MATERIAL AND EQUIPMENT STANDARD

FOR

PALLETS

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APPENDICES:

1. SCOPE

This Standard Specification covers the minimum requirements for pallets for materials handling to be used in Iranian Petroleum Industries. Compliance by the pallet Vendor with the provisions of this Standard dose not relieve him of the responsibility of furnishing pallets of proper design, mechanically suited to meet operating guarantees.

No deviation or exception from this Standard shall be permitted, without explicit approval of the Company, Intended deviations shall be separately listed by the Vendor, supported by reasons thereof and submitted for company's consideration.

2. CONFLICTING REQUIREMENTS

In case of conflict between this Standard, and purchase order following priority of documents shall govern:

a) purchase order and variations thereto,
b) this Standard.

All conflicting requirements shall be referred to the Purchaser in writting. The Purchaser will issue confirmation document if needed for clarification.

3. UNITS

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

4. DEFINITIONS AND TERMINOLOGY

For the purpose of this Standard, the following definitions apply.

4.1 Pallets

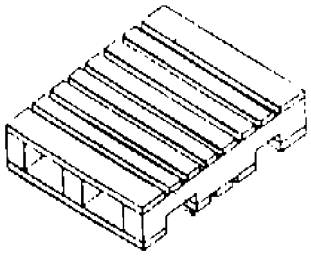
A horizontal platform, of minimum height compatible with handling by pallet trucks, and other appropriate handling equipment, used as a base for assembling, storing, handling and transporting goods and loads.

It may be constructed with, or fitted with, a superstructure.

4.2 Pallet Types

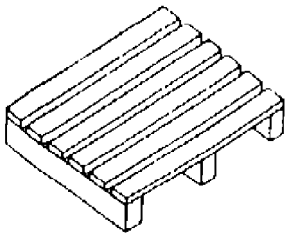
4.2.1 Flat pallet

Pallet without super-structure.



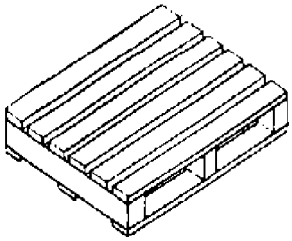
4.2.1.1 Single-Deck pallet

Flat pallet with only one deck.



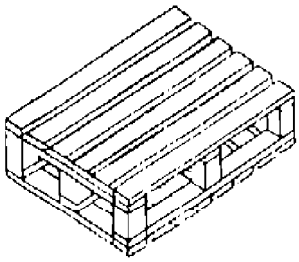
4.2.1.2 Double-Deck pallet

Flat pallet with a top and a bottom deck.



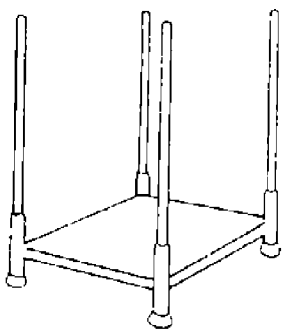
4.2.2 Reversible pallet

Double-deck flat pallet with similar top and bottom decks, either of which can take the same load.



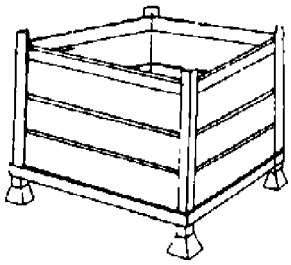
4.2.3 Post pallet

Pallet having a fixed or detachable superstructure of posts to permit stacking, either with or without rails or sides.



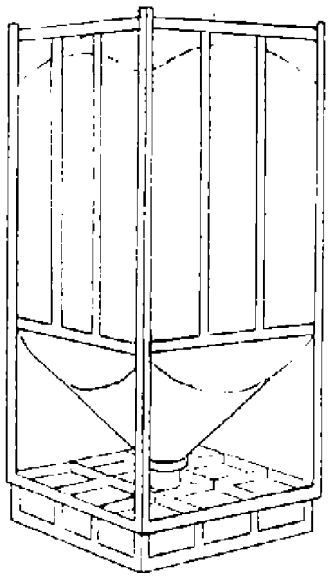
4.2.4 Box pallet

Pallet, with or without a lid, having a superstructure of at least three fixed, removable or collapsible vertical sides, solid, slatted or mesh, which generally permits stacking.



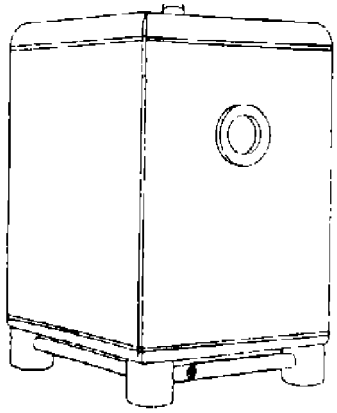
4.2.5 Silo pallet

Sealed four-sided box pallet fitted with a sealable lid and an emptying device in the base. Commonly used for carrying dry powders or granules.

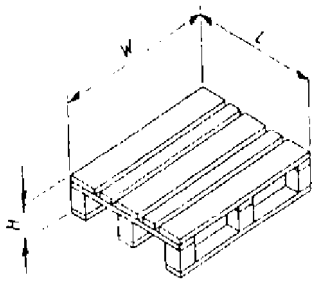


4.2.6 Tank pallet

Sealed four-sided box pallet, fitted with a sealable lid, which can be emptied by a tap fitted to the base or by aspiration through the top opening. Commonly used for carrying liquids and gases.



4.3 Dimension of Flat Pallets



4.3.1 Length

Deck dimension in direction of stringers (bearers) or stringer-boards

Note:

The length dimension is quoted first when designating the pallet size.

4.3.2 Width

Deck dimension at right angles to the length. (see W in the figure.)

4.3.3 Height

Overall dimension vertical to the horizontal plane of the length/width axes. (see H in the figure.)

4.4 Rating (R)

The designated load capacity of the pallet, in Kilograms, assuming an evenly and uniformly distributed load.

5. DESIGN RATING AND MAXIMUM WORKING LOAD

For through transit, pallets are often loaded in such a way that the load being carried (the payload) contributes to the overall performance of the loaded pallet. Therefore a given design of pallet is suitable for several different payloads and will have nature of the particular payload.

However, a given pallet without payload has only one rating (R), namely its designated load capacity with a uniformly distributed load. The rating, expressed in kilograms, is verified by test and cannot be changed, for example a rating of 1000 kg might be referred to in a test report as 1000 kg.

During palletization, it is the duty of the responsible supervisor to ensure that a safe working load is not exceeded. Table 5.1 shows the relationship, for different types of load, between the pallet rating (R) and the payload of the pallet which may be considered the maximum working load.

TABLE 5.1 - RATING AND MAXIMUM WORKING LOAD RELATIONSHIP WITH DIFFERENT TYPES OF PAYLOAD

DISPOSITION OF LOAD ON PALLET	EXAMPLE OF LOAD ON PALLET	AREA OF DECK UNDER LOAD[1)]	MAXIMUM WORKING LOAD AS A FACTOR OF THE RATING
Point load	Electric motor	< 0.3 A	0.6 R
Patch or concentrated load	Large case (but smaller than pallet)	Between 0.3 A and 0.85 A	R
Uniformly distributed or articulated load (UDL)	Cold flowing butyl rubber sheets	> 0.85 A	R
Unbounded-uniformly placed load	Non-interlocked cases	> 0.85 A	1.25 R
Bonded uniformly placed load	Interlocked cartons in regular pattern	> 0.85 A	1.5 R
Solid load	Horizontal concrete slabs	> 0.85 A	1.5 R

1) A = Total plan area of pallet deck

6. PRINCIPAL DIMENSIONS AND TOLERANCES

6.1 Plan Dimensions

6.1.1 Nominal overall dimensions

The nominal overall plan dimensions of pallets shall be as follows:

1200 mm × 1000 mm: Pallet size corresponding to the preferred modular unit load size of 1200 mm × 1000 mm

1200 mm × 800 mm: Pallet size corresponding to the recognized unit load size of 1200 mm × 800 mm

1140 mm × 1140 mm: Pallet size corresponding to the recognized square unit load size of 1140 mm × 1140 mm.

6.1.2 Tolerances

The tolerances on the nominal overall plan dimensions given in 6.1.1 shall be -6^{+0} mm.

In order to meet the specified tolerances, certain materials require a positive tolerance at the time of manufacture because of shrinkage. Such pallets may have a manufacturing tolerance of ±3 mm.

