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Pallets — Slip sheets

Palettes — Feuilles intercalaires

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12776 was prepared by Technical Committee ISO/TC 51, *Pallets for unit load method of materials handling*.

This first edition cancels and replaces ISO/TR 12776:1995 which has been technically revised.

Introduction

The system of slipsheet unit-load handling involves the use of a thin sheet of material, the slipsheet, as a base on which items are assembled as a unit load for handling, transport and storage. Slipsheets provide an alternative to the use of pallets for assembling, handling, transporting and sorting goods in unit-load form.

To use slipsheets, a conventional lift truck is equipped with a special attachment for gripping, pulling and pushing the slip-sheeted unit loads. The attachment may be permanent or removable depending on the application and circumstances. If all lift trucks in the distribution cycle are equipped with the proper attachment, a slipsheet is the only material-handling base required. Unit loads on slipsheet, may be lifted, stacked and then retrieved and handled as a single unit. The stacking height may be as high as five unit loads, depending on the strength of the packing. However, the slipsheet may also be used in conjunction with a pallet, if desired, at certain stages in the distribution cycle.

Originally developed in the United States, the slipsheet provides an inexpensive and lightweight unit-load base that occupies little shipping cube and is more easily disposed of than conventional pallets. If both the shipper and receiver have the appropriate equipment and other basic requirements are met, the full benefits of unitized load handling can be met using slipsheets.

Pallets — Slip sheets

1 Scope

This International Standard specifies slipsheets used for arranging commodities into a unit-load, and also for loading, unloading, transporting and storing unit-load commodities mainly handled by forklift trucks equipped with a push-pull device.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 445, *Pallets for material handling — Vocabulary*

ISO 527 (all parts), *Plastics — Determination of tensile properties*

ISO 1924-2, *Paper and board — Determination of tensile properties — Part 2: Constant rate of elongation method*

ISO 3676, *Packaging — Unit load sizes — Dimensions*

ISO 6780, *Flat pallets for intercontinental materials handling — Principal dimensions and tolerances*

3 Terms and definitions

For purposes of this document, the terms and definitions given in ISO 445 and the following apply.

3.1
corner cut-out
corner notch
corner configuration on two-**tab** (3.18) adjacent, three-tab and four-tab **slipsheets** (3.17)

NOTE The configuration may be a 90° cut-out, a diagonal cut-out or a slit.

3.2
corrugated fibreboard
board consisting of one or more sheets of fluted paper glued to a flat sheet of board or between several sheets

[ISO 4046-4:2002, definition 4.49]

3.3
cross direction
CD
direction perpendicular to the **machine direction** (3.10) in corrugated fibreboard and solid fibre **slipsheets** (3.17)

3.4
depth
slipsheet (3.17) dimension parallel to the direction of handling by a device such as a push-pull forklift

3.5
expendable slipsheet
slipsheet (3.17) intended to be discarded after a single cycle of use

3.6
frontage
slipsheet (3.17) dimension at right angles to the direction of handling by a device such as a push-pull forklift

3.7
laminated tab
tab (3.18) which has been reinforced with a layer of paper, plastic, cloth or similar material to the tab and **load surface** (3.9), allowing a portion to be under the unit load

3.8
length
slipsheet (3.17) dimension corresponding to the longer **load surface** (3.9) dimension

NOTE Length and width are not defined for square load surfaces.

3.9
load surface
portion of the **slipsheet** (3.17) under the unit load of goods or products

3.10
machine direction
MD
direction parallel to the direction of manufacture in corrugated fibreboard and solid fibreboard **slipsheets** (3.17)

3.11
maximum authorized freight mass
maximum load mass which the **slipsheet** (3.17) can endure while in service

3.12
nominal dimension
actual dimension of the **slipsheet** (3.17) including **load surface** (3.9) and **tabs** (3.18)

3.13
push-pull
mechanical, hydraulic or pneumatically powered attachment on an industrial truck used to retrieve or discharge a **slipsheet** (3.17) unit load

