BS EN ISO 12625-9:2015

BSI Standards Publication

Tissue paper and tissue products

Part 9: Determination of ball burst strength

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National foreword

This British Standard is the UK implementation of EN ISO 12625-9:2015. It supersedes BS EN ISO 12625-9:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PAI/11, Methods of test for paper, board and pulps.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Papier tissue et produits tissue - Partie 9: Détermination de la résistance à l'éclatement, méthode à la balle (ISO 12625-9:2015)

Tissue-Papier und Tissue-Produkte - Teil 9: Bestimmung der Berstfestigkeit mit einem Durchstoßkörper (ISO 12625-9:2015)

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Foreword

This document (EN ISO 12625-9:2015) has been prepared by Technical Committee ISO/TC 6 “Paper, board and pulps” in collaboration with Technical Committee CEN/TC 172 “Pulp, paper and board” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2015, and conflicting national standards shall be withdrawn at the latest by August 2015.

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The text of ISO 12625-9:2015 has been approved by CEN as EN ISO 12625-9:2015 without any modification.

Contents

Page

Foreword

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The committee responsible for this document is ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement) in collaboration with by the European Committee for Standardization (CEN) Technical Committee CEN/TC 172, Pulp, paper and board.

This second edition cancels and replaces the first edition, ISO 12625-9:2005, which has been technically revised.

The following changes have been made:

— Clause 4 was reformulated;

— internal diameter of the two concentric rings was reduced to 50 mm;

— description of the procedure in Clause 9 was simplified;

— precision data in Annex A was added;

— editorial updating.

ISO 12625 consists of the following parts, under the general title *Tissue paper and tissue product*:

— *Part 1: General guidance on terms;*

— *Part 3: Determination of thickness, bulking thickness apparent bulk density and bulk;*

— *Part 4: Determination of tensile strength, stretch at maximum force and tensile energy absorption;*

— *Part 5: Determination of wet tensile strength;*

— *Part 6: Determination of grammage;*

— *Part 7: Determination of optical properties — Measurement of brightness and colour with D65/10° (outdoor daylight);*

— *Part 8: Water-absorption time and water-absorption capacity, basket-immersion test method;*

— *Part 9: Determination of ball burst strength;*

— *Part 11: Determination of wet ball burst strength;*

— *Part 12: Determination of tensile strength of perforated lines — Calculation of perforation efficiency;*

— *Part 15: Determination of optical properties — Measurement of brightness and colour with C/2° (indoor daylight);*

— *Part 16: Determination of optical properties — Opacity (paper backing) — Diffuse reflectance method*

Introduction

This part of ISO 12625 is applicable to tissue papers and tissue products. In principle, application to other paper types is possible, but not covered by this part of ISO 12625.

It is expressly stated that the detection of impurities and contraries in tissue and tissue products be applied according to ISO 15755.

For the determination of moisture content in tissue paper and tissue products, ISO 287 and ISO 638 are applied.

INTERNATIONAL STANDARD ISO 12625-9:2015(E)

Tissue paper and tissue products —

Part 9:
Determination of ball burst strength

1 Scope

This part of ISO 12625 specifies a test method for the determination of the resistance to mechanical penetration (ball burst strength procedure) of tissue paper and tissue products.

Currently, two types of clamping devices are available on the market with two different diameters, one is with 50 mm and one is with 89 mm (see Annex B). This part of ISO 12625 applies for a 50 mm clamping device to be able to measure all sample sizes of tissue paper and tissue products and to be consistent with ISO 12625-11.

2 Normative references

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

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 12625-1, *Tissue paper and tissue products — Part 1: General guidance on terms*

ISO 12625-6, *Tissue paper and tissue products — Part 6: Determination of grammage*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12625-1 and the following apply.

3.1
grammage
g
mass of a unit area of tissue paper or tissue product as determined by the procedure specified in ISO 12625-6

Note 1 to entry: The grammage is expressed in gram per square metre (g/m^2).