6.2 Vertical Dimensions for Lifting Devices

6.2.1 The entries for the forks of fork lift trucks and the fingers of pallet trucks shall be not less than 98 mm high, except for pallets with free entries, where they shall be not less than 95 mm high (see Fig. 6.1).

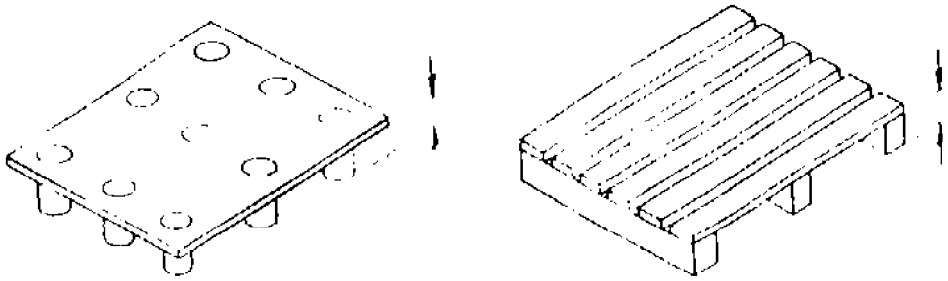
6.2.2 If notches for the forks of fork lift trucks are provided, the distance from the top of the notch to the ground shall be not less than 55 mm. The distance from the top of the notch to base of the stringer itself shall not exceed 45 mm (see Fig. 6.2).

6.2.3 The distance from the underside of the lowest element of the top deck to the ground shall not exceed 127 mm for double-deck pallets with free entries.

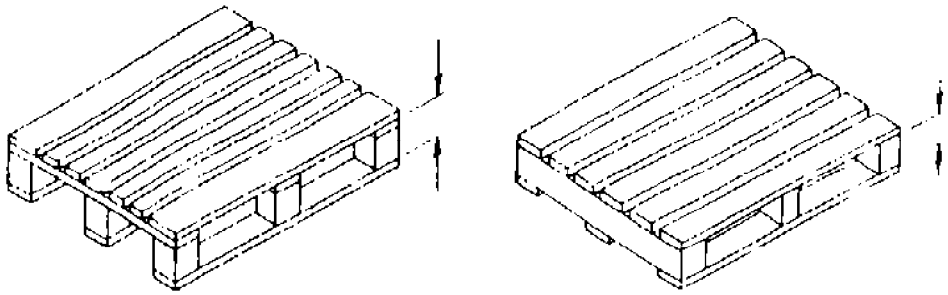
For full perimeter base pallets, this distance shall not exceed 156 mm (see Fig. 6.3).

Note:

With hygroscopic materials, the dimensions stated in 6.2.1, 6.2.2 and 6.2.3 relate to an average moisture content of (20 ±2)%.

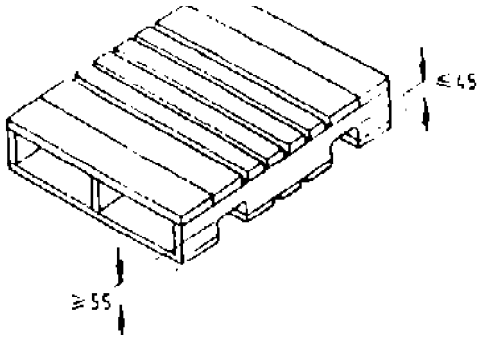


a) Free entry not less than 95 mm

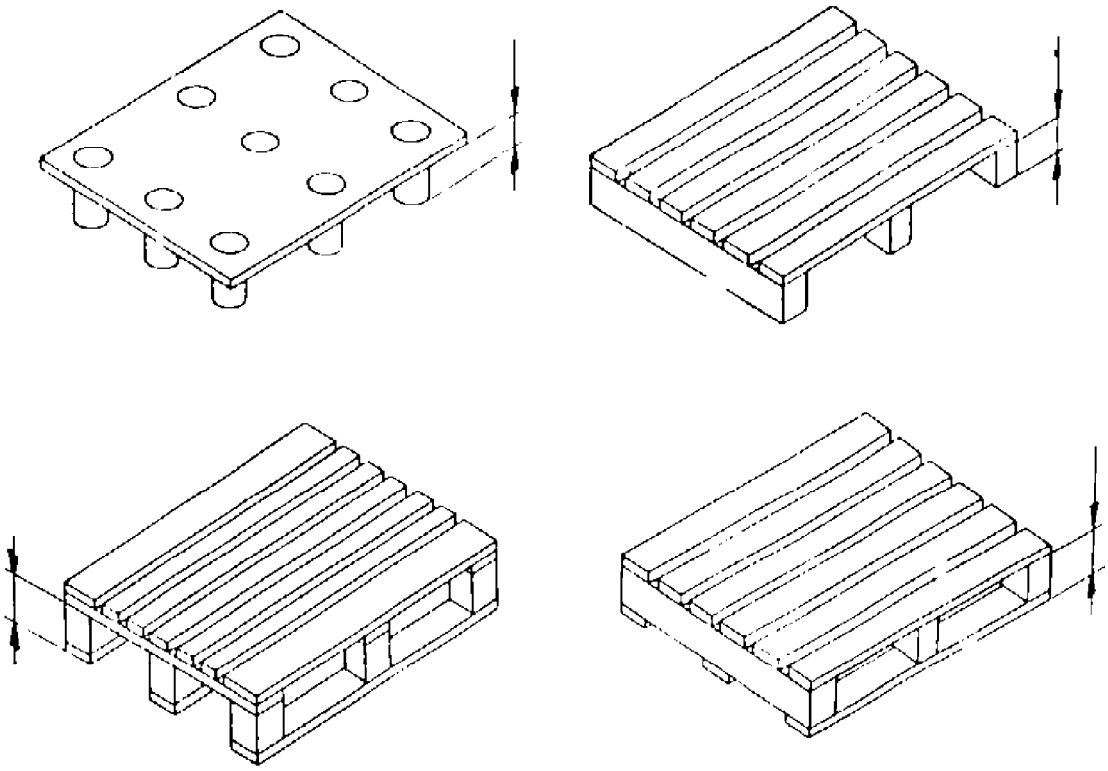


b) Entry not less than 98 mm

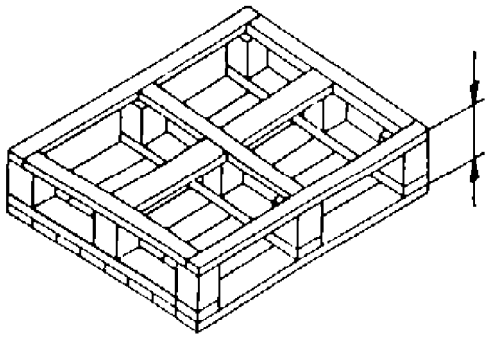
TYPICAL TWO-WAY AND FOUR-WAY PALLET DESIGNS ILLUSTRATING THE VERTICAL DIMENSIONS SPECIFIED IN 6.2.1
Fig. 6.1



PARTIAL FOUR-WAY PALLET ILLUSTRATING THE VERTICAL DIMENSIONS SPECIFIED IN 6.2.2
Fig. 6.2



a) Not more than 127 mm



b) Not more than 156 mm

TYPICAL TWO-WAY AND FOUR-WAY PALLET DESIGNS ILLUSTRATING THE VERTICAL DIMENSIONS SPECIFIED IN 6.2.3
Fig. 6.3

6.3 Horizontal Dimensions of the Entries and Openings for Lifting Devices

6.3.1 The arrangements and horizontal dimensions of the entries for the forks of fork lift trucks shall be as shown in Fig. 6.4 and as specified in Table 6.1 (for two-way and four-way pallets).

6.3.2 The arrangements and the dimensions of the openings in the bottom deck of pallets to allow the use of pallet trucks shall be as shown in Fig. 6.4 and as specified in Table 6.1 (for two-way and four-way pallets).

6.4 Dimensions of Bottom Deck Members

The thickness of the members of the bottom deck of a pallet shall not exceed 28 mm, to facilitate entry of the finger-wheels of a pallet truck. If the thickness exceeds 10 mm, the leading and trailing edges of the members of the bottom deck shall be chamfered on each side of the top face as follows:

a) the angle between the chamfered face and the horizontal shall be 40° ±5°;
b) the height of the vertical face of the member shall not exceed :

15 mm, for wood,
10 mm, for other materials.

c) width of the wing shall not be less than 65 mm.

