
**Plastics — Industrial compostable
plastic drinking straws**

*Plastiques — Pailles en plastique compostables en compostage
industriel*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 14, *Environmental aspects*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Plastic drinking straws are used worldwide for many years. This caused several environmental problems, such as terrestrial pollution, contamination of soil and water/marine environment pollution. These pose a severe risk to ecosystems, biodiversity and human health. Recently, many countries, regions and cities have enacted legislation to ban or severely reduce the use of plastic drinking straws to help tackle these issues.

This document does not aim to bypass this legislation, but aims to specifically address the following aspects where plastic drinking straws suitable for industrial composting can be used:

- a) offering methods for testing compostability, followed by demonstrating the impact of industrial compostable drinking straws on the ecological environment;
- b) providing a reference for the evaluation of industrial compostable plastic straws.

Development of this document is expected to effectively improve the quality management of industrial compostable drinking straws in countries, regions, and cities where industrial composting is available.

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Plastics — Industrial compostable plastic drinking straws

1 Scope

This document specifies the terms and definitions, basic requirements, technical requirements, test methods, test regulations, and packaging of industrial compostable plastic drinking straws.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 17088, *Plastics — Organic recycling — Specifications for compostable plastics*

ISO 18188:2016, *Specification of polypropylene drinking straws*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

compost

organic soil conditioner obtained by biodegradation of a mixture consisting principally of vegetable residues, occasionally with other organic material and having a limited mineral content

[SOURCE: ISO 17088:2021, 3.1]

3.2

compostable plastic

plastic that undergoes degradation by biological processes during composting to yield CO₂, water, inorganic compounds and biomass at a rate consistent with other known compostable materials and leave no visible, distinguishable or toxic residue

Note 1 to entry: “Hazardous” is used synonymously to toxic.

[SOURCE: ISO 17088:2021, 3.2]

3.3

composting

aerobic process designed to produce *compost* (3.1) starting from biodegradable waste

Note 1 to entry: Composting is classified into industrial composting, home composting and worm composting.

[SOURCE: ISO 17088:2021, 3.3]

3.4 industrial composting

composting (3.3) process performed under controlled conditions on industrial scale with the aim of producing compost for the market

Note 1 to entry: In some regions, industrial composting is referred to as professional composting.

[SOURCE: ISO 17088:2021, 3.13]

3.5 drinking straw

hollow tubes for drinking water, beverages and liquid foods

3.6 pointed straw

straw that is machined into a bevel at one end

3.7 spoon-type straw

straw that is processed into a spoon at one end

4 Technical requirements

4.1 Specification and size

Specification and size shall meet the requirements specified in [Table 1](#).

Table 1 — Specifications and size requirements

Index name	Requirements
Length deviation	$\leq \pm 2$ %
Outer diameter deviation	$\leq \pm 3$ %
Maximal wall thickness to minimum wall thickness ratio	$\leq 1,2$
Damage rate after straightening the corrugated pipe	≤ 2 %
Total mass deviation of 100 straws	$\leq \pm 5$ %

4.2 Industrial compostability

The fitness to industrial compostability of "industrial compostable drinking straws" shall be evaluated in accordance with ISO 17088.

5 Test methods

5.1 Conditioning and testing atmosphere

The standard environment for sample conditioning and testing shall be performed in accordance with procedures specified in ISO 291.

5.2 Specification and size

5.2.1 Length deviation

The length of straw shall be measured using a graduated ruler or other suitable means, capable of reading to 0,5 mm or less.

The value of the length deviation of the straw is calculated by using [Formula \(1\)](#):

$$\Delta l = \frac{l - l_0}{l_0} \times 100 \% \quad (1)$$

where

Δl is the length deviation of the straw, expressed as a percentage (%);

l is the measured length, in millimetres (mm);

l_0 is the nominal length, in millimetres (mm).

5.2.2 Calculation of average deviation of thickness

The average thickness deviation is calculated using [Formula \(2\)](#):

$$\Delta \bar{e} = \frac{\bar{e} - e_0}{e_0} \times 100 \% \quad (2)$$

where

$\Delta \bar{e}$ is the average thickness deviation, expressed as a percentage (%);

$\bar{e}$ is the average thickness, in millimetres (mm);

e_0 is the nominal thickness, in millimetres (mm).

5.2.3 Outer diameter deviation

Measure the outer diameter of a straw at one end, using a vernier calipers or other suitable means, capable of reading to 0,02 mm or less.

The value of the outer diameter deviation of the straw is calculated by using [Formula \(3\)](#):

$$\Delta d = \frac{d - d_0}{d_0} \times 100 \% \quad (3)$$

where

Δd is the outer diameter deviation of the straw, expressed as a percentage (%);

d is the measured diameter, in millimetres (mm);

d_0 is the nominal diameter, in millimetres (mm).

5.2.4 Wall thickness uniformity

The straw wall thickness uniformity shall be tested in accordance with the method specified in ISO 18188:2016, 6.3.4.

