
**Plastics — Methods for determining
the density of non-cellular plastics —**

Part 1:

**Immersion method, liquid pycnometer
method and titration method**

*Plastiques — Méthodes de détermination de la masse volumique des
plastiques non alvéolaires —*

*Partie 1: Méthode par immersion, méthode du pycnomètre en milieu
liquide et méthode par titrage*

ISO 1183-1:2019

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Published in Switzerland

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

This third edition cancels and replaces the second edition (ISO 1183-1:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

- the buoyancy correction has been revised.

A list of all parts in the ISO 1183 series can be found on the ISO website.

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.

This corrected version of ISO 1183-1:2019 incorporates the following corrections:

- correction of the definition of [Formula \(2\)](#).

Plastics — Methods for determining the density of non-cellular plastics —

Part 1:

Immersion method, liquid pycnometer method and titration method

WARNING — The use of this document might involve hazardous materials, operations or equipment. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate health and safety practices.

1 Scope

This document specifies three methods for the determination of the density of non-cellular plastics in the form of void-free moulded or extruded objects, as well as powders, flakes and granules.

- Method A: Immersion method, for solid plastics (except for powders) in void-free form.
- Method B: Liquid pycnometer method, for particles, powders, flakes, granules or small pieces of finished parts.
- Method C: Titration method, for plastics in any void-free form.

NOTE Density is frequently used to follow variations in physical structure or composition of plastic materials. Density can also be useful in assessing the uniformity of samples or specimens. Often, the density of plastic materials depend upon the choice of specimen preparation method. When this is the case, precise details of the specimen preparation method are intended to be included in the appropriate material specification. This note is applicable to all three methods.

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 472, *Plastics — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following 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 <http://www.electropedia.org/>

3.1

mass

m

quantity of matter contained in a body

Note 1 to entry: It is expressed in kilograms (kg) or grams (g).

3.2

apparent mass

m_{APP}

mass of a body obtained by measuring its weight using an appropriately calibrated balance

Note 1 to entry: It is expressed in kilograms (kg) or grams (g).

3.3

density

ρ

ratio of the mass m of a sample to its volume V (at the temperature T), expressed in kg/m³, kg/dm³ (g/cm³) or kg/l (g/ml)

Note 1 to entry: The following terms, based upon ISO 80000-4^[1], are given in Table 1 for clarification.

Table 1 — Density terms

Term	Symbol	Formulation	Units
Density	ρ	m/V	kg/m ³ kg/dm ³ (g/cm ³) kg/l (g/ml)
Specific volume	v	$V/m (= 1/\rho)$	m ³ /kg dm ³ /kg (cm ³ /g) l/kg (ml/g)

4 Conditioning

The test atmosphere shall be in accordance with ISO 291. In general, conditioning specimens to constant temperature is not required, because the determination itself brings the specimen to the constant temperature of the test.

Specimens which change in density during the test to such an extent that the change is greater than the required accuracy shall be conditioned prior to measurement in accordance with the applicable material specification. When changes in density with time or atmospheric conditions are the primary purpose of the measurements, the specimens shall be conditioned as described in the material specification and, if no material specification exists, then as agreed upon by the interested parties.

5 Methods

5.1 Method A — Immersion method

5.1.1 Apparatus

5.1.1.1 Analytical balance or instrument specifically designed for measurement of density, accurate to $\pm 0,1$ mg.

An automatically operating instrument may be used. The calculation of density may be done automatically using a computer or software integrated into the analytical balance.