6.5 Bearing Surface of Bottom Deck Double-Deck Pallets

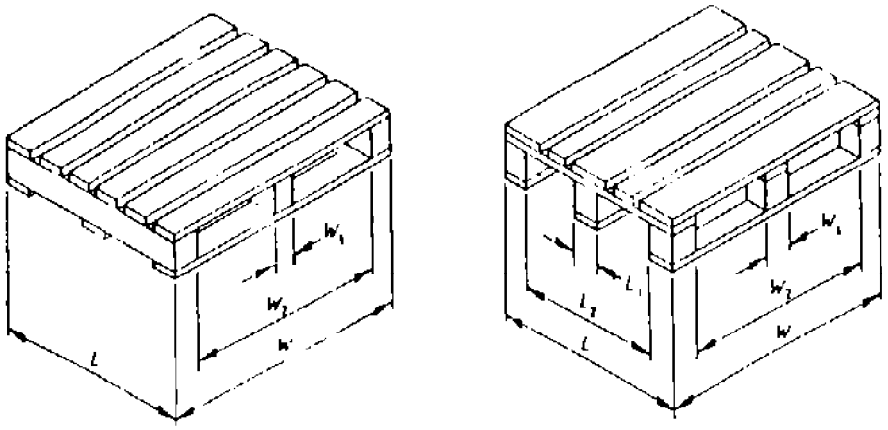
The bearing surface of the element or elements of the bottom deck shall be equal to or greater than 35% of the nominal overall plan dimensions.

Note:

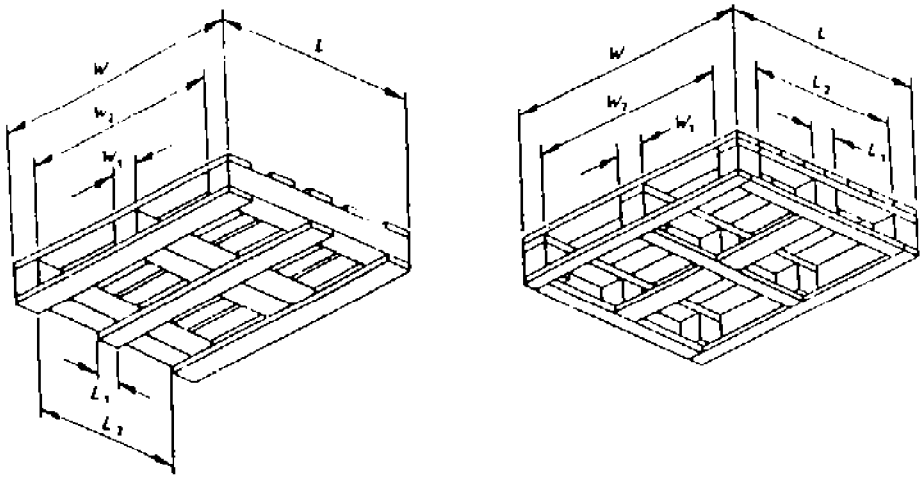
35% should be regarded as the absolute minimum and should be increased wherever practicable.

6.6 Squarness

At the time of manufacture, the difference in length of the two diagonals shall not exceed 13 mm.



a) Entries



b) Openings

HORIZONTAL DIMENSIONS OF ENTRIES AND OPENINGS FOR TWO-WAY PALLETS (see Table 6.1)
Fig. 6.4

TABLE 6.1 - HORIZONTAL DIMENSIONS OF ENTRIES AND OPENINGS FOR TWO-WAY AND FOUR-WAY PALLETS (see Fig. 6.4)

NOMINAL DIMENSION OF PALLETS *(l or w)*	ENTRIES AND OPENINGS	
	l_1 and w_1 max.	l_2 and w_2 min.
800	150	590
1000	150	720
1140	150	760
1200	150	770

7. MATERIAL

Pallets may be fabricated and supplied in materials such as processed or unprocessed woods, plastics and metals according to the Purchaser's request, provided that all these materials shall be subjected to test specified in this Standard and approved.

8. TEST METHODS

8.1 Measurement and Checking of Test Pallets

8.1.1 Pallets selected for testing shall be checked to ensure that materials, construction and dimensions conform with any stated specification.

8.1.2 The mass of each pallet shall also be determined and recorded, together with the moisture content of individual components at the time of weighing (where appropriate).

8.2 Number or Replicates and Sequence of Testing

When evaluating a pallet in relation to its designed load capacity, a minimum of three replicates shall be tested. The complete sequence of tests shall be carried out consecutively in the exact order laid down in this Standard.

For each complete sequence of tests, the same pallet shall be used, including those tests where it is necessary to test the pallet across both of its horizontal axis.

8.3 Conditioning

8.3.1 Temperature and moisture are known to affect pallets of a number of materials both under test and in the field. Conditioning prior to testing takes account of the reaction of the pallet material to the test environment and ensures valid and repeatable test results.

A further purpose of conditioning is to predict the behavior of identical pallets under the extreme conditions that may be encountered in transit while loaded with goods.

8.3.2 Table 8.1 includes details of conditioning environments relevant to pallet usage. They shall be applied as follows:

a) the moisture content of timber pallets should not be less than 18%. If the moisture content is below this value, the test may proceed provided that the moisture content of critical components is recorded every 24 h until completion of the test programme;

b) at least one specimen of a plastics pallet shall be conditioned to environment A and a further pallet to environment B;

c) at least one speciment of paper-based and wood-based pallet shall be conditioned to environment C or D.

Note :

Composite pallets consisting of two or more materials, for example hollow plastics blocks supporting plywood decks, may have to undergo more extensive conditioning.

8.3.3 Where conditioning is relevant and the whole test laboratory cannot be maintained at the required level, then tests shall commence within 1 h after the pallet has been removed from the conditioning chamber. When environments A and B apply, the tests shall commence immediately after the pallet has been removed from the conditioning chamber.

Immediately after each individual test, specimens subjected to environment A or B shall be returned to the conditioning chamber for a minimum of 1 h.

8.3.4 For wood or wood-based materials, a record shall be made of the moisture content in selected components at the beginning of the full test programme.

TABLE 8.1 - CONDITIONING ENVIRONMENTS

CONDITIONING ENVIRONMENT	ATMOSPHERE	TEMPERATURE °C	RELATIVE HUMIDITY %	TIME h	PALLET MATERIAL
No conditioning Required [see B.3.2 (a)]					Unprocessed (sawn) timber with metal fastenings
A	Air	40 ±2	—	24	Plastics
B	Air	-25 ±3	—		
C	Air	25 ±5	90 ±5	48	Paper-based and processed wood (for example plywood, particle board[1)]
D	Water	20 ±5	—	24	
No conditioning required					All metal

1) Includes any pallet containing or assembled with adhesive

8.4 Accuracy of Test Apparatus

8.4.1 Test apparatus described in Clauses 8.5 and 8.6 shall satisfy the following requirements:

a) in the design of the test equipment, the tolerances on all dimensions shall be ±2%;
b) the resolution/accuracy of measuring equipment for tests shall be better than ±0.5 mm;
c) the accuracy of positioning of every component, excluding the test load, shall be ±2 mm;
d) the accuracy of positioning of the center of gravity of the test loads referred to in Clause 9.5 shall be ±20 mm;
e) the total mass of the test loads used shall be within ±3 of the predetermined value.

8.4.2 No part of any test rig shall deflect an amount greater than 2 mm when under maximum test load.

8.4.3 The inclined-plane apparatus shall be constructed; of a plan inclined to the vertical at 10 ±1°C.

8.5 Static Tests

For all static tests described in 8.5.1 to 8.5.4, the test load applied shall include in all cases the mass of any load board and load applicators.

8.5.1 Stacking test

The purpose of this test is to determine the compression strength of the pallet or pallet corner block to localized vertical loads.

