

INTERNATIONAL STANDARD



5651

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Paper, board and pulps – Units for expressing properties

Papiers, cartons et pâtes – Unités pour l'expression des propriétés

First edition – 1978-12-15

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 5651:1978](#)

<https://standards.iteh.ai/catalog/standards/sist/7c25b10e-cb7f-4ff8-8082-db0f7045c62d/iso-5651-1978>

UDC 676.1/7 : 620.1 : 53.081

Ref. No. ISO 5651-1978 (E)

Descriptors : papers, paperboards, paper pulps, tests, properties, units of measurement.

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5651 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in December 1976.

It has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	Romania
Austria	Hungary	South Africa, Rep. of
Belgium	India	Spain
Brazil	Iran	Sweden
Bulgaria	Ireland	Switzerland
Canada	Israel	Turkey
Chile	Italy	United Kingdom
Egypt, Arab Rep. of	Mexico	U.S.S.R.
Finland	New Zealand	
France	Norway	

No member body expressed disapproval of the document.

Paper, board and pulps – Units for expressing properties

iTeh STANDARD PREVIEW
(standards.iteh.ai)

0 INTRODUCTION

This International Standard deals with the application of the International System of Units (abbreviated to SI) within the field of paper, board and pulps.

The SI system of units has been adopted by ISO for use in its International Standards, and details of the SI system are given in the various parts of ISO 31 and in ISO 1000. Implementation of this policy is not always easy, however. For instance, some quantities can be expressed in different units, all within the SI system, and various multipliers can also be used. Such variations can lead to confusion in reporting test results and quoting values for properties.

In order to overcome such problems within its own area of activity, ISO/TC 6 has agreed on the units recommended for use in that area and its decisions are given in this International Standard.

1 SCOPE AND FIELD OF APPLICATION

This International Standard states the units recommended for use in expressing properties of paper, board and pulps.

Table 1 gives recommended units for use in connection with test methods which are already the subject of International Standards (or ISO Recommendations).

Annex A gives recommended units for use in connection with test methods which are at present under discussion within ISO/TC 6. It also includes certain other units, recommended for the expression of properties widely referred to in international technical exchanges, though not falling within the categories already mentioned.

Although the list of properties in table 1 and annex A cannot be regarded as comprehensive, it may be possible to determine the appropriate units for describing other properties by analogy with the units given in this International Standard.

Annex B lists ISO publications dealing with test methods for paper, board and pulps.

2 RECOMMENDED UNITS FOR PROPERTIES FORMING THE SUBJECT OF AN INTERNATIONAL STANDARD (OR ISO RECOMMENDATION)

The units recommended to express properties which form the subject of International Standards (or ISO Recommendations) are given in table 1. The names of the properties and quantities listed are given in an abbreviated form where this is easily understood.

Wherever practicable, the SI system of units is used. In a few instances where there is no satisfactory SI unit, units outside the SI system are quoted instead, though units permitted by ISO 1000 are used wherever possible.

In the majority of instances, a single unit is recommended to express a given property. However, for certain properties that show a wide range in numerical values, such as stiffness where a range in numerical values exceeding $10^6 : 1$ can be encountered, more than one recommended unit is given.

In combined units based upon special derived units, i.e. units for which special names exist, the units are not simplified where to do so might lead to confusion or unnecessarily obscure the principle of the test.

TABLE 1 — Recommended units for properties forming the subject of an International Standard (or ISO Recommendation)

