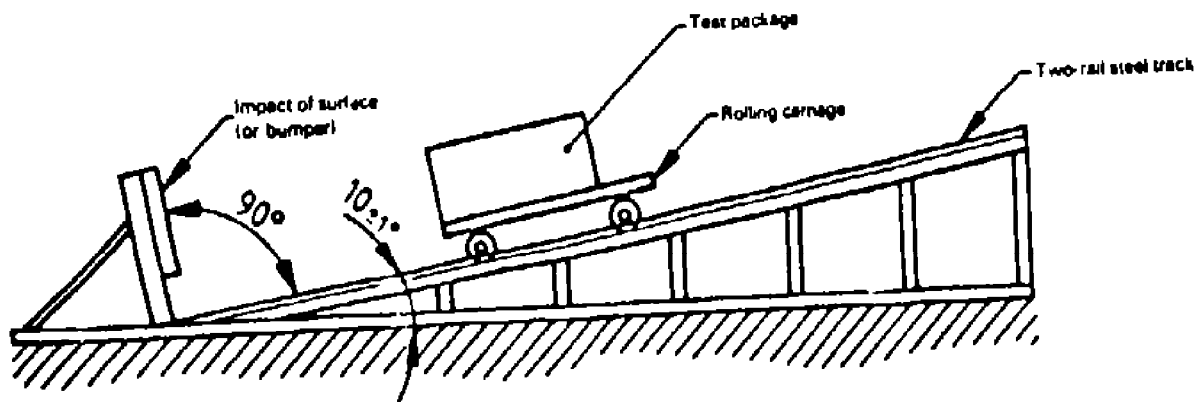
The test shall be carried out as per 7.3.3 except on horizontal impact. A horizontal velocity shall be applied to the test package and bringing it to a halt by impact with a vertical impact surface.

The impact surface should be either:

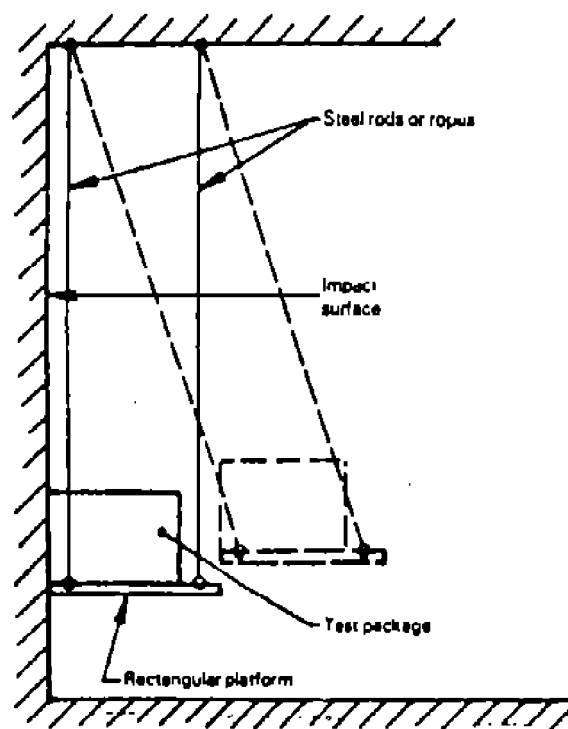
- a) a plane inclined to the vertical at $10^\circ \pm 1^\circ$ (for the inclined plane test), Fig. 6.
- b) a plane vertical to within 1° (for the horizontal or pendulum test) Fig. 7.

The dimensions of the impact surface shall be greater than these of the impacting face, or selected part of the test package.

For more detail information regarding the test procedure about a, and b above, refer to ISO-2244.



INCLINED PLANE TESTER
Fig. 6



PENDULUM APPARATUS
Fig. 7

7.3.5 Vibration test

The test shall be use to assess the performance of package in-terms of its strength, when it is subjected to vibration. Refer to ISO-2247.

The test package shall be placed on a vibration table. When required, a load may be superimposed on the package to simulate conditions at the bottom of a stack.