8.5.1.1 Deformation measurements

When tested in accordance with the method specified in 8.5.1.2, the change in the height, *Y*, of top deck at point A, as shown in Fig. 8.1 relative to the ground (or test frame) shall be recorded.

a) At the datum load (see 8.5.1.2), every 5 min. until successive readings are identical (limited to a maximum period of 1 h);

b) at the beginning and end of the full-load period;

c) upon unloading, at the datum load (see 8.5.1.2). every 5 min. until successive readings are identical (limited to a maximum period of 1 h);

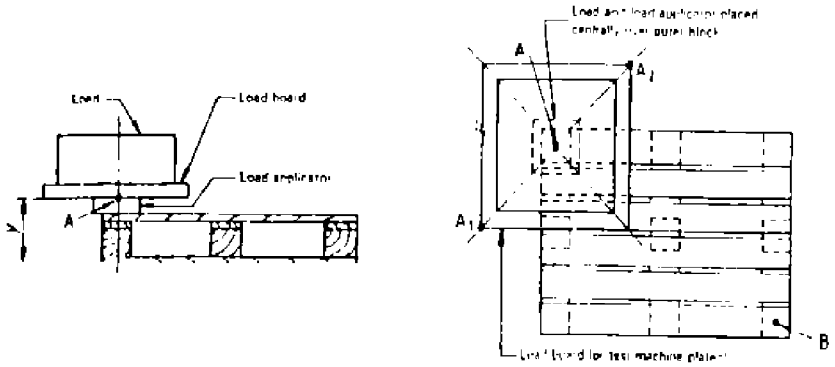
The deflection at A is established by taking the mean value of measurements at points A_1 and A_2 (see Fig. 8.1).

Similar measurements shall be made relating to point B when the test is repeated on the diagonally opposite corner (see 8.5.1.2).

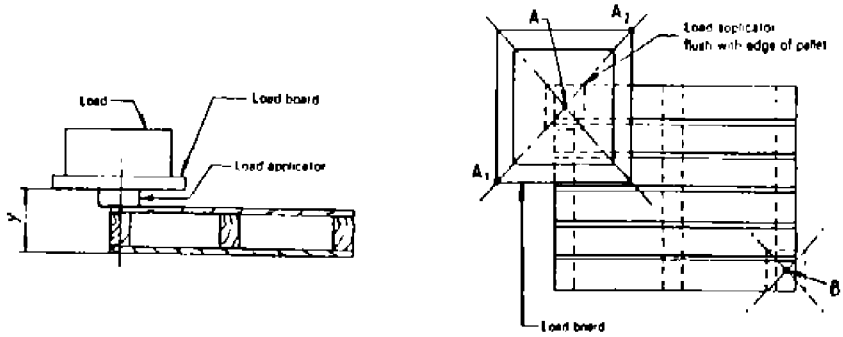
8.5.1.2 Procedure

Place the pallet in a normal position on a flat, hard, rigid, horizontal surface. Place a rigid load applicator of dimensions 200 mm × 200 mm × 25 mm over an outer block [as shown in Fig. 8.1 (a)] or, in the case of a stringer pallet, over one end of a stringer [as shown in Fig. 8.1 (b)].

Gradually apply the test load at a uniform rate from 0 to 0.25 *R*, where *R* is the designed load capacity of the pallet, assuming an evenly and uniformly distributed load. This shall be the datum for subsequent deflection measurements.



a) Load applicator over one outer block (deflection measured at points A_1 and A_2)



b) Load applicator over one end of a stringer (deflection measured at points A_1 A_2)

STACKING TEST
Fig. 8.1

Apply the full test load of 1.1 *R*, per loaded block, for not less than 1 min. and not more than 5 min. If deadweight is used for the test load, it shall be symmetrically built up during loading. Keep the full test load in place for a period dependent on the pallet material (see Table 8.2).

Reduce the test load to the datum load for the necessary period (see 8.5.1.1 c).

Take deflection measurements relating to point A (see 8.5.1.1).

Repeat the test at point B (see Fig. 8.1) so that the test shall have been carried out on two diagonally opposed corners of the pallet. Take a further set of deflectjon measurements relating to point B (see 8.5.1.1).

Note:

Alternatively the test may be carried out on several corners simultaneously with an appropriate increase in full test load (i.e. 2.2 *R* on two corners or 4.4 R on four corners).

Deflection measurements shall be made at all the corners under test.

TABLE 8.2 - TEST LOAD DURATION FOR STATIC TESTS

PALLET MATERIAL	TEST PERIOD h
Unprocessed (swan) timber with metal fastenings	2
Plastics	24
Paper-based and processed wood (for example plywood, particle board)	24
All metal	2
Composite containing plastics	24
Pallet assembled with adhesives	24

8.5.2 Bending test

The purpose of this test is to determine the stiffness and flexural strength of the complete pallet.

8.5.2.1 Deflection measurements

When tested in accordance with the method specified in 8.5.2.2, the deflection at points A and B, as shown in Fig. 8.2, measured relative to the upper (or lower) surface of the top or bottom decks and the ground (or test frame) shall be recorded;

a) at the datum load (see 8.5.2.2);
b) at the beginning and end of the full-load period;
c) upon unloading, at the datum load (see 8.5.2.2), every 5 min. until successive readings are identical (limited to a maximum period of 1 h).

The distance between the decks, h, directly under the load applicators shall be measured so that data on the minimum fork entry heights under full load can be obtained.

Similar measurements shall be made at points C and D and between the decks when the test is repeated along the second horizontal axis of the pallet (see 8.5.2.2).

8.5.2.2 Procedure

Place the pallet, top deck uppermost, on square (or semi-circular) section supports positioned with their inside edges (or center liens) 75 mm from the outer edge of the pallet (see Fig. 8.2). The load applicators shall be positioned at 0.25 l_1 when measured as shown, where l_1 is the distance between the inside edges (square section) of the pallet supports (see Fig. 8.2).

Load applicators and supports shall be flush with or project beyond the pallet. Edges shall be relieved with 2 mm as shown in Fig. 8.3.

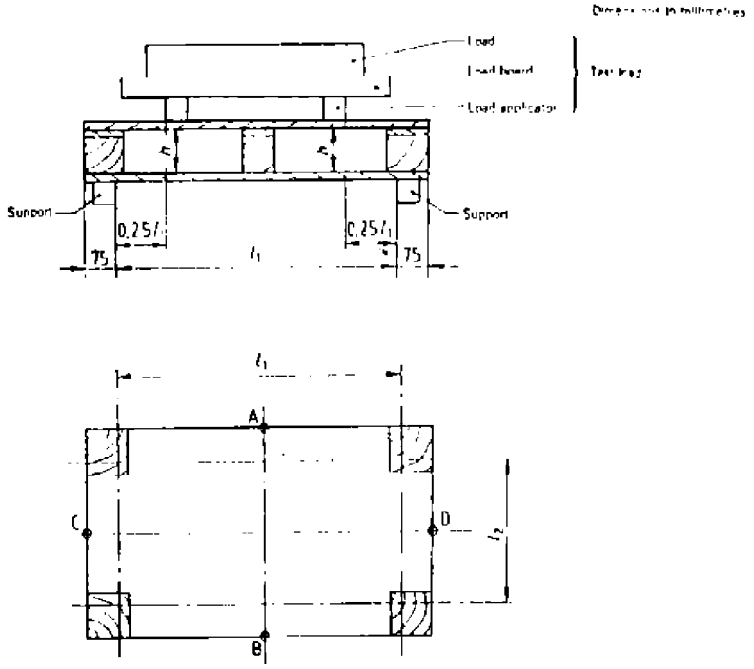
Gradually apply the test load at a uniform rate from 0 to 0.1 R. This shall be the datum for subsequent deflection measurements. Apply the full test load of 1.25 R for not less than 1 min. and not more than 5 min. If deadweight is used for the test load, it shall be symmetrically built up during loading. Keep the full test load in place for a period dependent on the pallet material (see Table 8.2).

Reduce the test load to the datum load for the necessary period (see 8.5.2.1 c).

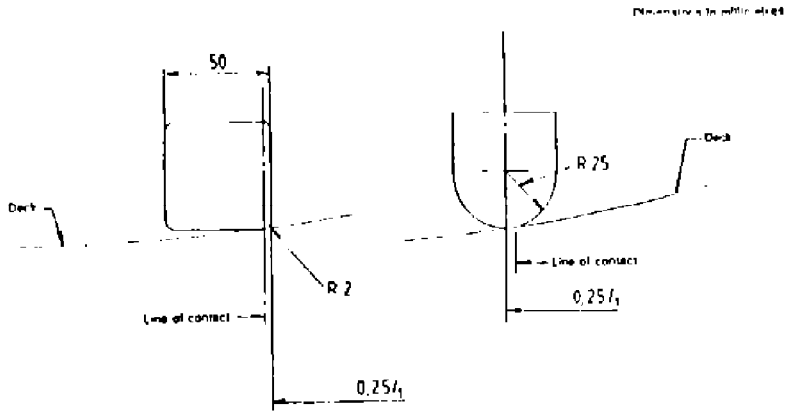
Take deflection measurements at points A and B (see 8.5.2.1).

