भारतीय मानक

Indian Standard

IS 16058 : 2024

वेयरहाउसिंग उपयोग के लिए पुनर्नवीनीकृत पैकेजिंग अपशिष्ट से बने डनेज पैलेट — विशिष्टि

(पहला पुनरीक्षण)

Dunnage Pallets Made from Recycled Packaging Wastes for Warehousing Application — Specification

(First Revision)

ICS 55.180.20

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

May 2024 **Price Group 10**

Transport Packages, Packaging Codes and Pallets Sectional Committee Sectional Committee, TED 24

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Transport Packages, Packaging Codes and Pallets Sectional Committee Sectional Committee had been approved by the Transport Engineering Division Council.

Packaging has become an integral part of human life due to its application for the containment, preservation, presentation, information and marketing tool for any commodity. The continuous advancement of this technology has enabled to develop numerous variety of innovative packaging materials like paper and paper board, mono and multi-layered plastic films, combination of paper, paperboard, plastic films, aluminum foils and to make laminated structure with adequate physical, mechanical strength and also physico-chemical properties to improve upon the barrier properties of the laminated structure against the ingress of moisture content and oxygen gases from the atmosphere to avoid the deterioration of goods which are sensitive to moisture and oxygen gases and thus to enhance the shelf life of food, pharmaceutical and cosmetics items.

But, these packaging materials are non-recyclable due to its composite structure which leads to the problem of accumulation of post-consumer packaging wastes as garbage and thus, become non-compliance to environmental regulations. However, the innovative technology has been able to reprocess these post-consumer packaging waste materials and convert into innovative composite board by means of compression molding techniques with adequate mechanical strength and all other functional properties and made available as an alternative of wood and wood based materials and in many cases plastic based materials too. In fact, these become as an ideal solution for the conversion of packaging waste into value added products. These composite boards can be cut into required sizes of pieces as batten for the fabrication of pallet by means of nailing and use these pallets in the warehouses, godowns and port yards for the storage of food grains packed in jute bags, fertilizers and cement packaged in plastic woven sacks or corrugated fiber board boxes for engineering, electrical and other components.

Considering the importance and application of these materials, Indian Standard IS 16058 was published in 2013. However, it was observed that there is a need to revise this standard by highlighting the quality of raw materials, reprocessing techniques, designs etc. Keeping in view of this objective, this standard has been revised in compliance to International Standards to meet the domestic and export market requirements.

While revising the standard, considerable amount of assistance has been derived from the following standards:

IS No./Other Standards	*Title*
IS 8005 : 1976	Classification of unit load
ISO 445 : 2013	Pallets for materials handling — Vocabulary
ISO 6780 : 2003	Flat pallets for intercontinental materials handling — Principal dimensions and tolerances
ISO 8611-1 : 2021	Pallets for materials handling — Flat pallets — Part 1: Test methods
ISO 8611-2 : 2021	Pallets for materials handling — Flat pallets — Part 2: Performance requirements and selection of tests
ISO 8611-3 : 2011	Pallets for materials handling — Flat pallets — Part 3: Maximum working loads
ISO 12776 : 2008	Pallets — Slip sheets
ISO 12777-1 : 1994	Methods of test for pallet joints — Part 1: Determination of bending resistance of pallet nails, other dowel-type fasteners and staples
ISO 12777-2 : 2000	Methods of test for pallet joints — Part 2: Determination of withdrawal and head pull-through resistance of pallet nails and staples
ISO 12777-3 : 2002	Methods of test for pallet joints — Part 3: Determination of strength of pallet joints

(*Continued on third cover*)

Indian Standard

DUNNAGE PALLETS MADE FROM RECYCLED PACKAGING WASTES FOR WAREHOUSING APPLICATION — SPECIFICATION

(First Revision)

1 SCOPE

This standard specifies for pallets made from recycled/reprocessed packaging wastes, types of packaging wastes and its quality parameters, processing techniques of packaging wastes, standard dimensions, design criteria, requirements of reprocessed materials and components for the construction of different types of pallets and its testing, used in warehouse/godowns/port yards etc for the stacking and storage of various kinds of packaged goods like food grains, seeds, fertilizers, engineering goods for providing protection against the ingress of floor moisture and bio-degradation to provide forth aeration of stored items.

NOTE — The scope of this standard only covers the pallets intended for warehousing/storage purposes. The pallets intended for transportation applications are not covered under the scope of this standard.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 1708 (Part 5) : 1986	Methods of testing of small clear specimens of timber: Part 5 Determination of static bending strength
IS 2380	Methods of test for wood particle boards and boards from other lignocellulosic materials:
Part 1 : 1977	Preparation and conditioning of test specimens
Part 3 : 1977	Determination of moisture content and density
IS 3971 : 2019/ ISO 445 : 2013	Pallets for materials handling — Vocabulary

3 TERMINOLOGY

3.1 Pallets — The pallets are ancillary packaging materials which are defined as flat structure used as base for the unitization of goods in supply chain. The pallet as portable, horizontal, rigid, composite platform used as (a) based for assembling, storing, stacking, handling and transporting goods as unit load; often equipped with a super structure. The super structure is the assembly that is attached to supporting base of the pallet.

3.2 Dunnage Pallets — Dunnage pallets are mainly used for storage purpose in the warehouse/godowns for stacking of packaged commodity goods in flexible bags made of either jute fabric or plastic woven sacks for providing the protection against floor moisture and biodegradation and forth aeration of stored items over the pallets.

3.3 Pay Load — Load carried by the pallet in use.

3.4 Maximum Working Load — Greatest payload that a pallet is permitted to carry in specific loading and support condition.

3.5 Ultimate load — Load at which compression, displacement or deflection is no longer contained, resulting in the destruction of the specimen or breaking of one component, or when displacement, deformation or deflection becomes excessive.

3.6 Uniformly Distributed Bonded Load — Load spread across the full surface of the pallet deck, where the pattern of each single layer changes so that packages are interlocked.

3.7 Uniformly Distributed Un-bonded Load — Load spread evenly across the full surface of the pallet top deck where the packages are not interlocked bound or connected.

3.8 Solid Load — Single, compact, rigid, homogeneous load supported by all the blocks or stringers of the pallet.

3.9 Concentrated Load — Load concentrated over an area of less than 50 percent of the pallet top deck.

3.10 Unit Load — The sum of pay load and weight of the pallet.

3.11 Top Member/Deck — Reinforced composite board made from recycled/reprocessed packaging waste consisting of plastic, paper, aluminum foil, any natural fiber etc shall be used for forming the top member/deck which shall be remain in contact with the storage bags.

3.12 Bottom Section — Reinforced composite board made from recycled/reprocessed packaging waste consisting of plastic, paper, aluminum foil, any natural fiber etc or shall be used for forming the bottom sections which shall be remain in contact with the floor surface.

4 PACKAGING WASTES AS RAW MATERIAL

Reinforced composite board made from recycled/ reprocessed packaging waste consisting of plastic, paper, aluminum foil, any natural ingredient etc.

4.1 Sources of Packaging Wastes

4.1.1 *Pre-Consumer Waste*

Rolls, sheets, trims, cutoff waste of packaging waste generated during the printing or packaging process and also from paper manufacturing process. This waste is generally procured directly from printing and packaging manufacturers and paper manufacturers.

4.1.2 *Post-Consumer Packaging Waste*

Packaging waste discarded by consumer collected post consumption through various collection mechanisms.

4.2 Types of Packaging Wastes

4.2.1 *Multi-Layer Packaging Waste*

Waste generated from composite packaging format (such as plastic tube, aseptic package, pouches, sachets, plastic bags etc) consisting of either monolayer or multilayer plastic film, paper, metalized film, aluminum foil, ink, adhesives, coating materials etc.

4.2.2 *Mono Layer Packaging Waste*

Packaging material consisting of single polymeric material.

4.2.3 *Mixed Packaging Waste*

This waste could be a mix of multi-layer packaging waste as per 4.2.1 as well as mono layer packaging waste as per 4.2.2 with a condition that there should be minimum 60 percent polyolefin material.

4.3 Quality Requirement of Packaging Waste as Raw Materials

Raw material should be free of contaminations such as stone, hard metal, glass, rubber, hard plastic, PVC, mono layer PET, dirt etc. However adequate drying facility is required for wet packaging waste.