3.14
recyclable slipsheet
slipsheet (3.17) material which can be reprocessed

3.15
reusable slipsheet
slipsheet (3.17) intended for multiple cycles of use

3.16
score line
impression or crease in the **slipsheet** (3.17) material that is provided to locate and facilitate folding to create a **tab** (3.18)

3.17
slipsheet
rectangular, flat sheet of material with a **tab** (3.18) on one or more edges, used as a base for assembling, handling, storing or transporting goods and products in unit load form

3.18
tab
part or parts of a **slipsheet** (3.17) which extend beyond the unit load dimensions to facilitate handling by a **push-pull** (3.13) device equipped with a gripper jaw

3.19
thickness
caliper
vertical dimension through the **slipsheet** (3.17) material

3.20
width
slipsheet (3.17) dimension corresponding to the direction opposite to the **length** (3.8)

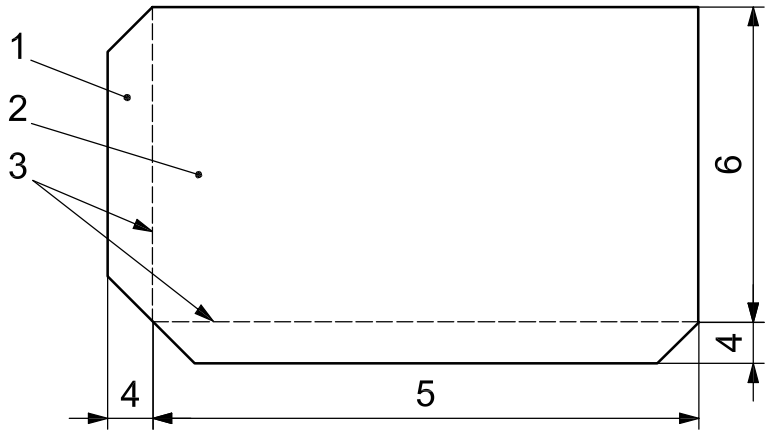
NOTE Length and width are not defined for square load surfaces.

3.21
width of a tab
depth of a **tab** (3.18) adjoining the longer or the shorter side of the **load surface** (3.9)

3.22
ultimate tensile strength
maximum resistance of the **slipsheet** (3.17) against a tensile load

4 Identification of parts

The names of parts of the slipsheet are shown in Figure 1.



Key
1 tab (3.18)
2 load surface (3.9)
3 score line (3.16)
4 width of a tab (3.21)
5 length (3.8)
6 width (3.20)

Figure 1 — Parts of a slipsheet (form shown is an example)

5 Type, classification and maximum authorized freight mass

5.1 Types

5.1.1 General

The types of slipsheets are described and shown in 5.1.2. to 5.1.5.

5.1.2 Type 1 — One-tab slipsheet

A one-tab slipsheet has a single tab at one side of the slipsheet. This type is used for loading and unloading a unit-load from the side. See Figure 2.

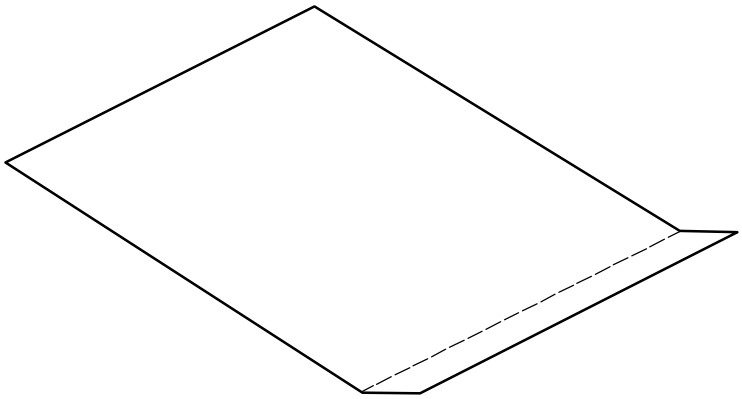


Figure 2 — One-tab slipsheet

5.1.3 Type 2 — Two-tab slipsheet

5.1.3.1 Type 2A — Two-tab slipsheet — Adjacent

A two-tab slipsheet — adjacent has two tabs located at adjacent sides of the slipsheet. This type is used for loading and unloading a unit-load from the adjacent sides. This type becomes useful when changing the orientation of rectangular unit loads during handling, storage and distribution. One of the tabs can be used as a spare if the other tab becomes disabled. See Figure 3.