Repeat the test along the second horizontal axis of the pallet (i.e. both length and width are tested) with the load applicators positioned at 0.25 l_2 when measured as shown from the inside edges or center lines of the pallet supports, where l_2 is the distance between inside edges or center lines of the pallet supports (see Fig. 8.2 and Fig. 8.3).

A further set or deflection measurements shall be taken at points C and D (see 8.5.2.1).



BENDING TEST (see also Fig. 8.3)
Fig. 8.2



ALTERNATIVE PALLET SUPPORTS AND/OR LOAD APPLICATORS
Fig. 8.3

8.5.3 Bottom deck test

The purpose of this test is to determine the stiffness and flexural strength of the bottom deckboards between support points.

8.5.3.1 Deflection measurements

When tested in accordance with the method specified in 8.5.3.2, the deflections at points A, B, C, and D, as shown in Fig. 8.4, measured relative to the upper or lower surface of the bottom deck and the ground (or test frame) shall be recorded.

a) At the datum load (see 8.5.3.2);
b) at the beginning, at the datum load (see 8.5.3.2);
c) upon unloading, at the datum load (see 8.5.3.2) every 5 min. until successive readings are identical (limited to a maximum period of 1 h).

Similar measurements shall be made at points E, F, G and H, as shown in Fig. 8.4 when the test is repeated on the second horizontal axis of the pallet (see 8.5.3.2).

8.5.3.2 Procedure

Place the top deck of the pallet downwards on a flat, hard, rigid horizontal surface and place two square or semi-circular section load applicators, as shown in Fig. 8.4, so that the centers of the load applicators are midway between the blocks or the stringers (i.e. at 0.5 l_3 0.5 l_4 or 0.5 l_5). The load applicators shall project over or be flush with the edge of the pallet base and shall be symmetrically placed about the center line of the pallet.

Gradually apply the test load at a uniform rate from 0 to 0.1 R. This shall be the datum for subsequent deflection measurements. Apply the full test load of 1.15 R, in not less than 1 min. and not more than 5 min. If deadweight is used for the test load, it shall be symmetrically built up during loading. Keep the full test load in place for a period depending on the pallet material (see Table 8.2).

Reduce the test load to the datum load for the necessary period (see 8.5.3.1).

Take deflection measurements at points A, B, C and D (see 8.5.3.1).

For all except stringer pallet, repeat the test along the second horizontal axis of the pallet (i.e. both length and width shall be tested) with the centers of the load applicators placed midway between the blocks (i.e. at 0.5 l_4) (see Fig. 8.4 a).

A further set of deflection measurements shall be taken at points E, F, G and H (see 8.5.3.1)

8.6 Impact Tests

The purpose of impact tests is to simulate normal levels of shock load which are typically transmitted to pallets in through-transit and to determine the resistance of the pallet to such loads.

8.6.1 Inclined-Plane tests

For all three inclined-plane tests, the test load shall be 0.075 R. This test load comprises the load box having a plan size of 600 mm × 800 mm (see Fig. 8.5) plus the load in the box, which shall be placed in the box in a position dependent upon the individual test requirements described below. The detachable supporting edges shall be at least as long as the pallet under test. The test load shall not include the weight of the dolly.

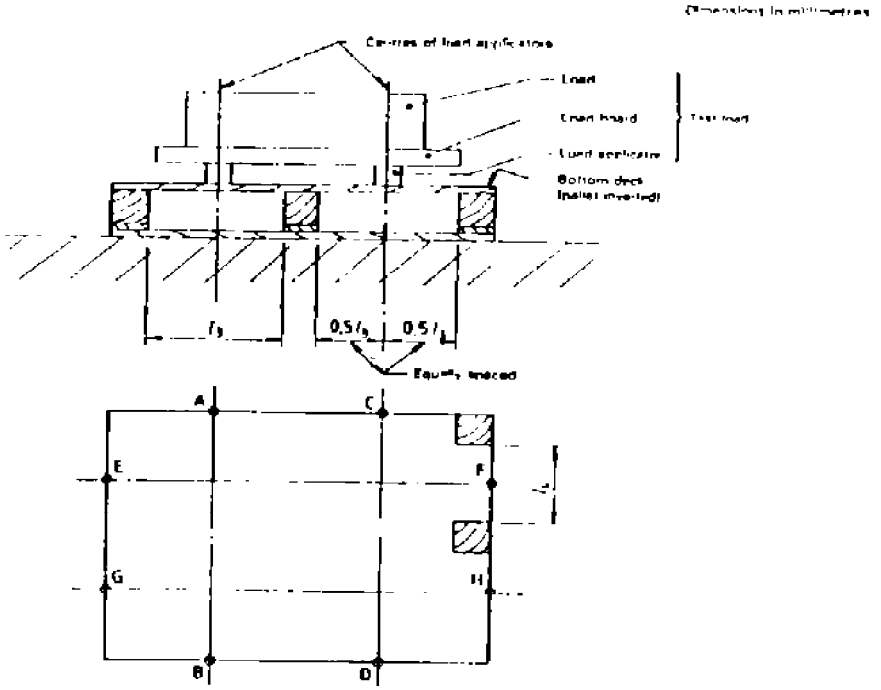
For the first two inclined-plane tests (see 8.6.1.1 and 8.6.1.2), the dolly is raised 1000 mm up the incline. For the third test (see 8.6.1.3), it is raised only 750 mm from the point of impact before release. Each test requires three impacts.

8.6.1.1 Shear test

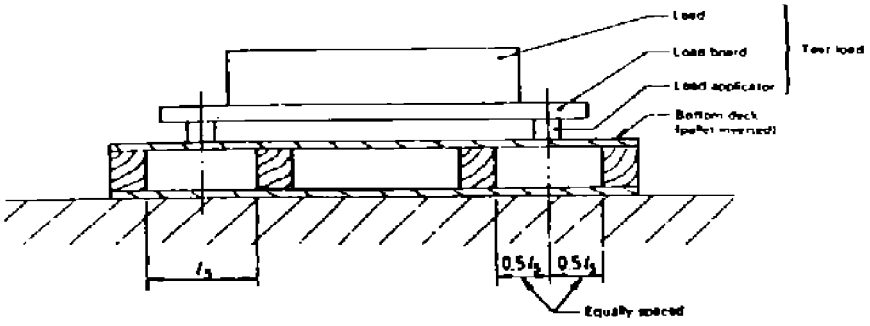
The purpose of this test is to determine the shear resistance between top and bottom decks.

8.6.1.1.1 Measurements

When tested in accordance with the method specified in 8.6.1.1.2, the defection changes *x* and *y* shall be measured between points A and B and between points C and D where construction makes this possible (see Fig. 8.6). The changes shall be recorded at a number of positions along the impacted surface.