3.2
bursting force
F
maximum force that a test piece of tissue paper or tissue product can withstand under the test conditions, applied at right angle to its surface

Note 1 to entry: The bursting force is expressed in newton (N).

3.3
burst index
X
bursting force of tissue paper or tissue product divided by the grammage

Note 1 to entry: The burst index is expressed in newton square metre per gram ($N \cdot m^2/g$).

4 Principle

The test consists of measuring the resistance force of a highly polished stainless steel burst ball, moving at a constant speed, penetrating perpendicularly a tissue test piece that is clamped between the two concentric rings.

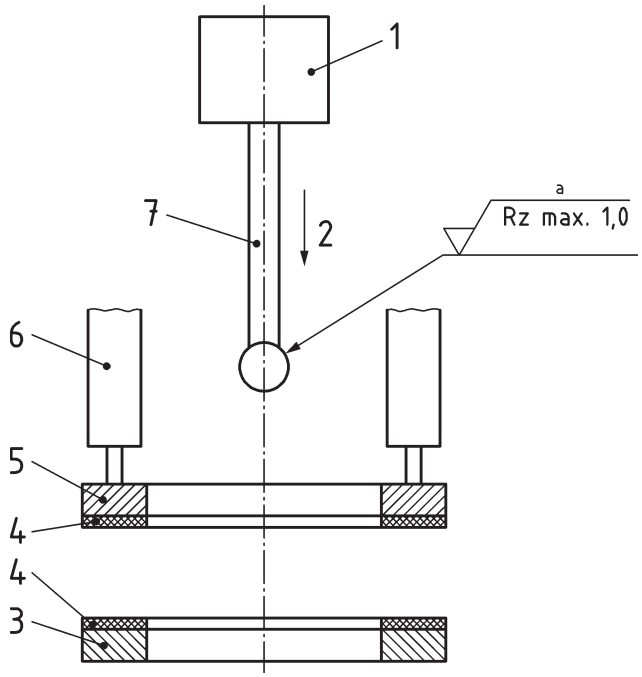
5 Apparatus

5.1 General

The apparatus shall be placed on a horizontal surface, free from externally induced vibrations.

5.2 Clamping system

The clamping system is designed to clamp the test piece firmly and uniformly between two concentric annular plane, parallel surfaces with same internal diameter. The clamping rings can be activated mechanically or pneumatically. The principle of the clamping system, using a pneumatic fixture is illustrated in Figure 1.



Key

1	load cell	5	movable ring
2	travel	6	pneumatic cylinder
3	stationary ring	7	probe
4	suitable band made of rubber (e.g. polychloroprene rubber)	a	polished stainless steel ball

Figure 1 — Principle of the clamping system, pneumatic fixture

The clamping pressure shall be sufficient to prevent slippage during the test while avoiding damaging the test pieces (e.g. including a weakness point near or under the clamping ring that could influence the results).

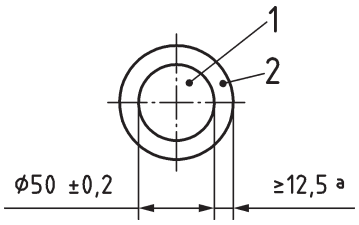
The clamping surfaces of the clamping rings shall be covered with a band made of a suitable commercial grade rubber material (e. g, polychloropren rubber), typically 1,0 mm to 2,0 mm thick having an IRHD hardness (International Rubber Hardness Degree) of 70 IRHD to 85 IRHD.

The inner edges of the annular rubber ring shall be coincident with the inner diameters of the clamping rings and the band shall be at least 12,5 mm wide.

The internal diameter of the two concentric rings shall be (50,0 ± 0,2) mm (see Annex B).

For the dimensions of the clamping system, see Figure 2.