4.4 Limitation on the Raw Material

Waste of packaging consisting of PVC, mono layer PET etc, cannot be used as raw material for the manufacturing recycled/reprocessed composite board. In case of mixed packaging waste, the waste material should contain minimum 60 percent of polyolefin material.

5 REPROCESSING/RECYCLING TECHNIQUE

The process involves compression molding at high temperature and pressure to achieve desired strength of the recycled/reprocessed composite sheets.

5.1 Sequence of Processing Operations

The process includes:

5.1.1 *Primary Cleaning*

Cleaning of wastes to remove dust, dirt etc.

5.1.2 *Primary Drying (Applicable for Wet Raw Material only)*

Drying of waste before further operation.

5.1.3 *Shredding*

To make the waste materials into small pieces of size 1 cm to 2 cm length.

5.1.4 *Mixing*

All the shredded waste materials of different sources are mixed together.

5.1.5 *Secondary Drying*

Drying of waste shredded materials to maintain the moisture content at the level of 15 percent.

5.1.6 *Layering*

Depending on the thickness of chip board, the waste materials are spreaded.

5.1.7 *Pressing*

The layered materials are subjected to press at about 200 ºC.

5.1.8 *Cutting*

The board developed by means of compression molding process are cut into required sizes.

5.1.9 *Fabrication*

The different value-added items are fabricated from the cut boards.

6 TYPES OF COMPOSITE CHIP BOARD

Depending upon the application of pallets made from recycled composite chip board there are following two types of composite boards:

6.1 Interior Grade

Composite chip board to fabricate pallets used under covered area in indoor conditions.

6.2 Exterior Grade

Composite chip board to fabricate pallets used for open area in outdoor condition.

7 TYPES OF DUNNAGE PALLETS

Depending upon the location of storage of pallets, the dunnage pallets are divided into two categories:

7.1 Type A

Made from interior grade composite board. Depending upon static load capacity, Type "A" is further sub-divided into two sub-types "A-1" or heavy duty pallet and "A-2" or medium duty pallet. The details of the same are given in Table 1.

7.2 Type B

Made from exterior grade composite board. The detail of the same is given in Table 1.

8 FASTENERS

Following types of fasteners shall be used for construction of pallets. IS 3971 may be referred for ensuring quality of these fasteners.

8.1 Types of Fasteners

8.1.1 *Nails*

Straight fastener, made from round or square stock, usually pointed and headed, designed to be impulse driven (*see* Fig. 1).

Table 1 Types of Dunnage Pallets Corresponding Static Load Capacity

(*Clauses* 7.1 *and* 7.2)

Sl No.	Type	Sub-Type	Description	Static Load Capacity
				kg per sqft
(1)	(2)	(3)	(4)	(5)
i)	A	A-1	Indoor heavy duty pallet	500
		A-2	Indoor medium duty pallet	300
ii)	B	B	Outdoor medium duty pallet	300

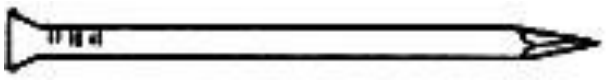


FIG. 1 NAIL

8.1.2 *Threaded Nail*

Nail which a portion of the shank has formed so as to provide increased withdrawal resistance (*see* Fig. 2).

8.1.3 *Ring Nail*

Annularly threaded nail, threaded nail on which the threaded portion has multiple ring-like threads rolled completely round the shank (*see* Fig. 3).

8.1.4 *Interrupted Thread Nail*

Threaded nail on which the threaded portion has a non-threaded zone between two threaded areas, to allow for collating by wire or plastics strip (*see* Fig. 4).

8.1.5 *Collated Nail*

Nail in a loose reel held temporarily together by connecting wires or strips in order to feed automatic pneumatic or electric nailing tools (*see* Fig. 5).

8.1.6 *Screw*

Straight, slender, pointed and headed fastener with a thread along a portion of the shank and with a slot or other indentation in the head to facilitate turning for insertion (*see* Fig. 6).

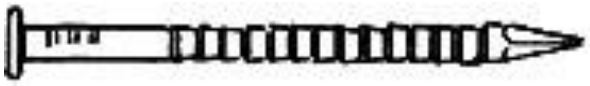


FIG. 2 THREADED NAIL

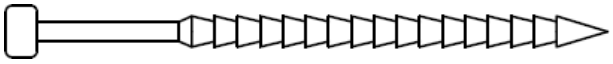


FIG. 3 RING NAIL

FIG. 4 INTERRUPTED THREAD NAIL

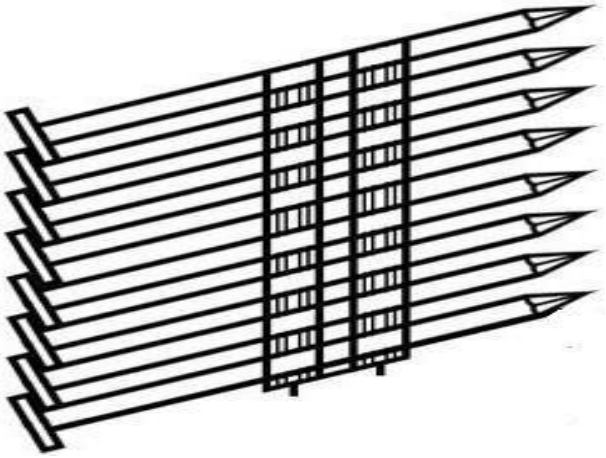


FIG. 5 COLLATED NAIL

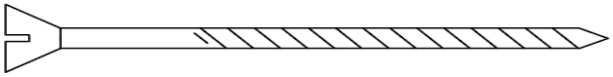


FIG. 6 SCREW

8.2 Requirements for Fasteners

Fasteners used in pallets should meet following requirements:

a) Number of fasteners should be 3 on planks whose width is 145 mm or above and 2 on planks whose width is below 145 mm;

b) Screws/nails are countersunk and should not protrude and flush with composite board surface;

c) Fasteners should be driven keeping 35 mm to 50 mm apart and on centre of stringer; and

d) Length of fasteners should be minimum thrice the thickness of plank.

9 CONSTRUCTION

The top and bottom decks of the pallets shall be fabricated by using the specified size of cut pieces as plank from the composite chip board which shall be made from the materials described in **4**.

10 DESIGN OF DUNNAGE PALLETS

10.1 Design of Type "A-1" and Type "A-2" Pallets

The design of Type "A-1" (indoor heavy-duty pallet) and Type "A-2" (indoor medium duty pallet) shall be as given below (*see* Fig. 7).

10.2 Design of Type "B" Pallets

The design of Type "B" (outdoor medium duty pallet) shall be as given below (*see* Fig. 8).

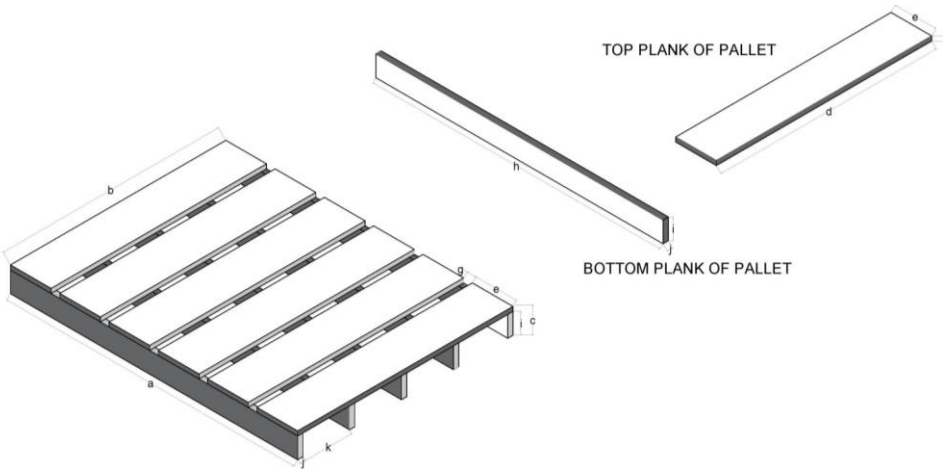


FIG. 7 DESIGN OF INDOOR HEAVY DUTY PALLET TYPE 'A-1' AND TYPE 'A-2'