5.2.5 Spoon type end development rate

Unfold the spoon-shaped straw section of spoon-type straw. Measure the maximum width, using a graduated ruler or other suitable means, capable of reading to 1 mm or less.

The value of the spoon type end development rate of the straw is calculated by using [Formula \(4\)](#):

$$\Delta k = \frac{k}{\pi d_0} \times 100 \% \quad (4)$$

where

Δk is the outer diameter deviation of the straw, expressed as a percentage (%);

k is the measured maximum width, in millimetres (mm);

d_0 is the nominal diameter, in millimetres (mm).

5.2.6 Damage rate after straightening the corrugated pipe

Randomly select 100 straws from the same batch of products and perform damage rate by visual inspection after straightening the corrugated pipe.

Fracture, breakage and cracking properties shall be evaluated by straightening the corrugated pipe.

5.2.7 Mass deviation

Randomly choose 300 straws from the same batch of products, and divide them into 3 groups, with 100 straws in each group.

Measure the mass of each group (100 straws), using a balance or other suitable means, capable of reading to 0,1 g or less.

The value of mass deviation of the straw is calculated by using [Formula \(5\)](#):

$$\Delta g = \frac{g - g_0}{g_0} \times 100 \% \quad (5)$$

where

Δg is the mass deviation of the straw, expressed as a percentage (%);

g is the measured mass, in gram (g);

g_0 is the nominal mass, in gram (g).

5.3 Industrial compostability

Industrial compostability test shall be in accordance with ISO 17088.

6 Testing regulations

6.1 Group batch

The products shall be inspected and accepted in batches. The straws of the same specification continuously produced from the same raw material and the same process shall be one batch.

6.2 Inspection classification

Inspection is divided into factory inspection and type inspection.

6.2.1 Factory inspection

The factory inspection items shall meet the requirements of [4.1](#).

6.2.2 Type test

The type inspection items shall be all technical requirements of this document.

6.3 Sampling plan

6.3.1 Specification and size

A double sampling plan for normal inspection according to ISO 2859-1 shall be used. The inspection level (il) is the general inspection level ii, and the acceptance quality limit (AQL) is 6.5. The sample and judgment array are shown in [Table 2](#). Each unit is packaged as the same unit, and the unit is packaged in boxes, bags or branches. At the time of the test, one product was randomly taken from each unit package as a sample test.

Table 2 — Sampling plan and judgment

Unit is package

Lot size	Sample	Sample size	Cumulative sample size	Acceptance number <i>Ac</i>	Rejection number <i>Re</i>
< 50	First	5	5	0	2
	Second	5	10	1	2
51-90	First	8	8	0	3
	Second	8	16	3	4
91-150	First	13	13	1	3
	Second	13	26	4	5
151-280	First	20	20	2	5
	Second	20	40	6	7
281-500	First	32	32	3	6
	Second	32	64	9	10
501-1,200	First	50	50	5	9
	Second	50	100	12	13

6.3.2 Industrial compostability

Take randomly a sufficient number of samples from the extracted samples for testing.

6.4 Decision rule

6.4.1 Determination of various requirements

6.4.1.1 Specification and size

The determination of the sample size unit shall be carried out in accordance with [5.2](#).

If the test result of the sample unit meets the requirements of [Table 2](#), the specification size is considered qualified, otherwise the item is rejected.

6.4.1.2 Industrial compostability

This item is rejected as soon as one of following items is unqualified:

- a) the biodegradability;
- b) the disintegration;
- c) the control of constituents; or
- d) the effects of compost on terrestrial organisms.

6.4.2 Determination of qualified batch

If the inspection results of the inspection items are all qualified, the batch is judged to be qualified.

7 Packaging, labelling on packaging

7.1 Packing quantity

In counting the number of boxes from randomly extracted two (2) boxes of straws, no inadequate number of boxes should be found.

The number of straws in each bag (boxes) of the 2 bags (boxes) randomly drawn should be ≥ 98 % of the nominal number.

In the same batch, if less than adequate number of straws (boxes) is found, the batch shall be judged as unqualified. In case of an unqualified number of straws in the package (box), double number of samples shall be taken for re-examination. If the results of the re-examinations are qualified, this item (packing quantity) is judged as qualified, otherwise the item will be rejected.

7.2 Mark on packaging

Required marking shall include name of manufacturer, material and size of the straws, number of straws in a pack, production date, industrial compostable, name of the country where the plastic product or material is to be marketed or recycled by composting, and any information regarding health and safety required by the buyer.

7.2.1 Outer packaging

The outer packaging box or bag of the product shall have obvious signs (except for export or special requirements of customers), including:

- a) a reference to this document, i.e. ISO 5424;
- b) product name and type;
- c) specification and size;

The expression of specification and size shall include nominal outer diameter, D , and nominal length, L , and is expressed as straw shape outer diameter $\times$ length (unit: mm).

EXAMPLE The specifications of the bendable straw with an outer diameter of 5 mm and a length of 210 mm are expressed as: bendable straw 5 $\times$ 210.

- d) usage temperature range;
- e) the month and year of manufacture;
- f) name and address of manufacturer;