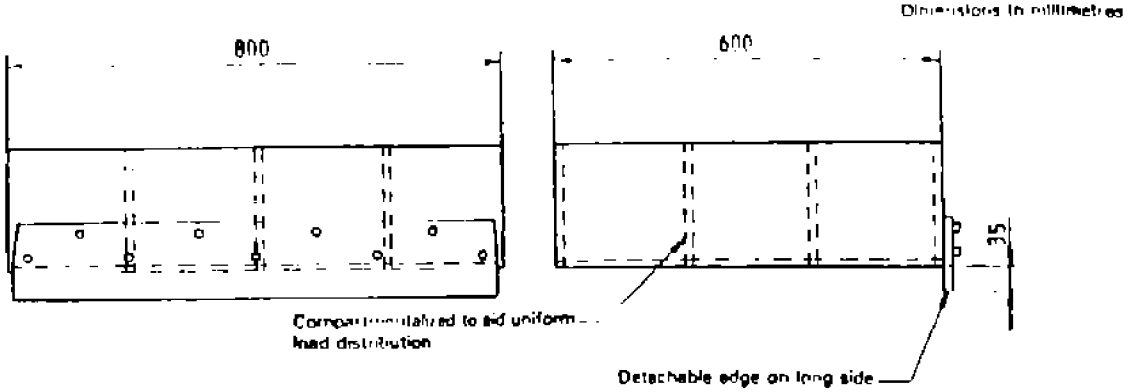


a) Three-Stringer pallet

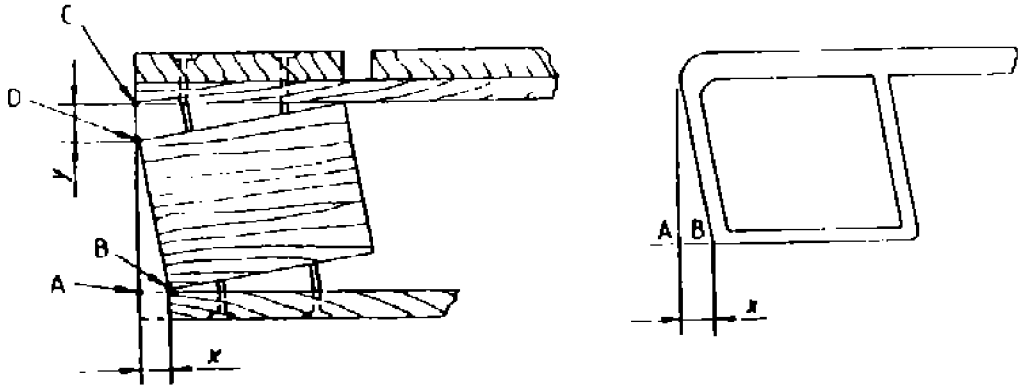


b) Four-Stringer pallet

BOTTOM DECK TEST WITH PALLET INVERTED
Fig. 8.4



LOAD BOX FOR INCLINED-PLANE TESTS
Fig. 8.5



SHEAR TEST-POINTS OF MEASUREMENT
Fig. 8.6

8.6.1.1.2 Procedure

Secure a steel or high-density hardwood barrier, 90 mm × 90 mm in nominal cross-section and at least as long as the longer dimension of the pallet, to the face of the backstop. The upper edge of the barrier shall be 15 mm above the surface of the pallet, (top surface of the dolly) when the dolly is in its lowest position (see Fig. 8.7).

Place the pallet on the dolly of the inclined-plane testing machine so that when the forward edge of the pallet is testing against the barrier, the dolly is 75 mm ±25 mm clear of it.

Attach the load box centrally on the pallet and load with ballast to 0.075 *R* such that loading is central to the axis of movement down the rails but biased towards the higher end of the box.

Bring the dolly and the loaded pallet to a predetermined position up the incline 1000 mm from the point of impact, then release.

Repeat the procedure twice more, repositioning the pallet, load carrier and load before each impact and then take measurements as specified in 8.6.1.1.1.

Carry out a similar sequence of three impacts along the second horizontal axis of the pallet and then take the specified measurements.

8.6.1.2 Top deck edge impact test

The purpose of this test is to determine the shunting resistance of the top leading edge deckboard and, where applicable, the stringerboard.

8.6.1.2.1 Measurements

When tested in accordance with the method specified in 8.6.1.2.2, deformations x, y_1, y_2 and y_3 (see Fig. 8.8) shall be recorded. The penetration depth and general damage at points of impact shall also be recorded.

8.6.1.2.2 Procedure

The inclined-plane tester described previously is used with the impact stop shown in Fig. 8.9.

Place the pallet and load box loaded to a mass of 0.075 R on the dolly of the tester. The load should be central to the axis of movement, but biased towards the lower end of the box.

Align the impact stops with the fork openings of the pallet at a height that allows the leading board to touch the top surface of the blade at a point between 100 mm and 250 mm from the shank face (see Fig. 8.10). The points of impact shall be within this area for each impact.

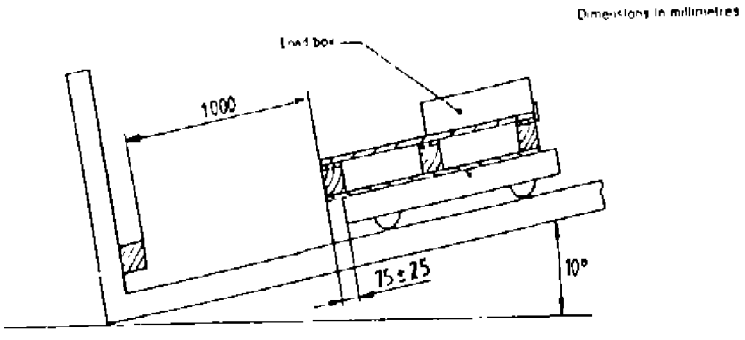
Note:

Table 8.3 gives appropriate spacing for impact stops in order to enable the range of pallets to be tested with minimum resetting.

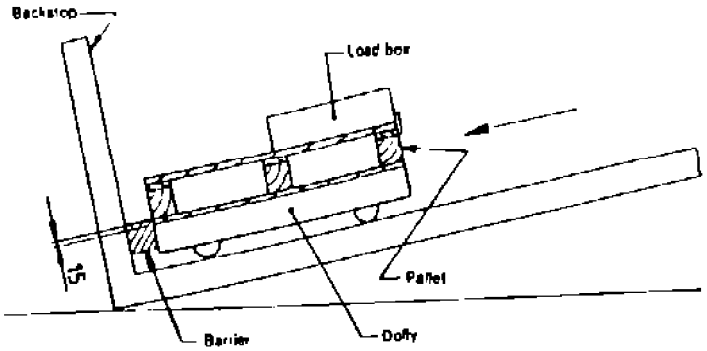
Raise the pallet with the dolly until the pallet is 1000 mm from the shank face (see Fig. 8.10), then release.

Repeat the procedure twice more, repositioning the pallet and load box before each impact, and then take measurements as specified in 8.6.1.2.1.

For four-way pallets, carry out a similar sequence of three impacts along the second horizontal axis of the pallet and then take the specified measurements.



a) Position before release



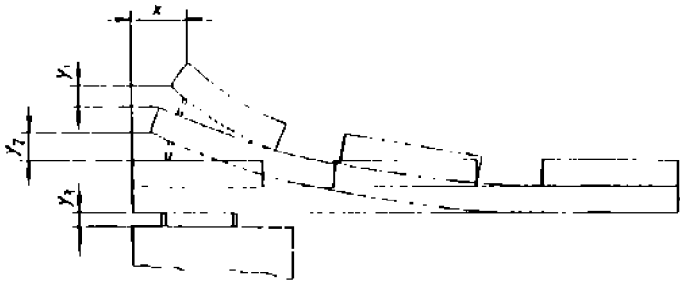
b) Position at impact

INCLINED-PLANE SHEAR TEST
Fig. 8.7

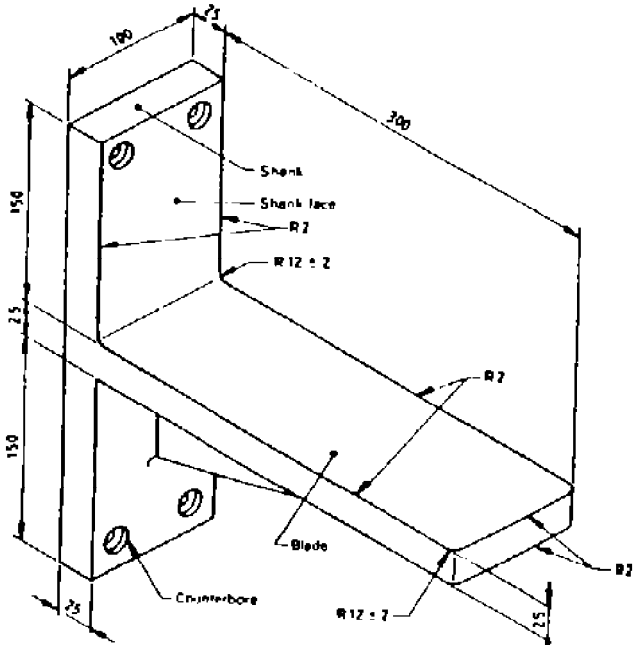
TABLE 8.3 IMPACT STOP SPACING

PALLET SIZE	*W*[1]
800	350
1000 to 1140	450
1200	550

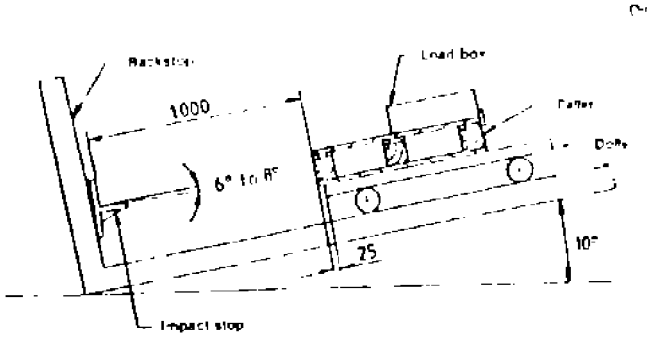
1. See Fig. 8.1.1



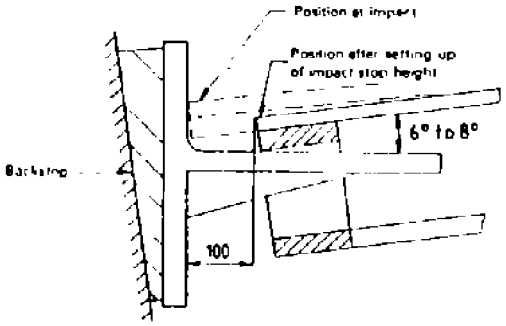
TOP DECK EDGE IMPACT TEST-POINTS OF MEASUREMENT
Fig. 8.8