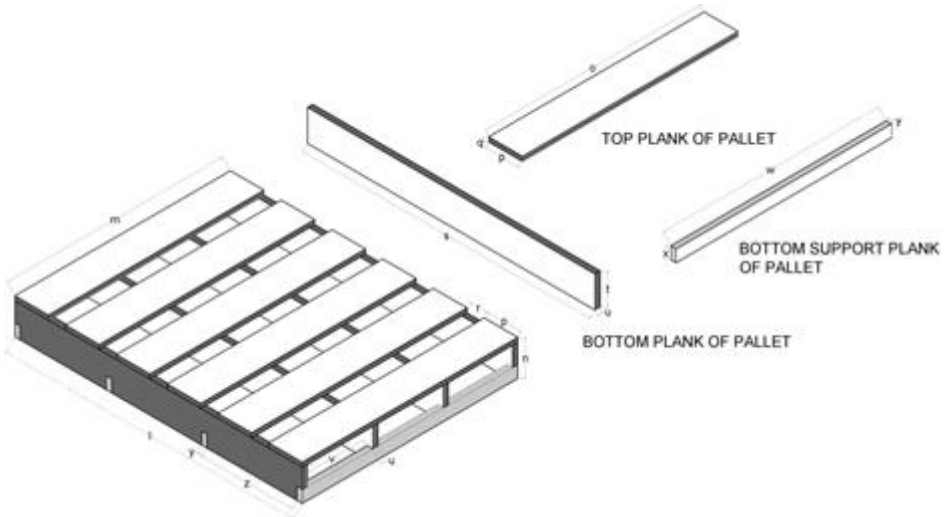


FIG. 8 DESIGN OF OUTDOOR MEDIUM DUTY PALLET TYPE B

11 DIMENSIONS

11.1 Dimensions of Pallet Type "A-1"

The dimensions of indoor heavy duty pallet Type "A-1" shall be as given in Table 2.1.

Table 2.1 Dimensions of Pallet Type "A-1"

(*Clause* 11.1)

Sl No.	Pallet Size (Length × Width)	Length (*a*)	Width (*b*)	Height (*c*)	Minimum Weight
	mm × mm	mm	mm	mm	kg
(1)	(2)	(3)	(4)	(5)	(6)
i)	1 500 x 600	1 500 ± 5	600 ± 5	104 ± 5	25
ii)	1 500 x 900	1 500 ± 5	900 ± 5	104 ± 5	34
iii)	1 200 x 600	1 200 ± 5	600 ± 5	104 ± 5	20
iv)	1 200 x 900	1 200 ± 5	900 ± 5	104 ± 5	28

11.1.1 The dimensions of top and bottom planks of indoor heavy duty pallet Type "A-1" shall be as given in Table 2.2 and Table 2.3 respectively.

Table 2.2 Dimensions of Top Plank of Pallet Type "A-1"

(*Clause* 11.1.1)

Sl No.	Pallet Size (Length × Width)	Length (*d*)	Width (*e*)	Thickness (*f*)	No. of Planks	Gap Between Planks (*g*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 500 × 600	600 ± 5	176 ± 5	18 ± 3	7	45 ± 5
ii)	1 500 × 900	900 ± 5	176 ± 5	18 ± 3	7	45 ± 5
iii)	1 200 × 600	600 ± 5	170 ± 5	18 ± 3	6	36 ± 5
iv)	1 200 × 900	900 ± 5	170 ± 5	18 ± 3	6	36 ± 5

Table 2.3 Dimensions of Bottom Plank of Pallet Type "A-1"

(*Clause* 11.1.1)

Sl No.	Pallet Size (Length × Width)	Length (*h*)	Width (*i*)	Thickness (*j*)	No. of Planks	Gap Between Planks (*k*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 500 × 600	1 500 ± 5	86 ± 5	22 ± 3	4	170 ± 5
ii)	1 500 × 900	1 500 ± 5	86 ± 5	22 ± 3	5	198 ± 5
iii)	1 200 × 600	1 200 ± 5	86 ± 5	22 ± 3	4	170 ± 5
iv)	1 200 × 900	1 200 ± 5	86 ± 5	22 ± 3	5	198 ± 5

11.2 Dimensions of Pallet Type "A-2"

The dimensions of indoor medium duty pallet Type "A-2" shall be as given in Table 2.4.

Table 2.4 Dimensions of Pallet Type "A-2"

(*Clause* 11.2)

Sl No.	**Pallet Size** (Length × Width)	**Length** (*a*)	**Width** (*b*)	**Height** (*c*)	**Minimum Weight**
	mm × mm	mm	mm	mm	kg
(1)	(2)	(3)	(4)	(5)	(6)
i)	1 500 x 600	1 500 ± 5	600 ± 5	80 ± 5	19
ii)	1 500 x 900	1 500 ± 5	900 ± 5	80 ± 5	28
iii)	1 200 x 600	1 200 ± 5	600 ± 5	80 ± 5	15
iv)	1 200 x 900	1 200 ± 5	900 ± 5	80 ± 5	21

11.2.1 The dimensions of top and bottom planks of indoor medium duty pallet Type "A-2" shall be as given in Table 2.5 and Table 2.6 respectively.

Table 2.5 Dimensions of Top Plank of Pallet Type "A-2"

(*Clause* 11.2.1)

Sl No.	**Pallet Size** (Length × Width)	**Length** (*d*)	**Width** (*e*)	**Thickness** (*f*)	**No. of Planks**	**Gap Between Planks** (*g*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 500 × 600	1 500 ± 5	160 ± 5	18 ± 3	3	60 ± 5
ii)	1 500 × 900	900 ± 5	140 ± 5	18 ± 3	8	55 ± 5
iii)	1 200 × 600	1 200 ± 5	160 ± 5	18 ± 3	3	60 ± 5
iv)	1 200 × 900	900 ± 5	145 ± 5	18 ± 3	6	66 ± 5

Table 2.6 Dimensions of Bottom Plank of Pallet Type "A-2"

(*Clause* 11.2.1)

Sl No.	**Pallet Size** (Length × Width)	**Length** (*h*)	**Width** (*i*)	**Thickness** (*j*)	**No. of Planks**	**Gap Between Planks** (*k*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 500 × 600	600 ± 5	60 ± 5	22 ± 3	8	189 ± 5
ii)	1 500 × 900	1 500 ± 5	60 ± 5	22 ± 3	5	197 ± 5
iii)	1 200 × 600	600 ± 5	60 ± 5	22 ± 3	6	213 ± 5
iv)	1 200 × 900	1 200 ± 5	60 ± 5	22 ± 3	5	197 ± 5

11.3 Dimensions of Pallet Type "B"

The dimensions of outdoor medium duty pallet Type "B" shall be as given in Table 2.7.

Table 2.7 Dimensions of Pallet Type "B"

(*Clause* 11.3)

Sl No.	Pallet Size (Length × Width)	Length (*l*)	Width (*m*)	Height (*n*)	Minimum Weight
	mm × mm	mm	mm	mm	kg
(1)	(2)	(3)	(4)	(5)	(6)
i)	1 200 × 600	1 200 ± 5	600 ± 5	150 ± 5	29
ii)	1 200 × 900	1 200 ± 5	900 ± 5	150 ± 5	41
iii)	1 200 × 600	1 200 ± 5	600 ± 5	225 ± 5	23
iv)	1 200 × 900	1 200 ± 5	900 ± 5	225 ± 5	32

11.3.1 The dimensions of top and bottom planks of outdoor medium duty pallet Type "B" shall be as given in Table 2.8 and Table 2.9 respectively.

