

Specification for

Potato storage boxes for mechanical handling

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Packaging and Freight Containers Standards Policy Committee (PKM/-) to Technical Committee PKM/14, upon which the following bodies were represented:

- British Fibreboard Packaging Association
- Forestry Commission
- Health and Safety Executive
- Institute of Trading Standards Administration
- Ministry of Agriculture, Fisheries and Food
- National Farmers' Union
- Potato Marketing Board
- Road Haulage Association Ltd.
- Timber Packaging and Pallet Confederation
- Timber Research and Development Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels;

- British Agricultural and Garden Machinery Association Ltd.
- North of Scotland College of Agriculture
- UK Softwood Sawmillers' Association
- United Kingdom Wood Processors' Association

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
1 Scope	1
2 Informative references	1
3 Definitions	1
4 Dimensions	2
5 Strength classes	3
6 Design	3
7 Performance	3
8 Test report	6
9 Marking	6
Annex A (normative) Bowing resistance test	7
Annex B (normative) Deck stiffness test	8
Annex C (normative) Diagonal racking test	9
Annex D (normative) Compression test	10
Annex E (informative) Design recommendations for potato storage boxes manufactured from wood and wood-based sheet materials	11
Annex F (informative) Guidance to users on the selection and safe use of potato storage boxes	12
Annex G (informative) Positive ventilation of potato storage boxes	14
Figure 1 — Convention for potato storage box component and box dimensions	2
Figure A.1 — An example of suitable test apparatus: bowing resistance test	7
Figure B.1 — Deck stiffness test apparatus	8
Figure C.1 — Examples of suitable diagonal racking test apparatus	9
Figure D.1 — An example of suitable test apparatus, full box compression test	10
Figure D.2 — Schematic diagram, corner post compression test	11
Figure D.3 — Corner post compression test, load centre position with single and double corner posts	11
Table 1 — Bowing resistance end test, maximum deflections	4
Table 2 — Deck stiffness test, maximum deflections	5
Table 3 — Diagonal rocking end test, maximum horizontal deflections	5
Table 4 — Diagonal racking side test, maximum horizontal deflections	5
Table D.1 — Load application rates and duration of load for boxes under test	12
List of references	Inside back cover

Foreword

This British Standard was prepared under the direction of the Packaging and Freight Containers Standards Policy Committee, at the request of the Potato Marketing Board. It is based on the findings of a research project sponsored jointly by the Department of Trade and Industry, materials suppliers, manufacturers and users.

BS 7611 is primarily concerned with ensuring that potato storage boxes, containing a nominal one tonne of potatoes, are sufficiently strong to withstand the loads and forces encountered when handled or when stacked. The height of block stacks in stores has risen over the years and potato storage boxes are currently stacked up to eight high.

Since the actual handling and stacking requirements may vary between users, three strength classes have been introduced, each related to a specific maximum safe stack height.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

Although this standard specifies general requirements for potato storage boxes and does not specify the materials of construction, it reflects the current position in that the tests have largely been developed using the most widely used type of box, that constructed from sawn wood. Certain of the test procedures reflect this, but in principle the test methods are applicable to all potato storage boxes, whatever the material and method of construction. The tests specified in Annex A, Annex B, Annex C and Annex D are prototype tests, conducted to determine whether the potato storage box design meets the appropriate requirements of the standard. It is essential therefore that test prototypes are manufactured using the same methods of construction as those to be used in normal production. Materials used for test prototypes should be of the lowest quality likely to be used in production.

The research project established that certain designs of sawn wood boxes in use at present may have difficulty achieving the performance requirements for the higher strength classes. Annex E therefore gives basic design guidance for boxes made from wood and wood-based sheet materials. Annex F contains guidance for users on the selection and use of potato storage boxes and Annex G provides information on the specific requirements for boxes to be used in positive ventilation systems.

1 Scope

This British Standard specifies dimensions and design requirements together with prototype tests and related performance requirements, for potato storage boxes having a tare weight of up to 150 kg, intended to contain a maximum of 1 150 kg¹⁾ of potatoes for short and long term storage and designed for handling by conventional fork lift truck handling systems, with or without box emptying mechanisms.