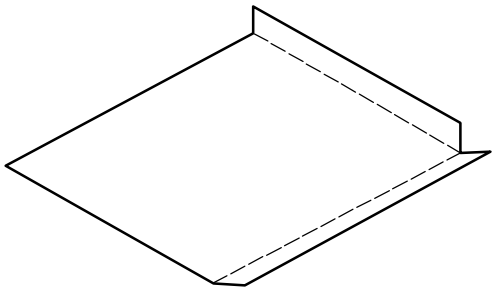


Figure 3 — Two-tab slipsheet — Adjacent

5.1.3.2 Type 2B — Two-tab slipsheet — Opposite

A two-tab slipsheet — opposite has two tabs located on opposite sides of the slipsheet. This type is used for loading and unloading a unit-load from the opposite sides. One of the tabs can be used as a spare if the other tab becomes disabled. See Figure 4.

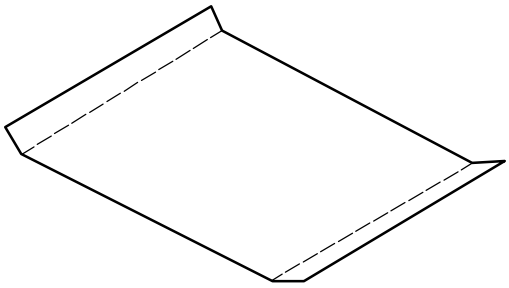


Figure 4 — Two-tab slipsheet — Opposite

5.1.4 Type 3 — Three-tab slipsheet

A three-tab slipsheet has three tabs located on three sides of the slipsheet. This type has the features of slipsheet types 2A and 2B combined. See Figure 5.

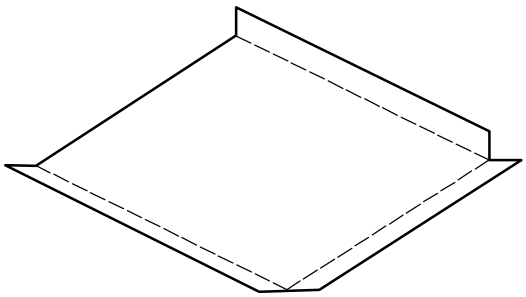


Figure 5 — Three-tab slipsheet

5.1.5 Type 4 — Four-tab slipsheet

A four-tab slipsheet has four tabs located on four sides of the slipsheets. This type has the features of slipsheet types 2A, 2B and 3 combined. It is also used to enclose and stabilize a loaded unit by folding all the tabs. See Figure 6.

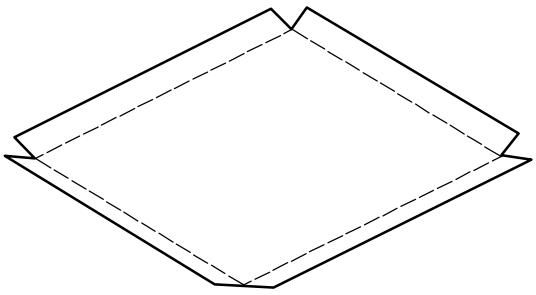
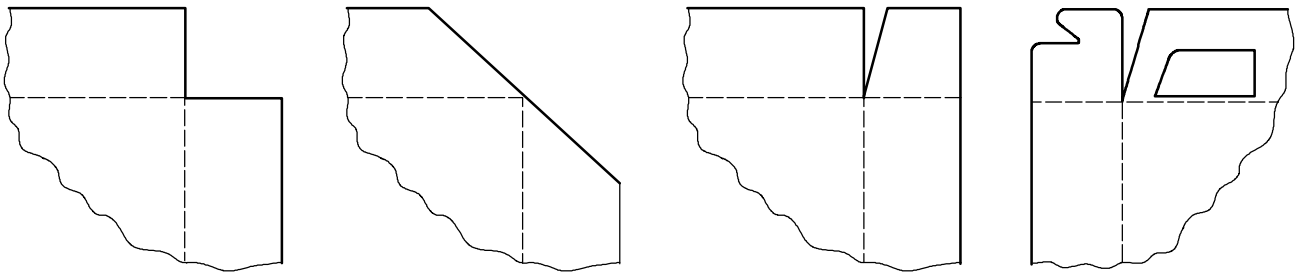