Table 2.8 Dimensions of Top Plank of Pallet Type "B"

(*Clause* 11.3.1)

Sl No.	Pallet Size (Length × Width)	Length (*o*)	Width (*p*)	Thickness (*q*)	No. of Planks	Gap Between Planks (*r*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 200 × 600 × 225	600 ± 5	140 ± 5	18 ± 3	6	72 ± 5
ii)	1 200 × 900 × 225	900 ± 5	140 ± 5	18 ± 3	6	72 ± 5
iii)	1 200 × 600 × 150	600 ± 5	140 ± 5	18 ± 3	6	72 ± 5
iv)	1 200 × 900 × 150	900 ± 5	140 ± 5	18 ± 3	6	72 ± 5

Table 2.9 Dimensions of Bottom Plank of Pallet Type "B"

(*Clause* 11.3.1)

Sl No.	Pallet Size (Length × Width)	Length (*s*)	Width (*t*)	Thickness (*u*)	No. of Planks	Gap Between Planks (*v*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 200 × 600 × 225	1 200 ± 5	207 ± 5	22 ± 3	3	267 ± 5
ii)	1 200 × 900 × 225	1 200 ± 5	207 ± 5	22 ± 3	4	270 ± 5
iii)	1 200 × 600 × 150	1 200 ± 5	130 ± 5	22 ± 3	3	267 ± 5
iv)	1 200 × 900 × 150	1 200 ± 5	130 ± 5	22 ± 3	4	270 ± 5

11.3.2 The dimensions of bottom support planks of outdoor medium duty pallet Type "B" shall be as given in Table 2.10.

Table 2.10 Dimensions of Bottom Support Plank of Pallet Type "B"

(*Clause* 11.3.2)

Sl No.	Pallet Size (Length × Width)	Length (*w*)	Width (*x*)	Thickness (*y*)	No. of Planks	Gap Between Planks (*z*)
	mm × mm	mm	mm	mm		mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	1 200 × 600 × 225	600 ± 5	50 ± 5	22 ± 3	4	370 ± 5
ii)	1 200 × 900 × 225	900 ± 5	50 ± 5	22 ± 3	4	370 ± 5
iii)	1 200 × 600 × 150	600 ± 5	50 ± 5	22 ± 3	4	370 ± 5
iv)	1 200 × 900 × 150	900 ± 5	50 ± 5	22 ± 3	4	370 ± 5

12 WORKMANSHIP

The pallets are fabricated by using required number of fasteners to make designs as per **11**.

13 FINISH

Each pallet shall be free from any visual defects like cracks, deformations, uneven surfaces, chipping of materials etc.

14 CONDITIONING

14.1 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.

14.2 A further purpose of conditioning is to predict the behavior of identical pallets in extreme conditions encountered in transit loaded with goods.

14.3 Table 3 includes details of conditioning environments known to be relevant to pallet usage. In accordance with this standard, they shall be applied as follows:

14.3.1 One specimen of packaging waste including of the mixture of plastics and metalized plastics films-based pallets shall be conditioned to environment C and D (*see* Table 3); and

14.3.2 One specimen of packaging waste including of the mixture of paper, metalized paper & plastic packaging waste-based pallets shall be conditioned to environment E (*see* Table 3).

Table 3 Conditioning Environments

(*Clauses* 14.3.1 *and* 14.3.2)

Sl No.	Conditioning Environment	Atmosphere	Temperature	Relative Humidity	Time for conditioning the pallets	Material
			°C	percent	h	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	C	Air	40 ± 2	—	24	Packaging waste with mixture of plastics and metalized plastics films based pallets
ii)	D	Air	25 ± 2	—	24	
iii)	E	Air	25 ± 5	90 ± 5	24 to 48	Packaging waste with mixture of paper, metalized paper and plastic

15 TESTS ON ASSEMBLED PALLETS

Pallets conforming to this standard shall be subjected to following tests:

15.1 Stacking Test Using Static Load

15.1.1 *Principle*

Stacking test using static load by placing on the pallet on a flat, horizontal surface and subjecting the test pallet to an evenly distributed load applied from above. The predetermined superimposed load is applied for a specified period of time at atmospheric condition. The top-to-bottom or the side-to-side deflection of the pallet during the test may be measured, if appropriate.

15.1.2 *Apparatus*

A horizontal flat surface (the difference in height between the highest and lowest points not exceeding 2 mm) and rigid. A concrete floor at least 150 mm thick is suitable.

15.1.3 *Procedure*

The test is carried out at atmospheric condition. Two number of test pallets are selected randomly from the lot of production of specified design and then placed on the horizontal flat surface (concrete floor) in such a way that there should not be any gap between any part of the bottom surface of the pallet and the concrete floor. A specified load based on the surface area of the pallet as stated in Table 4 are superimposed on the pallet where the load should be uniformly distributed to cover the entire surface area of both the pallets.

The super imposed load is applied for a period of 24 h or until collapse, whichever occurs earlier. It is also necessary to measure the dimensions of the pallet from top-to-bottom and side-to-side to assess the deflection of the pallet, if any during the test.

15.1.4 *Observation and Report*

After the completion of 24 hours, the superimposed load is removed from both the pallets and physical observations of the test pallets are taken. There should not be any kind of damage, crack or collapsing of any part of the pallet after the specified test period.

15.2 Vertical Impact Drop Test

15.2.1 *Apparatus*

Following arrangements and mechanisms shall be used for the test:

a) *Lifting Arrangement* — Lifting arrangement should be such that it will not damage the pallet during either lifting or release.
b) *Release Mechanism* — To release the pallet in such a way that its fall is not obstructed by any part of the apparatus before striking the impact surface.
c) *Impact Surface* — Horizontal and flat, massive enough to be immovable and rigid enough to be non-deformable under test.

Table 4 Superimposed Load Based on the Surface Area of Pallet

(*Clause* 15.1.3)

Sl No.	Type of Pallet	Dimensions (Length × Width)	Total surface area	Superimposed Load
		mm × mm	Square feet	kg
(1)	(2)	(3)	(4)	(5)
i)	A-1	1 500 × 600	10.0	5 000
ii)		1 500 × 900	15.0	7 500
iii)		1 200 × 600	8.0	4 000
iv)		1 200 × 900	12.0	6 000
v)	A-2	1 500 × 600	10.0	3 000
vi)		1 500 × 900	15.0	4 500
vii)		1 200 × 600	8.0	2 400
viii)		1 200 × 900	12.0	3 600
ix)	B	1 200 × 600	8.0	2 400
x)		1 200 × 900	12.0	3 600

15.2.2 *Procedure*

The test shall be carried out in the atmospheric conditions where the pallet is to be clamped in the fabricated clamping device in such a way that the pallet would remain in horizontal condition. The pallet is then lifted by means of lifting device at a height of 1 m and then release the pallet in such a way that it falls freely on a horizontal, immovable, rigid surface to allow to get vertical impact on the pallet. Three drops are carried out on the same pallet by following the same procedure.

15.2.3 *Observation and Record*

After three drops on the same pallet, there should not be any kind of damages or appearance of any crack on the pallet.

15.3 Corner Drop Test

15.3.1 *Purpose*

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

15.3.2 *Procedure*

Drop the pallet, vertically, with related diagonal AB as shown in Fig. 9, freely on to the corner from a height (*H*) of 0.5 m, onto a flat, hard, rigid, horizontal impact surface. Carry out the drop two times from a height (*H)* of 0.5 m. The first drop from the corner of A and the second drop from the diagonal corner of point B.

15.3.3 *Deformation Measurements*

The test is conducted in accordance with the prescribed methods given in **15.3.2**. The length of diagonal "Y" (distance between A and B) (*see* Fig. 9) shall be measured before the first drop as well as after the second 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 "Y" is measured) shall each be appropriately 40 mm from the respective corners.

15.3.4 *Observation and Record*

After the second drop, the observation will be taken. The corner point may slightly be dented but there should not be opening up any nail leading to dismantling of the pallet. In addition, the deviation of "Y" (distance between A and B point) should not be more than 40 mm from the original length of "Y".