NOTE Potato storage boxes supplied in kit form are not within the scope of this standard.

2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this standard the following definitions apply.

3.1

baseboard

a board fastened directly below the bearers (see 3.3) to distribute the load more evenly into the box below when stacked.

NOTE A baseboard may sometimes be referred to as a “bottom deckboard”, the term used in the context of pallets.

3.2

batten

horizontal member fixed inside or outside the sides (see 3.17) or ends (see 3.9) of the potato storage box

3.3

bearer

horizontal base component, to which the deckboards (see 3.8) are fixed, which serves to permit fork entry

NOTE Typically the bearers are bolted to the corner posts (see 3.7).

3.4

block stacking

the vertical stacking (see 3.20) of potato storage boxes without recourse to intermediate shelves or rack beams, but with the stacked boxes restrained on at least one side and one end by adjacent stacks

3.5

bracing

diagonal members intended to give resistance to racking forces. These may be fixed singly ($\backslash$), or in pairs ($\wedge$), or double (X)

3.6

closeboarded

boards fastened in edge contact during box assembly allowing minimum air passage and light transmission

3.7

corner post

corner member placed in a vertical position intended to resist vertical load and act as a connecting member between side and end

3.8

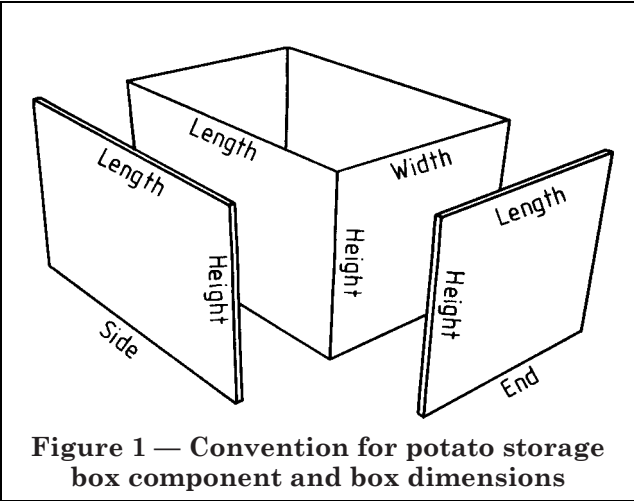
deck

the base of the potato storage box which supports the contents. Typically in wooden boxes it consists of a number of deckboards fastened directly above the bearers, usually spaced to allow ventilation, but it may be of sheet material

¹⁾ The potato storage boxes covered by the standard are normally referred to as “1 tonne” boxes but variations in the density of potatoes and the presence of soil may increase the mass of the contents above the nominal 1 t figure.

3.9
end

one of the two smaller vertical panels in a potato storage box. End width and height are given as overall external sizes including the base members. When assembled, the end length is known as the box width (see Figure 1)



3.10
height

the external vertical overall size, including the base

3.11
intermediate post

member placed in an intermediate vertical position usually mid-way in the side (see 3.17) of a box

3.12
nail bending strength

the bending moment measured in N m at the ultimate load sustained by the nail when tested in either 3 or 4 point bending configuration

NOTE Nail bending strength should not be confused with nail withdrawal resistance (see 3.13).

3.13
nail withdrawal resistance

the resistance of the shank to withdrawal from timber when load is applied axially to the nail. Measured in N/mm of penetration into timber

3.14
nail nominal diameter

for profiled or unprofiled section nails, the nominal diameter is the shank diameter of the unprofiled part of the nail (nail stock wire diameter)

3.15
oriented strand board (OSB)

three layered flakeboard in which the grain of the flakes in each of the layers is aligned, the orientation in the centre layer being across the board while the grain of the flakes in the surface layer lies parallel to the long axis of the board

3.16
racking

the forcing out of square of box sides or ends

3.17
side

one of the two longer vertical panels in a potato storage box. Side length and height are given as overall sizes including the base. When assembled the side length is known as the box length (see Figure 1). For square plan boxes, the side is the panel with the intermediate post (see 3.11), if fitted; if no intermediate post is fitted, then the side is defined as the panel below which fork lift entry is made

3.18
slatted box

a style of construction in which vertical or horizontal boards have distinct gaps between them, usually for ventilation purposes

NOTE Also known as open boarded or gapped.