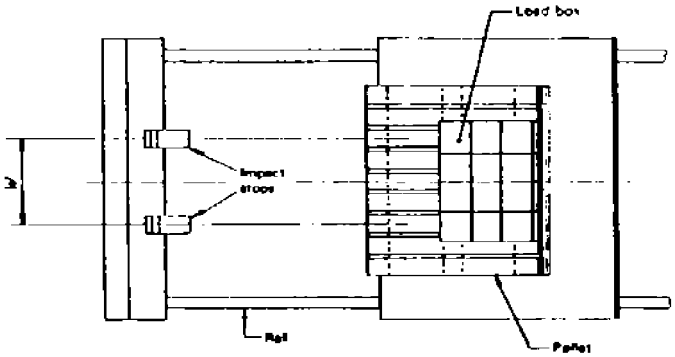
IMPACT STOP FOR TOP DECK EDGE AND CORNER IMPACT TEST RIGS
Fig. 8.9



a) Position before release



b) Setting-Up position



c) Plan view of position before release

TOP DECK EDGE IMPACT TEST RIG
Fig. 8.10

8.6.1.3 Block impact test

The purpose of this test is to determine the resistance of pallet blocks to eccentric impacts at the corners.

Note:

The test applies only to block pallets.

8.6.1.3.1 Measurements

When tested in accordance with the method specified in 8.6.1.3.2, the displacements x, y and z and the angles α and β of blocks (see Fig. 8.11) shall be recorded after each impact, together with the indentation depth.

For circular blocks, only displacements y and z and angle β shall be recorded.

8.6.1.3.2 Procedure

The inclined-plane tester described previously is used with the impact stop shown in Fig. 8.9.

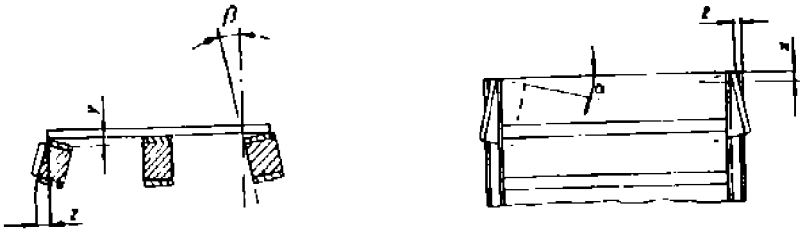
Place the pallet, with the load box loaded to 0.075 R, on the dolly of the tester. The load should be central to axis of movement, but biased to the upper end of the box.

Place the pallet so that lines parallel with the direction of travel can be drawn from edges A of the impact stops through points on the front face of the blocks, as shown in Fig. 8.12. The impact stops shall be positioned accordingly with the top of their leading edge blades 75 mm. above the top surface of the dolly.

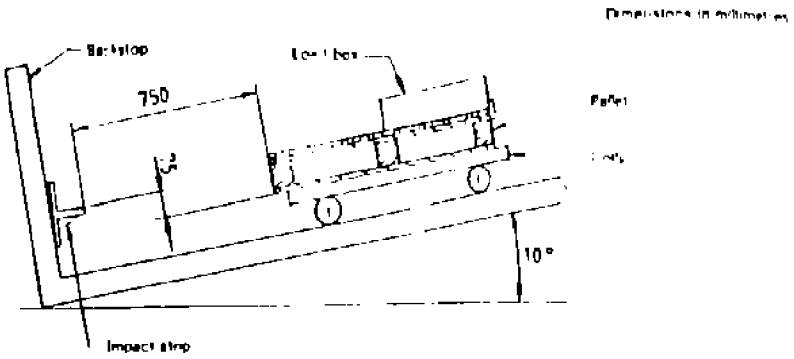
Raise the dolly and pallet so that they will travel 750 mm. before impact, then release.

Repeat the procedure twice more, repositioning the pallet and load box before each impact and then take measurements as specified in 8.6.1.3.1.

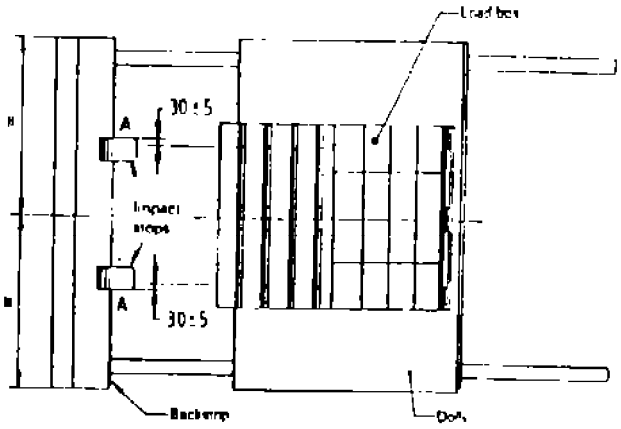
Carry out a similar sequence of three impacts along the second horizontal axis of the pallet and then take the specified measurements



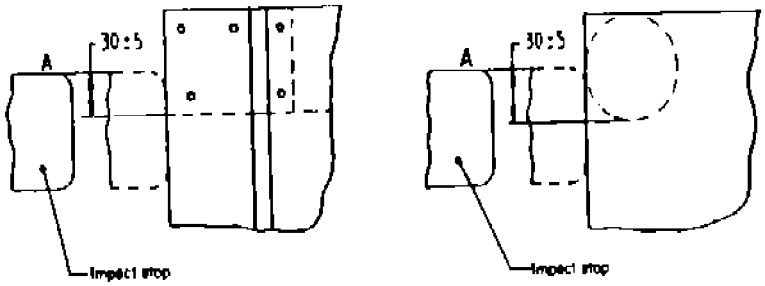
DISPLACEMENTS *X.Y* AND *Z* AND ANGLES α AND β
Fig. 8.11



a) Position before release



b) Plan view showing position of blocks



c) Positions of pallets with square or round blocks

IMPACT POINTS IN BLOCK IMPACT TEST
Fig. 8.12

8.6.2 Corner drop test

The purpose of this test is to determine the diagonal rigidity of a pallet.

8.6.2.1 Deformation measurements

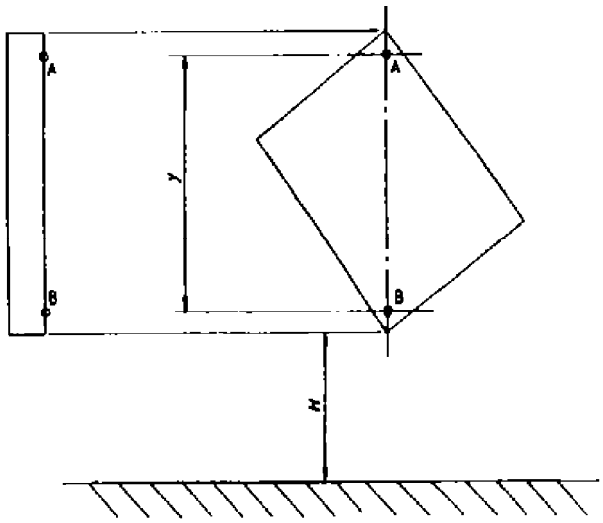
When tested in accordance with the method specified in 8.6.2.2, the length of diagonal *y* (see Fig. 8.13) shall be measured before the first drop and after the third drop. The measurement shall be taken at the same point in each cycle either when suspended or in the released position after impact. To avoid the effects of local deformation, the points A and B (between which the diagonal *y* is measured) shall each be approximately 40 mm from the respective corners (see Fig. 8.13)

8.6.2.2 Procedure

Drop the pallet, with the related diagonal AB vertical, freely onto the corner from a height *H* onto a flat, hard, rigid, horizontal impact surface (see Fig. 8.13). The drop height *H* shall be as specified in Table 8.4. Carry out the drop three times, always on the same corner and from the same height.