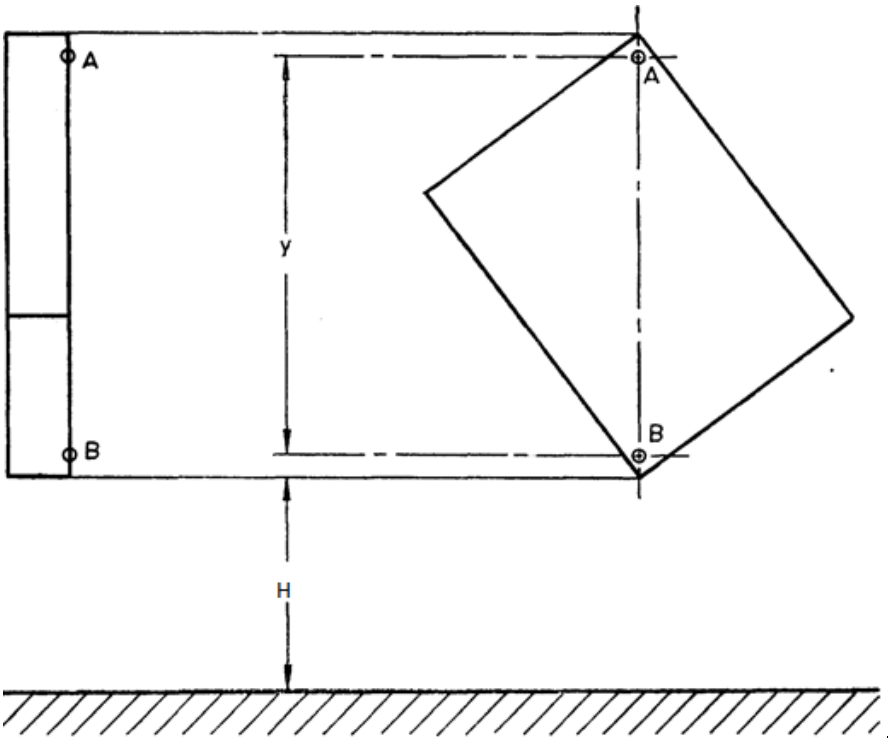


FIG. 9 CORNER DROP TEST

15.4 Hammer Test

15.4.1 *Apparatus*

A metallic plate of the size equivalent to the dimensions of different types of pallet (length × width) is having the dead weight of 60 kg. The metallic plate is to be lifted by means of a lifting device with release mechanisms as follows:

a) Lifting arrangement should be such that it will not damage the pallet during either lifting or release; and
b) Release mechanism should be there to release the metallic plate over the pallet in such a way that the plate falls by covering the entire surface area of the pallet.

15.4.2 *Procedure*

The packaging waste based pallet of a specified dimension is placed on a horizontal rigid surface (concrete floor) to ensure that there should not a gap of more than 2 mm between the pallet and the concrete floor. The metallic plate is lifted with the help of the lifting device and adjusted to the drop height of 6 feet from the top surface of the pallet. Subsequently, the metallic plate is dropped on the top surface of the pallet to allow the impact throughout the surface of the pallet.

15.4.3 *Observation and Record*

After removing the metallic plate, the physical observations of the pallet are to be taken from all faces. The pallet should not break or crack or deformed, even no nail or screw shall come out from the pallet for such test.

15.5 Load Bearing Test

15.5.1 *Apparatus*

Jute bags or plastic woven sacks of specified sizes of having 50 kg capacity, filled with dummy materials equivalent to the density of food grains are used for conducting this tests.

15.5.2 *Procedure*

At random 8 to 10 jute bags or plastic woven sacks of each 50 kg weight are filled with dummy materials equivalent to the density of food grains are to be dropped one after another from a height of 6 feet upon a fabricated recycled packaging waste pallet horizontally which would be placed on solid and even floor.

15.5.3 *Observations and Record*

The pallet shall withstand the impact of load and it shall not break or crack or deformed. No screw shall come out from the pallet from such load.

16 Routine Tests

Every pallet made from packaging waste, after assembling shall be tested and inspected visually as routine tests for the following parameters:

a) Construction;
b) Dimensions;
c) Design;
d) Workmanship; and
e) Finish.

17 ACCEPTANCE TEST

17.1 Physical Tests on Top and Bottom Member (Plank)

Sl No.	*Tests*	*Test Method*	*Requirement*
(1)	(2)	(3)	(4)
i)	Density (kg/m^3)	Annex A	900 to 1 100

17.2 Mechanical Tests on Top and Bottom Member (Plank)

Sl No.	*Tests*	*Tests Method*	*Minimum Requirement*
(1)	(2)	(3)	(4)
i)	Tensile stress at proportional limits (kg/cm^2)	Annex B	1 000
ii)	Tensile stress at maximum load (kg/cm^2)	Annex B	1 100
iii)	Modulus of elasticity in tension parallel to grain (kg/cm^2)	Annex B	14 000
iv)	Falling impact strength, minimum height of fall (cm)	Annex C	125
v)	Compression parallel to surface test (*Min*), (kg/cm^2)	Annex D	150

17.3 Chemical Tests on Top and Bottom Member (Plank)

Sl No.	*Tests*	*Test Method*	*Requirement*
(1)	(2)	(3)	(4)
(i)	Moisture (percent, *Max*)	Annex E	10 %
(ii)	Water absorption 2 h (percent, *Max*)	Annex F	5 %
(iii)	Water absorption 24 h (percent, *Max*)	Annex F	9 %
(iv)	Acidity and alkalinity resistance test	Annex G	Passes the test The plank shall not show any visible damage that is, blister, delamination, crack, softening or any remaekable change in colour or lustre in order to pass the "acidity and alkalinity resistance test".

17.4 Performance Tests on Assembled Dunnage Pallets

Sl No.	*Test*	*Test Method*	*Requirement*
(1)	(2)	(3)	(4)
i)	Stacking test using static load	**15.1**	No damage or crack or collapsing of any part of the pallet should be observed
ii)	Vertical impact drop test	**15.2**	No damage or appearance of any crack should be observed
iii)	Corner drop test	**15.3**	The diagonal corner point may slightly be dented but there should not be opening up any nail leading to dismantling of the pallet and the distance between two diagonal corner point should not be more than 40 mm from the original length between these two corner points
iv)	Hammer test	**15.4**	No breakage or crack or deformation and even no nail or screw shall come out from the pallet
v)	Load bearing test	**15.5**	No breakage or crack or deformation and even no nail or screw shall come out from the pallet

18 SAMPLING FOR TESTS

18.1 For Tests on Top and Bottom Members (Plank)

One out of every 500 dunnage pallets of the same type shall constitute the sample and shall be picked up at random from the stock of assembled dunnage pallets that has already been subject to the production routine tests.

18.2 For Tests for Assembled Dunnage Pallet

The number of samples shall be agreed to between the purchaser and manufacturer.

19 DELIVERY

Unless otherwise specified, the pallets should be delivered in a complete assembled form.

20 MARKING

20.1 Each poly-pallet shall be clearly marked with the following:

a) Manufacturer’s name or identification mark;
b) Month and year of the manufacture; and
c) Batch number.

20.2 BIS CERTIFICATION MARKING

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

ANNEX A

(*Clause* 17.1)

DETERMINATION OF DENSITY OF PLANK MATERIAL

A-1 WEIGHING AND MEASURING OF WHOLE PLANK

The width, length and thickness of each board shall be measured as given below. The mass shall be determined to an accuracy of ± 0.2 percent.

A-1.1 Length

The length of boards shall be measured to an accuracy of 2 mm at each edge of the board, 25 mm from the edge. Both measurements shall be recorded. The average for each board shall be reported separately.

A-1.2 Width

The width of boards shall be measured to an accuracy of 2 mm at each end, 25 mm from the end. Both measurements shall be recorded. The average for each board shall be reported separately.

A-1.3 Thickness

The thickness of boards shall be measured along the edges of the boards to an accuracy of ± 0.1 mm, measurements being taken 25 mm from the edge. Each measurement, and the average of all measurements for each board shall be recorded.

A-1.4 The contacting surfaces of the measuring instrument shall be flat and shall have a diameter of at least 6 mm and care shall be taken that the surfaces of the board are not deformed when the thickness is measured.

A-2 TEST SPECIMEN

The specimens shall be of the full thickness of the material and shall be 75 mm wide and 150 mm long. Smaller specimens may be used when deemed necessary. When the moisture content of test specimens of any other test is required, the same shall be determined from a coupon cut as near the failure of the specimen, as possible, and shall be of the maximum possible size available from the same. When for any reason additional determination of moisture content are required, separate samples shall be prepared from the same material as is used in preparing the test specimens. The test shall be carried out immediately after cutting the specimen. The width, length and thickness of each specimen shall be measured to the accuracy given in **A-1**. The specimen shall be weighed correct to ± 0.2 percent.

A-3 PROCEDURE

The dimension of each test specimen shall be measured to an accuracy given in **A-1** and each specimen shall be weighed to an accuracy of 0.2 percent.