Dimensions in millimetres



Key

1 test area

2 clamp ring covered with suitable material (e.g. polychloroprene rubber)

a suitable band made of rubber (e.g. polychloroprene rubber)

Figure 2 — Dimensions of the clamping system

5.3 Penetration system

The penetration (burst) system shall consist of a spherical ball permanently attached to the end of a hard solid rod designed to transmit force applied to the ball from the test piece. The penetration ball shall be made of highly polished stainless steel and shall have the following dimensions:

— diameter: (16 ± 0,2) mm;

— sphericity: better than 1 µm.

The penetration ball shall be centred with respect to the annular clamps. The diameter of the rod shall be smaller than the diameter of the ball.

5.4 Force-measuring system

The force-measuring system shall measure loads with an accuracy of ±1 % of the reading or ±0,1 N, whichever is greater and shall be calibrated and verified to conform to the requirements according to ISO 7500-1. The load cell system shall have a measuring range of 0,1 N to 50 N. The readout system shall have a display that shows the maximum force at burst.

5.5 Drive mechanism

The drive mechanism shall consist of a static uniaxial testing machine with a suitable mechanism for moving either the clamping system or the penetration system so that they approach each other at a constant rate in a direction perpendicular to the clamping system plane. The penetration test speed shall be (125 ± 5) mm/min.

6 Sampling

If the tests are being made to evaluate a lot, the sample shall be selected in accordance with ISO 186.

If the tests are being made on another type of sample make sure that the specimens taken are representative of the sample. Each test piece shall be free from perforations and faults not normally inherent in the tissue.

7 Conditioning

Condition the samples according to ISO 187 and keep them in the standard atmosphere throughout the test.

8 Preparation of test pieces

8.1 General

Test pieces shall be free of areas containing creases, dirt, or visible damage.

8.2 Preparation of test pieces

Test pieces shall be larger than the clamping area of the testing machine.

Prepare at least 10 test pieces of the sample conditioned as described in Clause 7.

The exact area of the portion of the specimen tested is defined by the inner diameter of the clamping system.

8.2.1 For converted tissue products, testing shall be done on the product as received, regardless of the number of plies which are supplied as a product unit. Generally, a single finished product sheet is suitable for use as a test piece.

8.2.2 Tissue that has not been converted into a finished product shall be tested as a single ply unless otherwise agreed between the parties concerned.

Toilet tissue is frequently produced in rolls of perforated sheets. In testing such toilet tissue it is convenient to remove a specimen consisting of three connected sheets. The outer two sheets should be used for moving the test piece into the clamping system, while the middle sheet is subjected to the test.

9 Procedure

9.1 Turn on the power of the testing machine at least 30 min prior to testing.

9.2 Clamp the conditioned test piece with its top side facing towards the burst ball without applying any tension to it. If the top side cannot be identified, ensure that the sample is clamped with the same side of all test pieces facing toward the burst ball.

9.3 Set the rate at which the penetration system and test piece approach each other to (125 ± 5) mm/min.

9.4 Activate the testing machine.

9.5 After rupture of the test piece by the penetration burst ball, record the maximum force as measured during the test to three significant figures. This value is the resistance to penetration (i.e. bursting force, F).

9.6 Perform the above sequence with the remaining pieces until 10 valid results are obtained.

10 Calculation

Determine the average value, $\bar{F}$, and the standard deviation of the resistance to penetration (bursting force) for the 10 test pieces tested.

Determine the burst index, *X*, expressed in newton square metres per gram, using Formula (1):

$$X = \frac{\bar{F}}{g} \tag{1}$$

where

$\bar{F}$ is the mean bursting force of the specimens, expressed in newton;

g is the grammage of the tissue, expressed in gram per square metre.