No.	Property	Recommended units or method of expression	Reference number of relevant International Standard (or ISO Recommendation)
2.1	General properties		
2.1.1	Grammage	g/m ²	536, 3039
2.1.2	Thickness	μm, mm	534, 3034
2.1.3	Bulking thickness	μm	438
2.1.4	Swelling after water immersion	%	769
2.2	Strength properties		
2.2.1	Tensile strength	kN/m	1924, 3781
2.2.2	Breaking length	km	1924
2.2.3	Tearing strength	mN	1974
2.2.4	Bursting strength	kPa	2758, 2759, 3689
2.2.5	Burst index	kPa·m ² /g	2758, 2759
2.2.6	Puncture resistance	J, kJ	3036
2.3	Folding, bending and compression properties		
2.3.1	Static bending force	mN, N	2493
2.3.2	Flat crush resistance (corrugated board)	kPa	3035
2.4	Surface properties		
2.4.1	Roughness, Bendtsen ¹⁾	ml/min	2494
2.4.2	Roughness, Sheffield ¹⁾	Sheffield units	2494
2.5	Permeability and absorption properties		
2.5.1	Water vapour transmission rate	g/(m ² ·d)	2528
2.5.2	Water absorbency — area basis	g/m ²	535
	— mass basis	%	769
2.5.3	Air resistance (Gurley) ¹⁾²⁾	s	3687
2.6	Optical properties		
2.6.1	Reflectance factor	%	2469, 2470, 3688
2.6.2	Opacity	%	2471
2.7	Composition		
2.7.1	Moisture content (or dry matter content)	%	287, 638
2.7.2	Ash content	%	1762, 2144
2.7.3	Other major constituents	%	624, 692, 699, 3260
2.7.4	Other minor constituents	mg/kg	776, 777, 778, 779, 1830
2.7.5	Saleable mass	kg	801
2.7.6	Degree of delignification	%, numerical value	

1) Properties so designated are measured using tests which give results in dimensions different from those of the property itself. It is therefore necessary to give the method of measurement when stating test results.

2) When the Gurley method of determining resistance is next reviewed, it is proposed to change the name of the property measured to "air permeance, Gurley" and to standardize the unit of measurements to m/(Pa·s) and its multiples.

ANNEX A

RECOMMENDED UNITS FOR OTHER PROPERTIES

Recommended units for the expression of properties which, although not forming the subject of an International Standard (or ISO Recommendation) are at present under discussion within ISO/TC 6, are given in table 2. This table also includes certain other units commonly encountered in test methods for paper, board and pulps and widely referred to in international technical exchanges in that field.

Apart from the basis on which properties are selected for inclusion in the table, the comments and explanations concerning table 1 that are given in clause 2 also apply to table 2.

TABLE 2 — Recommended units for other properties

No.	Property	Recommended units or method of expression	Relevant ISO document reference
A.1	General properties		
A.1.1	Apparent density	g/cm ³	ISO 6/2/10 N 6 and N7
A.1.2	Hygroinstability	%	ISO 6/2 N 618
A.1.3	Hydroinstability	%	ISO 6/2 N 617
A.1.4	Drainability of pulp "CSF" and Schopper-Riegler	numerical value	ISO 5267
A.1.5	Dirt and shives	10^2 (number of specks) kg	ISO 5350
A.2	Strength properties		
A.2.1	Tensile index	N·m/g	
A.2.2	Stretch at rupture	%	
A.2.3	Tensile energy absorption	J/m ²	
A.2.4	Tensile energy absorption index	mJ/g	
A.2.5	Tear index	mN·m ² /g	
A.2.6	Adhesion strength of glue bonds of corrugated fibreboard	kN/m	
A.2.7	z-direction strength properties	kPa kN/m J/m ² } as appropriate	
A.3	Folding, bending and compression properties		
A.3.1	Bending stiffness	μN·m, mN·m, N·m	
A.3.2	Fold number : double fold	numerical value	
A.3.3	Folding endurance	log ₁₀ (number of folds)	ISO 5626
A.3.4	Flat crush resistance of laboratory fluted corrugating medium (CMT method)	N(CMT) ¹⁾	
A.3.5	Ring crush	kN/m	
A.3.6	Edgewise compressive strength	kN/m	ISO 3037
A.4	Surface properties		
A.4.1	Roughness, general	μm	
A.4.2	Smoothness, Bekk ²⁾	s	ISO 5627
A.4.3	Picking velocity, IGT	mm/s, m/s	ISO 3782, ISO 3783
A.5	Permeability and absorption properties		
A.5.1	Air permeance, general	m/(Pa·s)	
A.5.2	Air resistance	Pa·s/m	
A.5.3	Ink absorbency, "K and N" ²⁾³⁾	"K and N" units	
A.5.4	Capillary rise	mm	

1) CMT stands for Concora Medium Test.