TABLE 8.4 DROP HEIGHTS FOR CORNER DROP TEST

MASS OF PALLET, *m*	DROP HEIGHT, *H* mm
$m \leq 30$	1000
$m > 30$	500



CORNER DROP TEST
Fig. 8.13

9. TEST REPORT

A test report shall be drawn up and shall include the following information:

a) reference to this Standard;

b) the number of identical pallets tested;

c) any deviations from any stated pallet specification as regards materials, construction and dimensions;

d) a full description of the pallets, including moisture content (as appropriate), materials. construction and dimensions;

e) the relative humidity, temperature and length of conditioning of the pallets, together with relative humidity and temperature of the testing laboratory at the time of testing (where appropriate);

f) any deviations from the test methods specified in this Standard;

g) the results of the static and impact tests carried out in accordance with the methods specified in Clauses 8.5 and 8.6 respectively;

h) the date and place of test;

i) the signature of the person responsible for carrying out the testing.

Note:

These tests are not as comprehensive as required by most research programmes; for example, accurate comparisons between wood pallets require long-term conditioning to ensure moisture equilibrium, oven-drying methods to obtain wood density and moisture content, pre-selection of wood for preparation of specimen pallet, taking account of factors such as slope of grain, position of knots and extent of wane.

10. PERFORMANCE REQUIREMENTS

10.1 Number of Pallets Tested

When evaluating a pallet in relation to its designed load capacity, a minimum of three replicates shall be tested and the complete sequence of seven tests shall be conducted consecutively in the order given.

The average of the three (or more) results shall be the criterion for assessment, not the individual results. For acceptance for a pallet design, the design shall meet the requirements of the seven tests of this Standard.

Complete or partial fracture of any pallet during performance testing shall be considered failure to meet the requirements of this Standard. This shall apply however large the sample undergoing test.

10.2 Performance Requirements

The symbols *x* and *y* are used to identify displacement/deflection measurements in the horizontal and vertical planes respectively, but the actual detail and magnitude varies between tests. For the tests covered in 10.3.2.3 and 10.4.2.3, where a third translational plane is defined, *z* is also used for deflection, and α and β for angular displacement.

10.3 Normal Grade Pallets (Grade N)

When pallets are tested the recommended performance levels for normal grade pallets are as given in 10.3.1 and 10.3.2.

10.3.1 Static tests

10.3.1.1 Stacking test

The change in deformation *y* shall not exceed 4 mm under full load measured in relation to the 0.25 *R* datum load. During unloading, the change in *y* shall not exceed 1.5 mm under the 0.25 *R* datum load and recovery shall be attained within 1 h.

10.3.1.2 Bending test

The rate of deflection shall decrease during the test and, in addition, the deflection shall not exceed 0.025 l_1 (0.025 l_2) under full load measured in relation to the 0.1 *R* datum load. Recovery shall be attained within 1 h to a value not exceeding 0.01 l_1 (0.01 l_2) measured under the 0.1 *R* datum load.

The distance between the decks, *h*, shall be 92 mm min. under full test load.

10.3.1.3 Bottom deck test

The rate of deflection shall decrease during the test and, in addition, the deflection shall not exceed 0.02 l_3 (0.02 l_4, 0.02 l_5) measured in relation to the 0.1 *R* datum load. Recovery shall be attained within 1 h to a value not exceeding 0.007 l_3 (0.007 l_4, 0.007 l_5) measured under the 0.1 *R* datum load.

10.3.2 Impact tests

10.3.2.1 Inclined plane-shear test

After three impacts, the increase in *x* at any point on the leading edges shall be 6 mm max. The mean increase in *y* shall be 4 mm max.

10.3.2.2 Inclined plane-top deck edge impact test

After three impacts, the mean increase in *x* shall be 3 mm max. and in *y*, *3* mm max.

10.3.2.3 Inclined plane-block impact test

After three impacts, the mean of *x* (combined measurement of block displacement plus indentation depth) shall be 3 mm max., *y* shall be 3 mm. max., and *z* shall be 3 mm. max. At this point after three impacts the angles α and β shall be 5° max.

There is no displacement requirement for circular blocks in relation to *x* and α.

10.3.2.4 Corner drop test

After three drops on the same corner of the same pallet, the change in diagonal *y* shall be 0.04 *y* max., measured as the mean change for three pallets.

10.4 Special grade pallets (grade S)

When pallets are tested, the recommended performance levels for special grade pallets are as given in 10.4.1 and 10.4.2.

10.4.1 Static tests

10.4.1.1 Stacking test

The change in deformation *y* shall not exceed 1 mm under full load measured in relation to the 0.25 *R* datum load. During unloading, the change in *y* shall not exceed 0.5 mm under the 0.25 *R* datum load and recovery shall be attained within 1 h.

10.4.1.2 Bending test

The rate of deflection shall decrease during the test and, in addition, the deflection shall not exceed 0.012 5 l_1 (0,012 5 l_2) under full load measured in relation to the 0.1 *R* datum load. Recovery shall be attained within 1 h to a value not exceeding 0.005 l_1 (0.005 l_2) measured under the 0.1 *R* datum load.

The distance between the decks, *h*, shall be 95 mm min. under full test load.

10.4.1.3 Bottom deck test

The rate of deflection shall decrease during the test and, in addition, the deflection shall not exceed 0.01 l_3 (0.01 l_4, 0.01 l_5) under full load measured in relation to the 0.1 *R* datum load. Recovery shall be attained within 1 h to a value not exceeding 0.004 l_3 (0.004 l_4, 0.004 l_5) measured under the 0.1 *R* datum load.

10.4.2 Impact tests

10.4.2.1 Inclined plane-shear test

After three impacts the increase in *y* shall be 2 mm max.

10.4.2.2 Inclined plane-top deck edge impact test

After three impacts, the mean increase *x* shall be 2 mm max. and in *y* 2 mm max.

10.4.2.3 Inclined plane-block impact test

After three impacts, the mean of *x* (combined measurement of block or string displacement plus indentation depth) shall be 3 mm max., *y* and *z* shall be 3 mm max. At this point after three impacts the angles α and β shall be 5° max.

There is no displacement requirement for circular blocks in relation to *x* and α.

10.4.2.4 Corner drop test

After three drops on the same corner of the same pallet, the change in diagonal *y* shall be 0.04 *y* max. measured as the mean change for three pallets.

11. GUARANTEE AND WARRANTY

During a period of 18 months after the date of shipment the Vendor shall with all possible speed and without cost to the Purchaser, replace the pallets found to be defective due to faulty material, workmanship or to any act or omission of the Vendor.

APPENDICES

APPENDIX A
RECOMMENDED PERFORMANCE REQUIREMENTS

TABLE A.1 - SUMMARY OF PERFORMANCE REQUIREMENTS FOR PALLETS

TEST	MAXIMUM TEST LOAD	LENGTH OF SLIDE OR DROP HEIGHT	NUMBER OF TIMES	MAXIMUM PERMITTED DEFLECTION N GRADE	S GRADE	PERMITTED DAMAGE
Static tests						
Stacking	1.1 R	—	1	Y = 4 mm	Y = 1 mm	None
Bending[1)]	1.25 R	—	1	0.025 l_1 0.025 l_2	0.012 5 l_1 0.012 5 l_2	None
Bottom deck Impact test	1.15 R	—	1	0.02 l_1 0.02 l_2	0.01 l_1 0.01 l_2	None
Inclined plane Shear	0.075 R	1 m	3	X = 6 mm Y = 4 mm	X = 4 mm Y = 2 mm	None
Inclined plane Top deck	0.075 R	1 m	3	X = 3 mm Y = 3 mm	X = 2 mm Y = 2 mm	None
Inclined plant Block	0.075 R	750 mm	3	X = 3 mm Y = 3 mm Z = 3 mm a = 5°, b = 5°	X = 3 mm Y = 3 mm Z = 3 mm a = 5°, b = 5°	Block indentation
Corner drop[2)]	Own weight	1 m or 500 mm	3	0.04 y	0.04 y	Local Compression

1) The maximum deflection values given in 10.3.1.2 and 10.4.1.2 for the bending test are far in excess of those expected of identical pallets in service.

The in-service maximum deflections would be expected to be 25% to 50% of those given when a typical uniformly distributed load is applied to the pallet.

2) With nailed wooden pallets, the results of the corner drop test are often sensitive to the tightness of the joints. When assessing corner drop test results, particular emphasis should be placed upon records of moisture content bothassembly and during test and upon ensuring that these are representative of normal manufacture and service. In this test although damage the renders a pallet unsuitable for its purpose is not acceptable, minor compression damage within 50 mm of the impacted corner is acceptable.