11 Test report

The test report shall include the following information:

a) a reference to this part of ISO 12625;

b) the date and place of testing;

c) the conditioning atmosphere used;

d) a complete identification of the sample tested and the sampling method used;

e) the results, expressed as average bursting force result ($\bar{F}$), reported in newton rounded to three significant figures;

f) the standard deviation of the 10 individual burst force results, reported to two significant figures, along with the maximum and minimum *F* values measured;

g) if required, the burst index *X* to two significant figures, expressed in newton square metres per gram;

h) the diameter of clamping ring;

i) any departure from this part of ISO 12625 and other circumstances that might have affected the test results.

Annex A
(informative)

Precision

A.1 General

In December 2009, an international interlaboratory test was performed on six converted tissue products by 10 different laboratories according to this part of ISO 12625 with a 50 mm clamp. In addition, an 89 mm clamping diameter was included in this interlaboratory test to compare the two settings.

The repeatability and reproducibility limits reported are estimates of the maximum difference which should be expected in 19 of 20 instances, when comparing two test results for material similar to those described under similar test conditions. These estimates might not be valid for different materials or different test conditions.

NOTE Repeatability and reproducibility limits are calculated by multiplying the repeatability and reproducibility standard deviations by 2,77, where $R = 1{,}96\sqrt{2} \cdot s$.

A.2 Ball burst 50 mm diameter clamp — Repeatability and reproducibility data

Table A.1 — Precision of repeatability data

Sample	Mean bursting force $\bar{F}$ N	Number of laboratories p	Repeatability standard deviation s_r N	Coefficient of variation $C_{V,r}$ %	Repeatability limit r N
household towel (type 1) 2 plies	9,36	10	1,02	10,92	2,83
bathroom tissue 2 plies	3,72	10	0,50	13,34	1,38
kitchen towel	5,29	10	0,69	13,12	1,92
bathroom tissue 4 plies	6,25	10	0,94	14,98	2,59
household towel (type 2) 2 plies	3,84	10	0,63	16,38	1,74
handkerchief 4 plies	6,44	10	0,77	11,99	2,14

Table A.2 — Precision of reproducibility data

Sample	Mean bursting force $\overline{F}$ N	Number of laboratories p	Reproducibility standard deviation s_R N	Coefficient of variation $C_{V,R}$ %	Reproducibility limit R N
household towel (type 1) 2 plies	9,36	10	1,28	13,67	3,55
bathroom tissue 2 plies	3,72	10	0,51	13,71	1,43
kitchen towel	5,29	10	0,68	12,86	1,88
bathroom tissue 4 plies	6,25	10	0,96	15,37	2,66
household towel (type 2) 2 plies	3,84	10	0,66	17,21	1,83
handkerchief 4 plies	6,44	10	0,87	13,50	2,40

A.3 Ball burst 89 mm diameter clamp – Repeatability and reproducibility data

50 mm and 89 mm diameter clamping settings have been compared during this interlaboratory test.

In this study, no significant differences between the two diameters in terms of average values as well as repeatability and reproducibility data were detected.

Table A.3 — Precision of repeatability data

Sample	Mean bursting force $\overline{F}$ N	Number of laboratories p	Repeatability standard deviation s_r N	Coefficient of variation $C_{V,r}$ %	Repeatability limit r N
household towel (type 1) 2 plies	9,14	10	1,06	11,61	2,94
bathroom tissue 2 plies	3,78	10	0,39	10,31	1,08
kitchen towel	5,77	10	0,58	9,97	1,59
bathroom tissue 4 plies	6,00	10	0,80	13,29	2,21
household towel (type 2) 2 plies	3,8	10	0,70	18,31	1,93
handkerchief 4 plies	5,99	10	0,66	11,09	1,84

Table A.4 — Precision of reproducibility data

Sample	Mean bursting force $\overline{F}$ N	Number of laboratories p	Reproducibility standard deviation s_R N	Coefficient of variation $C_{V,R}$ %	Reproducibility limit R N
house-hold towel (type 1) 2 plies	9,14	10	1,09	11,92	3,03
bathroom tissue 2 plies	3,78	10	1,19	11,38	1,19
kitchen towel	5,77	10	0,65	11,26	1,81
bathroom tissue 4 plies	6,00	10	0,83	13,83	2,29
household towel (type 2) 2 plies	3,81	10	0,72	18,89	1,99
handkerchief 4 plies	5,99	10	0,71	11,85	1,98

Annex B
(informative)

Adaptor

Current instruments on the market have clamp devices with inner diameters either of 50 mm or 89 mm. By using adaptors for the clamping system of 89 mm, the clamps can still be used for dry ball burst according to this part of ISO 12625.

