

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1183

*Withdrawn
1987-07-01*

PLASTICS

METHODS FOR DETERMINING THE DENSITY AND RELATIVE DENSITY
(SPECIFIC GRAVITY) OF PLASTICS EXCLUDING CELLULAR PLASTICS

1st EDITION

February 1970

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Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 1183, *Plastics – Methods for determining the density and relative density (specific gravity) of plastics excluding cellular plastics*, was drawn up by Technical Committee ISO/TC 61, *Plastics*, the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 823, which was circulated to all ISO Member Bodies for enquiry in July 1965. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Argentina	France	Romania
Australia	Germany	South Africa, Rep. of
Austria	Greece	Spain
Belgium	Hungary	Sweden
Brazil	India	Switzerland
Canada	Italy	U.A.R.
Chile	Japan	United Kingdom
Colombia	Netherlands	U.S.A.
Czechoslovakia	New Zealand	U.S.S.R.
Finland	Poland	Yugoslavia

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1970, to accept it as an ISO RECOMMENDATION.

PLASTICS

**METHODS FOR DETERMINING THE DENSITY AND RELATIVE DENSITY
(SPECIFIC GRAVITY) OF PLASTICS EXCLUDING CELLULAR PLASTICS****1. SCOPE**

This ISO Recommendation describes four methods for the determination of the density and relative density (specific gravity) of non-cellular plastics in the forms of films, sheet, tube, moulded objects, powders and moulding powders :

Method A

Immersion method for plastics in a finished condition, whether machined or otherwise formed, such as sheet, rod, tube and moulded articles.

Method B

Pycnometer method for plastics in preformed condition such as moulding powder or pellets, flake and the like.

Method C

Sink-float method for plastics in forms similar to those required for Method A, and pellets.

Method D

Density gradient column method for plastics in forms similar to those required for Method A, and pellets.

Density gradient columns are columns of liquid the densities of which increase uniformly from top to bottom. They are particularly suited to measurements of small specimens, materials with density less than 1 g/cm^3 and density differences.

Density and relative density are frequently used to follow the variations in the physical structure of specimens and in calculations of the amount of material necessary to fill a given volume. Density is the preferred property relating the mass and volume of an object, specimen or material. These properties may also be useful in determining uniformity among samples or specimens. These methods are designed to yield results accurate to at least 0.2 % without applying corrections for weighings in air and to 0.05 % with such corrections.

The density of plastics often depends on the methods employed in preparing the test specimens. When this is the case, precise details of the methods of preparation must be given; these are ordinarily stipulated in the specifications for the material.

2. DEFINITIONS

2.1 *Density*. The mass per unit volume of material at t °C; it is expressed as

density, t °C (symbol : ρ_t) in kg/m³, g/cm³ or g/ml

Ordinarily t will be one of the standard laboratory temperatures, 20, 23 or 27 °C.

2.2 *Relative density*. The ratio of the mass of a given volume of material to that of an equal volume of a reference material at the same temperature; it is expressed as

relative density, t/t °C (symbol : d_t^t)

where t is the temperature in degrees Celsius. Ordinarily, t will be one of the standard laboratory temperatures, 20, 23 or 27 °C.

The term "specific gravity" is often used for "relative density" when the reference substance is water.

Relative density may also be defined as the ratio of the density of a substance to the density of a reference substance under conditions that should be specified for both substances.

Density in grammes per cubic centimetre at t °C may be converted to specific gravity at these temperatures as follows :

$$S = \frac{\rho_t}{k}$$

where

S is the specific gravity;

ρ_t is the density of the specimen;

k is the density of water, at temperature t , values at the standard laboratory temperatures being as follows :

t	k
°C	g/cm ³
20*	0.9982
23	0.9976
27	0.9965

Consult the International Bureau of Weights and Measures for exact relationships between density and specific gravity at other temperatures.

NOTE. — The following equivalent terms based upon ISO Recommendation R 31, Part III, *Quantities and units of mechanics*, are given here for clarification.

English term	French term	Symbol	Formulation	Units
1. density (mass density)	masse volumique	ρ, ρ	$\frac{m}{V}$	kg/m ³ g/cm ³ g/ml
2. relative density	densité relative	d	$\frac{\rho_1}{\rho_2}$	dimensionless
3. specific volume	volume massique	v	$\frac{V}{m} = \frac{1}{\rho}$	m ³ /kg cm ³ /g ml/g

* The reference temperature : see ISO Recommendation R 291, *Standard atmospheres for conditioning and testing*.