Figure 6 — Four-tab slipsheet

5.2 Corner profile of tab

5.2.1 General

Corner profiles of tabs are described in 5.2.2 to 5.2.5 and shown in Figure 7. The broken lines shown indicate score lines. Figure 2 shows examples of slipsheets with two adjacent tabs.



a) 90° corner-cut | b) Oblique corner-cut | c) Notched corner | d) Die-cut corner

Figure 7 — Examples of corner profiles of slipsheets with two adjacent tabs

5.2.2 90° corner-cut

This type is widely used and easy to make. Tabs can be folded independently, which is necessary to prevent tabs from being crushed or torn.

5.2.3 Oblique corner-cut

Many slipsheets belong to this type which reduces the possibility of damage to the adjacent tabs. The tabs of this type can be also folded independently.

5.2.4 Notched corner

This type is to be used by folding a tab and inserting it between the adjacent tab and the side of a unit load.

5.2.5 Die-cut corner

This type is to be used by locking tabs upward without taping or stapling.

5.3 Classification and symbol

The classification and symbols of the slipsheets are shown in Table 1.

Table 1 — Classification and symbol

Classification	Symbol	Remarks
Corrugated fibreboard slipsheet	C	Slipsheet in which corrugated fibreboard is used as its principal material
Solid fibreboard slipsheet	F	Slipsheet in which solid fibreboard is used as its principal material
Plastic slipsheet	P	Slipsheet in which plastic is used as its principal material

5.4 Maximum authorized freight mass

The maximum authorized freight mass of a particular slipsheet shall be either 500 kg, 1 000 kg, 1 500 kg or 2 000 kg.

6 Materials

6.1 Principal material

6.1.1 General

The principal material of a slipsheet is described in 6.1.2 to 6.1.5.

6.1.2 Corrugated fibreboard

Types of corrugated fibreboard are as follows:

a) one-sided corrugated fibreboard, also called single face;

b) double-sided corrugated fibreboard, also called single wall;

c) two-tiered-cores with three liners of corrugated fibreboard, also called double wall;

d) three-tiered-cores with four liners of corrugated fibreboard, also called triple wall.

The corrugations (also called medium) are classified into A, B, C, E, F, K and N flute according to the corrugation density of the core. The liners and corrugations may be further classified according to grammage as described in ISO 536. In order to obtain appropriate performance from the slipsheet under high humidity conditions, the liners or fibreboard should be treated or coated with a water-repellent treatment and may be glued to the core with a water-resistant adhesive. If a slipsheet requires more strength, textile threads may be inserted during its production stage. The threads will be placed according to the tensile direction.

6.1.3 Solid fibreboard

Solid fibreboard is made by laminating multiple layers of paperboards to obtain an appropriate tensile strength.

In order to obtain an appropriate performance from the slipsheet under high humidity conditions, the paperboards may be coated with a water-repellent solution, and then glued together with a water-resistant adhesive.

6.1.4 Plastics materials

The most common plastics materials used are polyethylene or polypropylene. However, other plastics materials can be used if they meet the requirements for tensile strengths and slip characteristics.

6.1.5 Other materials

Other materials can be used if they have an appropriate tensile strength and thickness. For example, a slipsheet of wood veneers covered with paper.