A-4 CALCULATION AND REPORT

The density of each plank or test specimen shall be calculated as follows and the moisture content reported:

$$\text{Density} = \frac{\text{Mass of board or test specimen in g}}{\text{Length (mm)} \times \text{Width (mm)} \times \text{Mean thickness (mm)}} \times 10^6 \text{ kg/m}^3$$

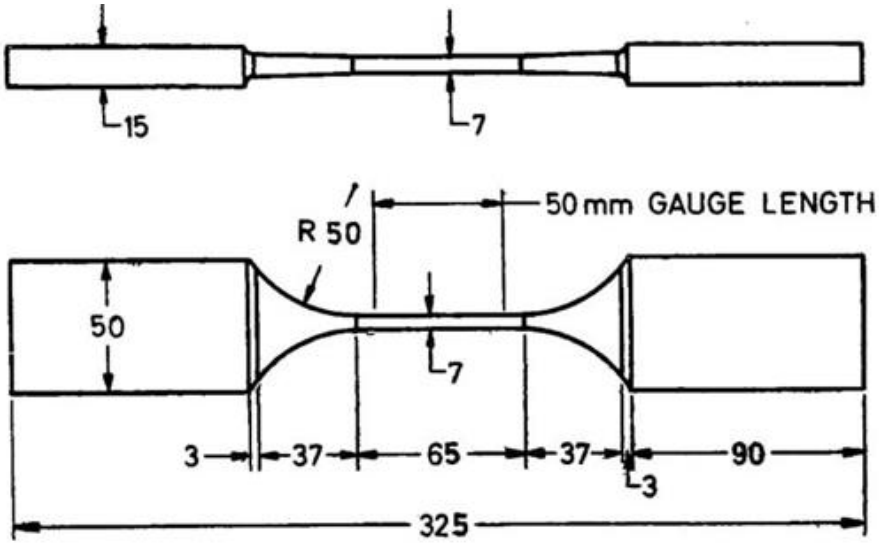
ANNEX B

(*Clause* 17.2)

DETERMINATION OF TENSILE STRENGTH PARALLEL TO GRAIN

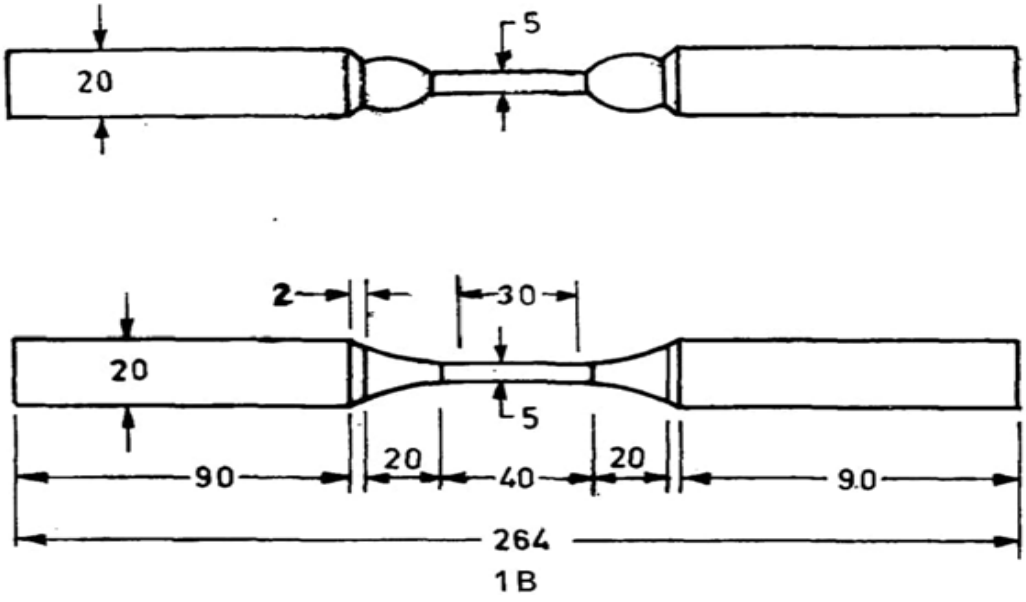
B-1 TEST SPECIMEN

The test specimen for the two sizes shall have the shape and size as shown in Fig. 10 and Fig. 11. The cross-section of the central portion of the specimen shall be 7 mm × 7 mm or 5 mm × 5 mm for the specimen in Fig. 10 and Fig.11 respectively. The gauge length shall be 50 mm and 30 mm for the two sizes respectively. The annual rings on the ends shall be perpendicular to the greater cross sectional dimension in case specimen described in Fig. 10.



All dimensions are in millimetres.

FIG. 10 TEST SPECIMEN FOR TENSION PARALLEL TO GRAIN



All dimensions are in millimetres.

FIG. 11 TEST SPECIMEN FOR TENSION PARALLEL TO GRAIN

B-2 PROCEDURE

B-2.1 Placing of the Specimen

The test shall be conducted on any testing machine provided with suitable types of grips to hold the specimen firmly without any slip during the test. The specimen shall be held firmly in the grips and the suitable elongation measuring device shall be attached to the gauge length.

B-2.2 Rate of Loading

The load shall be applied continuously during the test such that the movable head travels at a constant rate of one millimeter per minute for both sizes.

B-2.3 Measurement of Loads and Elongation

Elongation shall be measured correct to 0.002 mm at suitable load intervals such that 8 to 10 readings are available up to limit of proportionality. Readings shall be continued well beyond the proportional limit and the final reading of load at failure shall be recorded. It would be preferable to remove the elongation measuring device before the maximum load is reached.

B-3 CALCULATION

Load elongation curves shall be drawn observing the rules explained in **4.1** of Part 5 of IS 1708. Load and elongation at proportional limit shall then be read.

The various characteristics shall be determined by the following formula:

Sl No.	*Characteristic*	*Unit*	*Formula*
(1)	(2)	(3)	(4)
i)	Tensile stress at proportional limits (TS at PL)	kg/cm^2	$\frac{P}{A}$
ii)	Tensile stress at maximum load (TS at ML)	kg/cm^2	$\frac{P'}{A}$
iii)	Modulus of elasticity in tension parallel to grain (M of E in tension)	kg/cm^2	$\frac{PL}{A(\Delta L)}$

where

P = load at the limit of proportionality, in kg;

A = cross-sectional area, in cm^2;

P' = maximum load to cause the failure of the specimen, in kg;

L = gauge length between extensometer points, in cm;

ΔL = deformation at the limit of proportionality, in cm.

ANNEX C

(*Clause* 17.2)

DETERMINATION OF FALLING HAMMER IMPACT STRENGTH

C-1 TEST SPECIMEN

The test specimen shall be 135 mm × 135 mm and shall be of thickness of the board. Each specimen shall be conditioned as specified in **2.2** of IS 2380 (Part I) and the thickness shall be measured to the first decimal place of millimeter.

C-2 PROCEDURE

The test specimen shall be clamped firmly between 2 frames made of 20 mm thick and 20 mm wide hardwood strips, by 8 bolts of 5 mm diameter placed at equal distances from the corner (*see* Fig. 12). This frame containing the specimen shall be held rigidly on 4 pillars at its corners. It may be noted that minimum internal length and width of the test specimen shall be 90 mm × 90 mm after clamping.

A block having a mild steel hemispherical end with a radius of 25 mm shall be arranged to fall freely on the center of the specimen by suitable means (*see* Fig. 13). The mass of the block together with any associated falling part shall be 4 kg. The block shall be allowed to fall first from a height of 25 mm measured from the upper surface of the specimen and then from successive heights rising in increments of 25 mm until final failure of the specimen occurs.

The failure of the specimen may take the form of a puncture or a visible fracture at the bottom of the specimen.

C-3 OBSERVATION AND REPORT

Height of drop causing the final failure in the specimen shall be recorded. The average height of drop for a particular type and thickness of the board shall be reported along with the mass of the hammer and the moisture content.