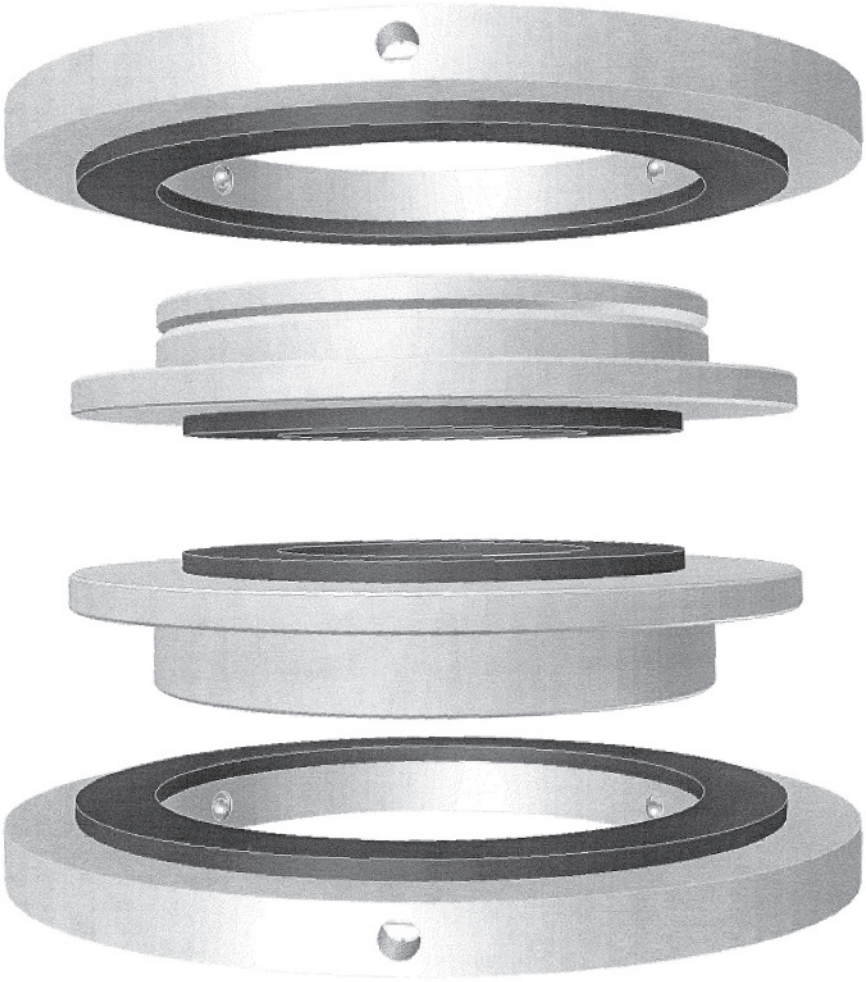


Figure B.1 — Example for reducing rings

Bibliography

[1] ISO 287, *Paper and board — Determination of moisture content of a lot — Oven-drying method*

[2] ISO 638, *Paper, board and pulps — Determination of dry matter content — Oven-drying method*

[3] ISO 12625-11, *Tissue paper and tissue products — Part 11: Determination of wet ball burst strength*

[4] ISO 15755, *Paper and board — Estimation of contraries*

[5] TAPPI T 570 pm–00, *Resistance to mechanical penetration of sanitary tissue parts (ball burst procedure)*

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