6.2 Anti-slip treatment

The slipsheet may be treated to prevent skidding and improve the characteristics for application and handling.

7 Dimension

7.1 Basic dimension

The basic dimension is the loading surface of a slipsheet which is equivalent to the plan-view size of a unit-load (which means the loading surface excluding tab dimension). The depth of loading and unloading

directions shall be $^{+50}_{0}$ mm, and the frontage width shall be $^{+50}_{-10}$ mm of the plan-view-size of the unit load. However, in the case of a slipsheet made with corrugated fibreboard or solid fibreboard, both the depth and the frontage width shall be $^{+50}_{0}$ mm.

7.2 Dimension of a unit-load

Use ISO 3676 and ISO 6780 as guidance for choosing an appropriate loading surface dimension.

7.3 Width of tab

The minimum and maximum width of a tab shall be 60 mm and 105 mm respectively.

7.4 Dimensional allowance

The dimensional tolerance of a slipsheet shall be within ± 7 mm of its user's specified dimensions.

7.5 Thickness of slipsheet

The minimum thickness of a slipsheet made with one of three commonly used materials is 0,6 mm.

8 Performance requirements

8.1 Tensile strength

8.1.1 General rules

A slipsheet used for a specific unit-load shall have enough tensile strength to avoid a breakage when a tab is properly held and a unit-load is properly pulled by a gripper.

NOTE Tensile strength cannot be considered as the only element to determine the performance of a slipsheet. The other elements including score lines, stiffness, moisture content, temperature and slipsheet construction interrelate with each other and affect the performance of the slipsheet. In general, slipsheets require high tensile strength because they are repeatedly handling heavy unit-loads by a push-pull device.

8.1.2 Tensile strength of corrugated fibreboard and solid fibreboard slipsheets

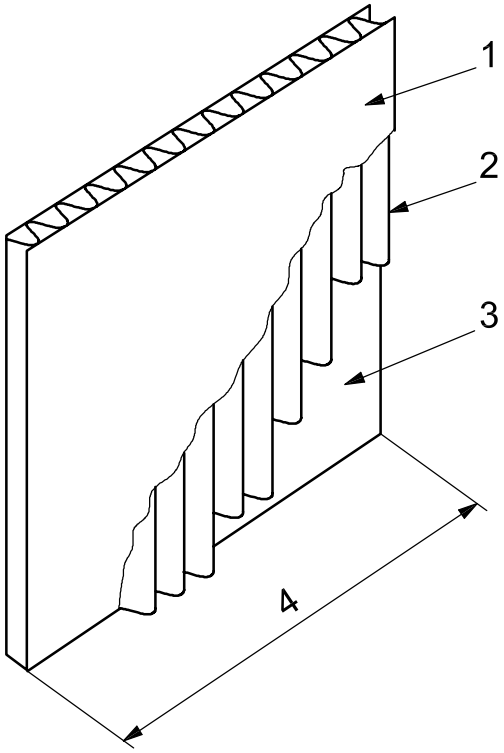
Corrugated fibreboard and solid fibreboard are anisotropic materials. They are typically stronger in tension in the machine direction as related to the manufacturing process. This is due to fibre alignment during manufacture. The **machine direction** (3.10) is shown for corrugated fibreboard in Figure 8.

The direction perpendicular to the machine direction is the cross direction. For slipsheet types 2A, 3, and 4 the tensile strength tests shall be conducted in both the **machine direction** (3.10) and **cross directions** (3.3).

8.1.3 The tensile strength of the direction perpendicular to the score line of a slipsheet

To test this characteristic, first a tab is bent along the score line upwards or downwards 90°, then the tensile load is applied in the direction horizontal to the loading surface of the slipsheet and perpendicular to the score line.

NOTE The test slipsheet should have a score line.