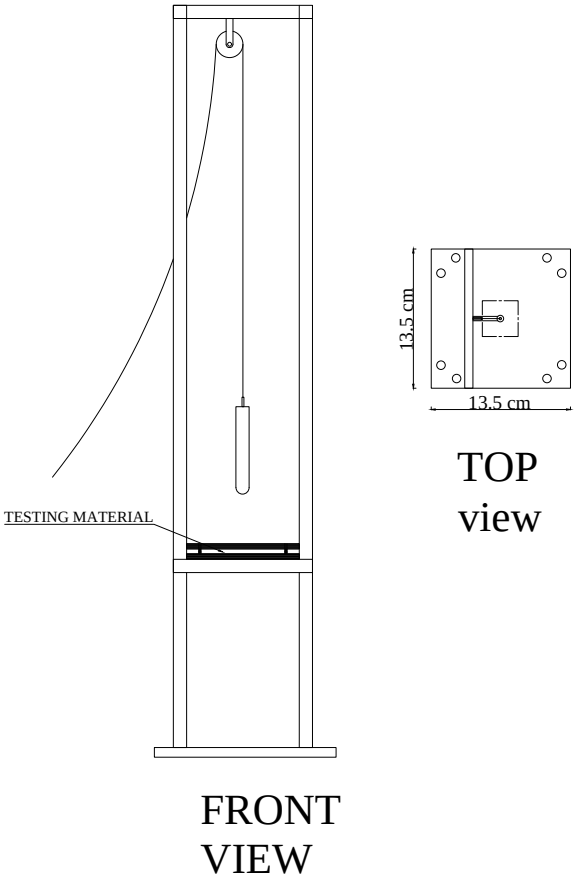


FIG. 12 DROP TEST EQUIPMENT WITH FRONT AND TOP VIEW

DROP TEST EQUIPMENT

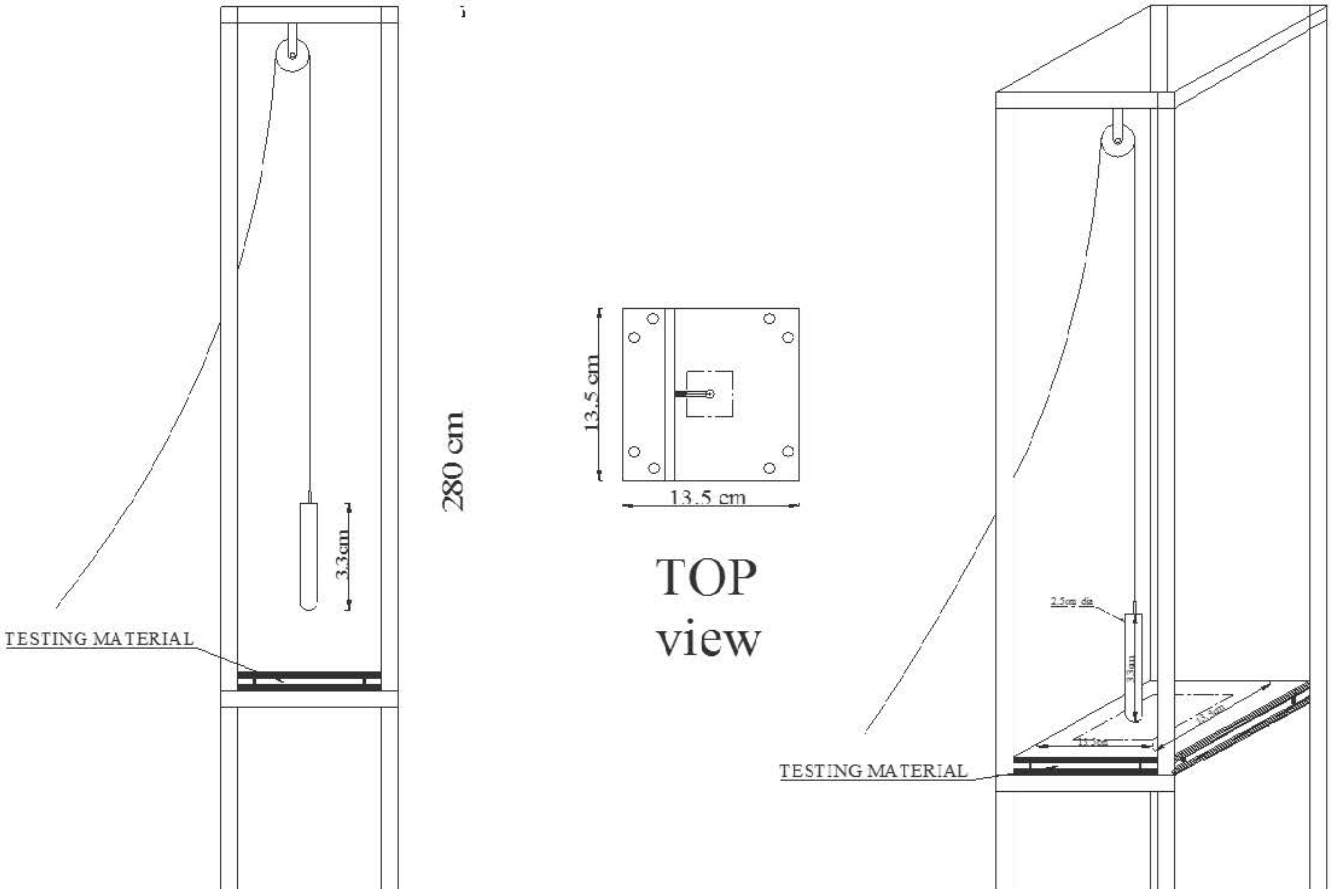


FIG. 13 DROP TEST EQUIPMENT WITH SIDE VIEW

ANNEX D

(*Clause* 17.2)

COMPRESSION PARALLEL TO SURFACE TEST

D-1 TEST SPECIMEN

The test specimen shall be 25 mm × 25 mm × 100 mm. If the thickness of the board is less than 25 mm, two or more thicknesses of the board shall be laminated by some epoxy resin as to give the thickness about 25 mm. While laminating, care shall be taken that the pressure should not be so high as to give any appreciable compression in the board. A pressure below 3.5 kgf/cm^2 is recommended. The specimen from the laminated board may be cut at least after 8 h of curing of the resin at room temperature. The specimen shall be conditioned as specified in **2.2** of IS 2380 (Part 1). The cross-section and the length shall be measured to an accuracy of 0.1 mm and mass shall be taken to an accuracy of 0.01 g. If the specimen is required to be tested under soaked condition it shall be submerged in water according to **2.3** of IS 2380 (Part 1). It may be noted that the length of few specimens shall be taken parallel to the long dimension and few perpendicular to long dimensions of the board to determine whether the material has any directional properties.

D-2 PROCEDURE

The specimen shall be compressed vertically in the direction of length (100 mm) by means of a spherical and self-aligning type loading block in a universal testing machine at a uniform rate of strain of 0.6 mm/min till a failure in the specimen is indicated. If load deformation readings are required the deformation shall be read correct to 0.002 mm by means of Lamb's roller compressometer or equally accurate instrument at equal increments of load. Increments of load shall be chosen so that about 12 to 15 readings may be obtained before elastic limit. Compressometer shall be attached at the central portion of the length and the gauge points shall be at least 2.5 cm from the ends of the specimens. From the load-deformation curve maximum load, and load and deformation at elastic limit shall be recorded.

D-3 REPORT

Maximum compressive stress, crushing stress at elastic limit and modulus of elasticity shall be calculated and reported along with the moisture percent and density determined according to IS 2380 (Part 3). The type of the failure shall also be described.

ANNEX E

(*Clause* 17.3)

DETERMINATION OF MOISTURE CONTENT

E-1 TEST SPECIMEN

The specimens shall be of the full thickness of the material and shall be 75 mm wide and 150 mm long. Smaller specimens may be used when deemed necessary. When the moisture content of test specimens of any other test is required, the same shall be determined from a coupon cut as near the failure of the specimen, as possible, and shall be of the maximum possible size available from the same. When for any reason additional determinations of moisture content are required, separate samples shall be prepared from the same material as is used in preparing the test specimens. The test shall be carried out immediately after cutting the specimen.

E-2 PROCEDURE

Each specimen shall be weighed to an accuracy of not less than ± 0.2 percent. The specimens shall then be dried in a ventilated oven at a temperature of (103 ± 2) °C until the mass is constant to ± 0.2 percent between two successive weighings made at an interval of not less than 1 hour.

E-3 CALCULATION AND REPORT

The moisture content, expressed as a percentage of the oven-dry mass, is given by the formula:

$$\text{Moisture content} = \frac{M1 - M0}{M0} \times 100$$

where

M_1 = initial mass; and

M_0 = oven-dry mass.

E-4 REPORT

The percentage moisture content of each test specimen and the average for each board shall be reported.