2) Properties so designated are measured using tests which give results in dimensions different from those of the property itself. It is therefore necessary to give the method of measurement when stating test results.

3) "K and N" units are specific units relating to ink absorbency, being the fall, expressed as a percentage, in the reflectance of the test area. K and N units are not intended to represent the units used for the measurement of temperature and force respectively.

TABLE 2 — Recommended units for other properties (concluded)

No.	Property	Recommended units or method of expression	Relevant ISO document reference
A.6	Optical properties		
A.6.1	Gloss	% or numerical value	
A.6.2	Reflection (optical) density	numerical value only	
A.6.3	Transmission (optical) density	numerical value only	
A.6.4	Light absorption power	numerical value only	
A.6.5	Light scattering power	numerical value only	
A.6.6	Light absorption coefficient	m ² /kg	
A.6.7	Light scattering coefficient	m ² /kg	
A.7	Electrical properties		
A.7.1	Surface resistivity	Ω	
A.7.2	Volume resistivity	Ω·m	
A.7.3	Electric strength	kV/mm	
A.7.4	Electrical conductivity of extracts ¹⁾	μS/m	
A.8	Composition		
A.8.1	Constituents other than moisture or ash	g/m ² , mg/kg, g/kg, %	ISO 4119
A.9	Other quantities		
A.9.1	Linear dimensions	nm, μm, mm, m, km	
A.9.2	Wavelength (optical)	nm	
A.9.3	Mass	μg, mg, g, kg, t	
A.9.4	Time	μs, ms, s, min, h, d	
A.9.5	Area	mm ² , cm ² , m ²	
A.9.6	Volume	mm ³ , cm ³ , dm ³ , m ³	
A.9.7	Volume of fluids	the units shown for A.9.6 above, or alternatively μl, ml, l	
A.9.8	Dynamic viscosity	mPa·s, Pa·s	
A.9.9	Surface tension	mN/m	
A.9.10	Pressure, stress	Pa, kPa, MPa	
A.9.11	Frequency	Hz	
A.9.12	Rotational frequency	s ⁻¹ , r/s	
A.9.13	Plane angle	° (with decimal sub-division)	ISO 5263
A.9.14	Linear load	kN/m	
A.9.15	Temperature	° C, K	
A.9.16	Colour temperature	K	
A.9.17	pH	numerical value	ISO 6/5 N 545
A.9.18	Limiting viscosity number	ml/g	ISO 5351

1) If the units given are not appropriate, suitable SI units should be used.