Key

1 outside liner
2 medium
3 inside liner
4 machine direction

Figure 8 —Corrugated fibreboard showing the machine direction relative to the flutes of the corrugation between the two liners

8.1.4 Measuring tensile strength

The test method for the plastic slipsheets shall conform to the requirements specified as a specific elongation method in ISO 527 (refer to the relevant part). The test method for corrugated fibreboard slipsheets and solid fibreboard slipsheets shall conform to the requirements specified as a specific elongation method in ISO 1924-2. The test result of the tensile strength of respective score line portion shall be according to Table 2 for each freight mass.

Table 2 — Tensile strength of each score line portion

Maximum authorized freight mass kg	**Minimum tensile strength** kN/m
500	10
1 000	20
1 500	30
2 000	40

8.2 Stiffness

To handle specific items such as bagged commodities or irregularly-shaped materials, the slipsheet shall have an appropriate stiffness in order to avoid a tab becoming extremely deformed and hampering a proper grip by a gripper. Generally, a higher stiffness can be obtained by increasing the thickness of the slipsheet.

8.3 Durability of tab

To ensure the tabs function throughout the distribution cycle of a unit load, carry out the following test.

Bend the tab along the score line from the horizontal position to the perpendicular position 15 times. Then conduct the tensile test according to ISO 1924-2. The test results shall be in compliance with Table 2.

8.4 Friction

It is desirable that the top surface (load surface) of the slipsheet has a higher coefficient of friction than the lower one. However, coefficient of friction depends on the surface conditions as well as whether the products are dry or wet.

8.5 Quality

a) Slipsheets shall have proper score lines. The score line portion should not be torn easily.

b) Slipsheets shall be free from damage or defects that are detrimental to practical use.

c) Tabs may have a corner-cut if necessary.

d) The cut surface and the corner of a slipsheet may be chamfered if necessary.

9 Designation of slipsheets

The slipsheets shall be designated according to:

— slipsheet name or number of this International Standard, i.e. ISO 12776:2008;

— type;

— classification or symbol;

— maximum authorized freight mass;

— size and width of a tab.

EXAMPLE 1 A single tab corrugated fibreboard slipsheet with a capacity of 1 000 kg and a load surface of 1 100 mm × 1 100 mm and a width of the tab 75 mm is designated by:

slipsheet type 1 corrugated fibreboard: ISO 12776:2008 1C 1 t (1 100 + 75) × 1 100

EXAMPLE 2 A double adjacent tab slipsheet with a capacity of 1 000 kg and a load surface of 1 140 mm × 1 140 mm and a width of the tab 75 mm is designated by

slipsheet type 2B plastic ISO 12776:2008 2B P 1 t(75 + 1 140 + 75) × 1 140

10 Marking

The following information may be marked on the slipsheet by using a marker that is not easily erased

a) Type, classification, maximum authorized freight mass, size and width of tabs, or their symbols.

b) Name of the manufacturer or its abbreviation.

c) Date of manufacturing or its abbreviation.

Annex A
(informative)

Guidance on the use of slipsheets

Forms and conditions of unit-load commodities	Slipsheet materials			
	Corrugated fibreboard	Corrugated fibreboard with laminated tabs	Plastics	Solid fibreboard
Heavy weight, wet	P	P	G	P
Heavy weight, dry	F	G	G	G
Light weight, wet	P	P	G	F
Light weight, dry	G	G	G	G
Frozen goods	F	F	G	G
Refrigerated goods	F	F	G	F
Bagged goods	F	F	G	G
Boxed or cased products, dry	G	G	G	G
Crated goods	G	G	G	G
Steel or fibreglass drums	P	P	G	G
Bulk bins	G	G	G	G
Fibreboard slipsheets	G	G	G	G
Masonry products	P	P	G	F
Bales	P	P	G	G
Evaluation: G = Good, F = Fair, P = Poor				
NOTE The moisture content of a slipsheet affects its performance.				

Bibliography

[1] ISO 536, *Paper and board — Determination of grammage*

[2] ISO 4046-4, *Paper, board, pulps and related terms — Vocabulary — Part 4: Paper and board grades and converted products*

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