ANNEX F

(*Clause* 17.3)

DETERMINATION OF WATER ABSORPTION

F-1 TEST SPECIMEN

Each test specimen shall be 135 mm × 135 mm and shall be prepared and conditioned as per the procedure as given below. All the four edges shall be smoothly and squarely trimmed. The specimen shall be sealed by coating with wax or other suitable sealant materials on all the four edges of the specimen and then shall be submerged horizontally under 25 mm fresh clean water maintained at a temperature of (27 ± 2) °C.

F-2 CONDITIONING

The test specimen shall be exposed to an atmosphere maintained at a relative humidity of (65 ± 5) percent and a temperature of (27 ± 2) °C until their masses are constant.

F-3 PROCEDURE

F-3.1 Mass and Volume of Test Specimen

After conditioning, the specimen shall be weighed to an accuracy of not less than ± 0.2 percent and the width, length and thickness shall be measured to an accuracy of not less than ± 0.3 percent. The volume of the specimen shall be computed from these measurements.

F-3.2 Submersion in Water

The specimen shall be submerged horizontally under 25 mm fresh clean water maintained at a temperature of (27 ± 2) °C, the water being renewed for each test. The test specimen shall be separated by at least 15 mm from each other and from the bottom and sides of the container. After a 2 h submersion, the specimen shall be suspended to drain for 10 min, at the end of which time the excess surface water shall be removed and the specimen immediately weighed. The specimen shall then be submerged for an additional period of 22 h and the above weighing procedure repeated.

F-3.3 Moisture Content

After submersion, the specimen shall be dried in an oven at (103 ± 2) °C as in **2.2** of IS 2380 (Part 3) and the moisture content (based on oven-dry mass) calculated from the masses after conditioning and after 2 h and 24 h submersions.

F-3.4 Density

The density of the specimen shall also be determined by the method specified in **3** of IS 2380 (Part 3).

F-4 CALCULATION AND REPORT

The amount of water shall be calculated from the increase in mass of the specimen during the submersion, and the water absorption shall be expressed as the percentage of mass based on the mass after conditioning. The specific gravity of water shall be assumed to be 1.00 for this purpose. The density of the specimen shall also be reported.

ANNEX G

(*Clause* 17.3)

ACIDITY AND ALKALINITY RESISTANCE TEST

G-1 OBJECTIVE

The object of this test is to assess the resistance of composite board surface against mild acidic or alkaline reaction of the material.

G-2 PREPARATION OF SOLUTIONS FOR TEST

Dissolve 5 g of chemically pure glacial acetic acid in 100 g distilled water in a clean beaker stirring by a glass rod. This solution shall be termed as 5 percent acid solution.

Dissolve 1 g of pure sodium carbonate (anhydrous) in 100 g distilled water in a clean beaker stirring by a glass rod. This solution shall be termed as 1 percent alkaline solution.

G-3 TEST SPECIMEN

Four specimens of 75 mm × 75 mm size shall be prepared from each type of the composite sheet. These shall be preconditioned to a constant mass at a relative humidity of (65 ± 5) percent and at a temperature of (27 ± 2) °C.

G-4 PROCEDURE

All the 4 specimens shall be placed horizontally on separate tables. On the surface of two specimens about 2 ml of acid solution and on the surface of other two specimens about 2 ml of alkaline solution mentioned in G-2 shall be dropped. The wet part of the specimens shall be covered by a watch-glass for 6 h. After the lapse of 6 hours the specimen shall be washed with water and dried at a room temperature for 24 h. Care shall be taken that the specimens are properly marked for acidic and alkaline test. The affected surface shall be examined under oblique light for any blister, delamination, crack, softening and for any remarkable change in colour or lustre.

G-5 REPORT

Any visible damage, that is, blister, delamination, crack, softening or any remarkable change in colour or lustre shall be reported separately for acidic and alkaline tests.

ANNEX H

(*Foreword*)

COMMITTEE COMPOSITION

Transport Packages, Packaging Codes and Pallets Sectional Committee, TED 24

Organization	*Representative(s)*
In Personal Capacity (*IVY Tower, Nahar Amrit Shakti, Chandivali, Powai, Mumbai - 400072*)	DR N. C. SAHA **(*Chairperson*)**
Association of Multi Modal Transport Operators of India, Mumbai	SHRI ARUN KUMAR SHRI HARESH LALWANI (*Alternate*)
Central Warehousing Corporation, New Delhi	DR ANURAG TRIPATHI SHRI SIDHARTH RATH (*Alternate*)
Deekay Pine Board Private Limited, Gandhidham	SHRI ASHWINI KEDIA SHRI NAWAL KEDIA (*Alternate*)
Deluxe Recycling India Private Limited, Mumbai	SHRI JIGNESH SHAH
Federation of Corrugated Box Manufacturers of India, Mumbai	SHRI K. P. SINGH SHRI RAJKAMAL JINDAL (*Alternate*)
Food Corporation of India (FCI), New Delhi	DR RAJESH GULIA SHRIMATI VEMULA SRIDEVI (*Alternate*)
Futuristic Industries Pvt Ltd	SHRI AMIT VASHISHT SHRI ASHISH SINGLA (*Alternate*)
Indian Institute of Packaging, New Delhi	SHRI MADHAB CHAKRABORTY DR TANWEER ALAM (*Alternate*)
Indian Oil Corporation Limited, New Delhi	SHRI S. SANKARASUBRAMONI SHRI T. K. MUKHERJEE (*Alternate*)
ITC Limited, Kolkata	SHRI AJITH KUMAR DR KAMAL KUMAR TYAGI (*Alternate*)
Larsen and Toubro Limited, Mumbai	SHRI VIJAY V. BHANDARKAR
M/s Shyamal Chaterjee, Kolkata	SHRI SHYAMAL CHATERJEE
Newgen Specialty Plastic Limited, Noida	SHRI V. K. SINGH SHRI S. K. SINGH (*Alternate*)
Nilkamal Limited, Mumbai	SHRI A. K. KHARBANDA SHRI SURINDER SINGH (*Alternate*)
Omega Industries, Mumbai	SHRI JITENDRA SHAH
Sun Pharmaceutical Industries Limited, Mumbai	SHRI P. SRINIVAS NAIDU
The Shipping Corporation of India, Mumbai	SHRI R. Y. KAMATH SHRI KUNAL YASHRAJ (*Alternate*)
The Supreme Industries Limited, New Delhi	SHRI SANJAY MISHRA SHRI SHYAM JHA (*Alternate*)
Time Technoplast Limited, Mumbai	SHRI B. RAI
Vishakha Industries, Baddi	SHRI HARSH DOSHI SHRI ANKUR KAUSHIK (*Alternate*)
BIS Directorate General	SHRI P. V. SRIKANTH SCIENTIST 'D'/JOINT DIRECTOR AND HEAD (TRANSPORT ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI GAURAV JAYASWAL
SCIENTIST 'B'/ASSISTANT DIRECTOR
(TRANSPORT ENGINEERING), BIS

(*Continued from second cover*)

IS No./Other Standards	*Title*
ISO 15629 : 2002	Pallets for materials handling — Quality of fasteners for assembly of new and repair of used, flat, wooden pallets
ISO 18333 : 2014	Pallets for material handling — Quality of new wooden components for flat pallets
ISO 18334 : 2010	Pallets for material handling — Quality of assembly of new wooden pallets
ISO 18613 : 2014	Pallets for materials handling — Repair of flat wooden pallets

This revised standard has been modified by incorporating additional information under **3** and **4** of the existing standard. In addition, new clauses like **5** (Reprocessing and Sequence of Processing operation), **6** (Types of Composite Board), **7** (Types of Dunnage Pallets), **8** (Fasteners), **10** (Designs of Pallets), **11** (Dimension), **14** (Conditioning) and the detailed testing under **15**, **16** and **17** along with **18** (Sampling) are incorporated in line with standards of pallets.

The composition of the Committee responsible for the preparation of this standard is given in Annex H.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: TED 24 (21700).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Manakalya, 4th Floor, NTH Complex (W Sector), F-10, MIDC, Andheri (East), Mumbai 400093	283 25838

Branches : AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HARYNA, HUBLI, HYDERABAD, JAIPUR, JAMMU & KASHMIR, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PARWANOO, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VIJAYAWADA.

Published by BIS, New Delhi