Vibration table of sufficient size, rigidity and mass carrying capacity, supported on a mechanism that will maintain the surface horizontal during vibration. The difference in surface level between the table extremities shall not exceed 10 mm.

7.3.6 Compression test

The test shall be carried and in-terms of its strength and its contents when it is subjected to compressive forces.

The test package shall be placed between the platens of a compression tester, and compression, the load and platen displacement being recorded until failure occurs or predetermined values for load or displacement are reached. Compression tester, shall be motor-driven, mechanical or hydraulic, platen-type, capable of applying load through uniform movement of one or both platens at a relative speed of 10 ± 3 mm/min.

7.3.7 Low pressure test

This method is applicable to complete, filled transport packages which are transported by unpressurized aircraft flying at 3500 m or less and pressurized aircraft flying at higher altitude. The test package shall be placed in a pressure chamber and reducing the pressure to that corresponding to 3500 m altitude. Holding of this pressure for a predetermined period after which it is permitted to return to ambient pressure. During this period, if required, the temperature may also be controlled to that corresponding to the same altitude. For more details refer to ISO-2873.

The above pressure also approximates to the condition in pressurized aircraft flying at any higher altitude.

7.3.8 Stacking test using compression tester

The stacking test shall be carried out using compression tester as outlined in 7.3.6.

The test package shall be placed on the lower platen of the compression tester and lowering of upper platen to impose a load upon it.

For the test procedure and method of application refer to ISO-2874.

7.3.9 Water spray test

Water spray test is a method for testing the resistance of a package to water spray or the protection it gives to its contents from water spray. It may also be used to precondition a package prior to other tests, to investigate reduction in strength caused by exposure to liquid water.

The test shall be performed on the package as prepared for transport and may form part of a test sequence.

The test package shall be placed in a test area and spraying water for a specified period at constant temperature.

The sprays shall be mounted, with nozzles directed vertically downwards, 2 m above the surface of the floor.

The sprays shall then be turned on and the times taken for the first and last containers to fill to overflowing shall be measured.

The temperature of the sprayed water and test area shall be between 5°C and 30°C.

For more information regarding the spray nozzles, adjusting the sprays and applying the test, refer to ISO-2875.

7.3.10 Rolling test

The test shall be performed to investigate the effect of rolling and ability of a package to withstand a distribution system that includes a rolling hazard.

The test package shall normally be filled with its intended contents. The test shall be carried out in the same atmospheric conditions.

The test package shall be placed on the impact surface (horizontal and flat) with surface uppermost.

Tilt the package by hand with the edges 3-4 (Fig 2 Page. 10) resting on the impact surface until the point of balance on the edge is reached. Then permit it to overbalance without thrust so as to impact on surface 4.

8. SHIPPING

Preparation for shipment shall be in accordance with manufacturer's standards unless otherwise noted on the request for Quotations and/or purchase order.

8.1 The manufacturer shall be solely responsible for adequacy of the preparation for shipment provisions employed in respect of material and application, to provide materials to their destination in ex-works condition by commercial carrier systems.

8.2 The preparation shall be suitable for at least 2 years of outdoor storage from the time of shipment in a manner requiring no disassembly prior to operation.

8.3 All materials shipped in separate crates shall be suitably identified with securely affixed corrosion resistant metal tags indicating the items and serial number of the equipment for which it is intended.

8.4 The greatest care must be taken to ensure that shipping description of packages for custom release are accompanied with the shipment.

8.5 Unit packages and intermediate packages not meeting the requirements for a shipping containers, shall be packed in shipping containers.

8.6 Items requiring protection from physical and mechanical damage or which are fragile in nature shall be protected by wrapping, cushioning or other means to prevent shock and vibration during handling and shipment.

8.7 The shipping container (including any necessary blocking, bracing, cushioning, or waterproofing) shall comply with the regulations of the carrier used and shall provide safe delivery to the destination at the lowest tariff cost. It shall be capable of multiple handling and storage under favorable conditions for a minimum of two years.

8.8 The requirements of above items shall not relieve the supplier/contractor of any of his responsibilities and his obligations for delivery of equipment in a sound undamaged and operable conditions at site.