ANNEX B

ISO PUBLICATIONS DEALING WITH TEST METHODS FOR PAPER, BOARD AND PULPS

- ISO 287, *Paper and board – Determination of moisture content – Oven-drying method.*¹⁾
- ISO/R 302, *Determination of the Kappa number of pulp (degree of delignification).*²⁾
- ISO/R 438, *Method for the determination of the bulking thickness and bulk of paper.*
- ISO/R 534, *Determination of the thickness of single sheets of paper.*
- ISO 535, *Paper and board – Determination of water absorption – Cobb method.*
- ISO 536, *Paper and board – Determination of grammage.*
- ISO 624, *Pulps – Determination of dichloromethane soluble matter.*
- ISO 638, *Pulps – Determination of dry matter content.*¹⁾
- ISO 692, *Pulps – Determination of alkali solubility.*
- ISO 699, *Pulps – Determination of alkali resistance.*
- ISO 769, *Fibre building boards – Hard and medium boards – Determination of water absorption and of swelling in thickness after immersion.*
- ISO 776, *Pulps – Determination of acid insoluble ash.*
- ISO/R 777, *Pulps – Determination of calcium content.*
- ISO/R 778, *Pulps – Determination of copper.*²⁾
- ISO/R 779, *Pulps – Determination of iron.*
- ISO 801, *Pulps – Determination of saleable mass in lots – Part I : Pulp baled in sheet form.*¹⁾
*Part II: Pulp (such as flash-dried pulp) baled in slabs.*¹⁾
- ISO 1762, *Pulps – Determination of ash.*
- ISO/R 1830, *Pulps – Determination of manganese.*²⁾
- ISO 1924, *Paper and board – Determination of tensile strength.*
- ISO 1974, *Paper – Determination of tearing resistance.*
- ISO 2144, *Paper and board – Determination of ash.*
- ISO 2469, *Paper, board and pulps – Measurement of diffuse reflectance factor.*
- ISO 2470, *Paper and board – Measurement of diffuse blue reflectance factor (ISO brightness).*
- ISO 2471, *Paper and board – Determination of opacity (paper backing) – Diffuse reflectance method.*
- ISO 2493, *Paper and board – Determination of stiffness – Static bending method.*
- ISO 2494, *Paper and board – Recommended procedure for the determination of roughness – Constant-pressure air-flow method.*
- ISO 2528, *Sheet materials – Determination of water vapour transmission rate – Dish method.*
- ISO 2758, *Paper – Determination of bursting strength.*
- ISO 2759, *Board – Determination of bursting strength.*
- ISO 3034, *Corrugated fibreboard – Determination of thickness.*
- ISO 3035, *Single-faced and single-wall corrugated fibreboard – Determination of flat crush resistance.*
- ISO 3036, *Board – Determination of puncture resistance.*
- ISO 3037, *Corrugated fibreboard – Determination of edgewise crush resistance.*³⁾
- ISO 3039, *Corrugated fibreboard – Determination of the grammage of the component papers after separation.*
- ISO 3260, *Pulps – Determination of chlorine consumption (Degree of delignification).*
- ISO 3687, *Paper and board – Determination of air resistance (Gurley).*
- ISO 3688, *Pulps – Measurement of diffuse blue reflectance factor (ISO brightness).*
- ISO 3689, *Paper and board – Determination of bursting strength after immersion in water for a specified period.*
- ISO 3781, *Paper and board – Determination of tensile strength after immersion in water for a specified period.*
- ISO 3782, *Paper – Determination of resistance to picking – Accelerating speed method using the IGT tester (Pendulum or spring model).*³⁾
- ISO 3783, *Paper – Determination of resistance to picking – Accelerating speed method using the IGT tester (Electric model).*³⁾
- ISO 4119, *Pulps – Determination of stock concentration.*³⁾
- ISO 5263, *Pulps – Laboratory wet disintegration.*³⁾

1) At present at the stage of draft (Revision of ISO Recommendation.)

2) At present under revision.

3) At present at the stage of draft.

ISO 5264, *Pulps – Laboratory beating –*
*Part I : Valley-beater.*¹⁾
*Part II : PFI mill.*¹⁾
*Part III : Jokro mill.*¹⁾

ISO 5267, *Pulps – Determination of drainability –*
*Part I : Schopper-Riegler method.*¹⁾
*Part II : CS Freeness method.*¹⁾

ISO 5350, *Pulps – Estimation of dirt and shives.*²⁾

ISO 5351, *Cellulose in dilute solutions – Determination of limiting viscosity number –*
*Part I : CUEN.*²⁾
*Part II : EWNN.*²⁾

ISO 5626, *Paper and board – Folding endurance.*¹⁾

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 5651:1978](https://standards.iteh.ai/catalog/standards/sist/7c25b10e-cb7f-4ff8-8082-db0f7045c62d/iso-5651-1978)

<https://standards.iteh.ai/catalog/standards/sist/7c25b10e-cb7f-4ff8-8082-db0f7045c62d/iso-5651-1978>

1) At present at the stage of draft.

2) In preparation.