3.19
tightboarded

boards wedged together during box assembly where relative board movement induced by racking (see 3.16) is restrained due to friction between the edges

3.20
vertical stacking

boxes of equal size superimposed upon each other with no interlocking between the boxes of adjacent stacks

4 Dimensions

4.1 Plan dimensions

The overall plan dimensions shall be one of the following.

Length of side		Width of end	Size code
1 830 mm	×	1 220 mm	A
1 830 mm	×	1 195 mm	B
1 805 mm	×	1 195 mm	C
1 525 mm	×	1 195 mm	D
1 290 mm	×	1 280 mm	E
1 270 mm	×	1 270 mm	F

The tolerances on the above sizes shall be ± 5 mm.
The difference between diagonals measured in plan shall be no greater than 15 mm.

4.2 Height

The maximum and minimum heights shall be stated as follows.

Size codes A, B and C 1 070 mm max.; 885 mm min.

Size code D 1 220 mm max.; 885 mm min.

Size codes E and F 1 270 mm max.; 885 mm min.

The tolerance on the stated nominal height shall be ± 5 mm.

4.3 Vertical dimensions related to handling by fork trucks

The base of the potato storage box shall be designed to allow the entry of forks on the two opposite sides only (two-way entry). The distance between the ground and the under surface of the deck shall not be less than 92 mm and not more than 155 mm.

5 Strength classes

Potato storage boxes shall be separated into three classes based upon performance as follows.

- a) *Class 8.* Suitable for up to 8 high stacking when filled. Class 8 boxes are also suitable for constant use in mechanical handling operations.
- b) *Class 6.* Suitable for up to 6 high stacking when filled. Class 6 boxes are not suitable for frequent use in mechanical handling operations, which involve tipping full boxes of potatoes, unless the box is clamped and racking movement limited.
- c) *Class 4.* Suitable for up to 4 high stacking. Class 4 boxes are not suitable for use in mechanical handling operations which involve tipping full boxes of potatoes, unless the box is clamped and racking movement eliminated.

6 Design

6.1 General

Potato storage boxes shall be designed to meet the contact requirements given in 6.2 and the performance requirements given in clause 7.

6.2 Contact between superimposed boxes

6.2.1 For classes 8 and 6 there shall be a minimum horizontal contact plan area between superimposed boxes of 0.91 % of the nominal plan area.

NOTE 1 The contact area requirement can be achieved by using four 50 mm $\times$ 100 mm section rectangular corner posts on the 1 830 mm $\times$ 1 195 mm plan size.

For Class 4, there shall be a minimum horizontal contact plan area of 0.68 % of the nominal plan area.

NOTE 2 The contact area requirement can be achieved by using four 50 mm $\times$ 75 mm section rectangular corner posts on the 1 830 mm $\times$ 1 195 mm plan size.

In calculating the contact area the following shall apply:

- a) intermediate posts designed to form fully supported columns throughout a stack shall have 50 % of their plan area taken into account;
- b) boards or sheet materials in sides or ends designed to make contact with the base of superimposed boxes, shall have 1 % of their area of contact taken into account.

6.2.2 The design shall ensure that, if a superimposed box is malpositioned in the horizontal plane by 20 mm in either the box length or width direction (not both), no more than one-third of the contact area specified in 6.2.1 is lost.

6.2.3 Any design incorporating special interlocking features shall still comply with the requirements of 6.2.1 and 6.2.2.

7 Performance

7.1 General

Prototype potato storage boxes shall be submitted to the tests described in Annex A to Annex C, in the following sequence:

- a) bowing resistance test (see Annex A);
- b) deck stiffness test (see Annex B);
- c) diagonal end racking test (see Annex C);
- d) diagonal side racking test (see Annex C).

NOTE The tests listed in a) to d) may be carried out on the same prototype.

A further prototype shall be subjected to either the full box compression test described in D.2.1 or the corner post compression test described in D.2.2, except that where the potato storage box has four or six continuous vertical posts and the manufacturer can produce documentary evidence of successful results from a compression test on boxes having the same number of vertical posts, of similar material and of the same or a smaller cross section, the test requirement is waived.