
**Plastics — Methods of test for the
determination of the effects of immersion in
liquid chemicals**

*Plastiques — Méthodes d'essai pour la détermination des effets de
l'immersion dans des produits chimiques liquides*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 175 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

This second edition cancels and replaces the first edition (ISO 175:1981), which has been technically revised.

Annex A forms a normative part of this International Standard. Annex B is for information only.

Introduction

Because of their varied applications, plastics are frequently brought into contact with liquids such as chemical products, motor fuels, lubricants, etc., and, possibly, with their vapours.

Under the action of a liquid, a plastic material may be subjected to several phenomena which may occur simultaneously. On the one hand, absorption of liquid and extraction of constituents soluble in the liquid may occur. On the other hand, a chemical reaction, often resulting in a significant change in the properties of the plastic, may occur. The equilibrium swelling ratio for a crosslinked polymer in a liquid that is a solvent for the same but non-crosslinked polymer is a measure of the degree of crosslinking.

The behaviour of plastics in the presence of liquids can be determined only under arbitrarily fixed conditions aimed at making comparisons between different materials. The choice of test conditions (nature of the liquid, immersion temperature and immersion time), as well as the choice of the properties in which changes are to be measured, depends on the eventual application of the plastic under test.

It is not possible, however, to establish any direct correlation between the experimental results and the behaviour of the plastic in service. These tests do, nevertheless, permit a comparison to be made of the behaviour of different plastic materials under specified conditions, thus allowing an initial evaluation of their behaviour in relation to certain groups of liquids.

NOTE In view of its special importance, the particular case of the determination of the quantity of water absorbed is dealt with in ISO 62. ISO 175 is concerned with the effects of water only where changes in the dimensions and physical properties of the plastic occur as a result of the action of the water.

Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals

1 Scope

1.1 This International Standard specifies a method of exposing test specimens of plastic materials, free from all external restraint, to liquid chemicals, and methods for determining the changes in properties resulting from such immersion. It does not cover environmental stress cracking (ESC) which is dealt with by ISO 4599, ISO 4600 and ISO 6252.

1.2 It only considers testing by immersion of the entire surface of the test specimen.¹⁾

NOTE This method may not be appropriate for simulating partial or infrequent wetting of plastics.

1.3 It is applicable to all solid plastics that are available in the form of moulding or extrusion materials, plates, tubes, rods or sheets having a thickness greater than 0,1 mm. It is not applicable to cellular materials.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 62:1999, *Plastics — Determination of water absorption.*

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastic materials.*

ISO 294-3:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates.*

ISO 295:1991, *Plastics — Compression moulding of test specimens of thermosetting materials.*

ISO 1817:1999, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 2818:1994, *Plastics — Preparation of test specimens by machining.*

ISO 3126:1974, *Plastics pipes — Measurement of dimensions.*

ISO 3205:1976, *Preferred test temperatures.*

1) Although it is not within the scope of this International Standard, it may also be of interest, when dealing with volatile liquids or those which give off vapours, to subject the specimen to only the gaseous phase above the liquid. In this event, it is advisable to proceed exactly as indicated, but to suspend the specimen above the liquid, seal the container and maintain it at the test temperature throughout.

ISO 4582:1998, *Plastics — Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or laboratory light sources.*

IEC 60296:1992, *Specification for unused mineral insulating oils for transformers and switchgear.*

3 Principle

Test specimens are completely immersed in a test liquid for a specified time and at a specified temperature.

Their properties are determined before immersion and after removal from the liquid, as well as after drying, if applicable. In the last-mentioned case, the determinations are made, if possible, one after the other on the same specimens.

NOTE The comparison of different plastics by means of this test is valid only if the specimens used are of the same shape, of the same dimensions (in particular of the same thickness) and in as nearly as possible the same state (of internal stress, surface, etc.).

Methods are specified for determining the following:

- a) changes in mass, dimensions and appearance immediately after removal from the liquid and after removal and drying;
- b) changes in physical properties (mechanical, thermal, optical, etc.) immediately after removal from the liquid and after removal and drying;
- c) the amount of liquid absorbed.

Measurements are made immediately after removal when it is necessary to ascertain the state of the material while it is still being acted on by the liquid. Measurements are made after removal and drying when it is necessary to ascertain the state of the material after the liquid, provided it is volatile, has been eliminated. It also allows the influence of a soluble constituent to be determined.

4 General requirements and procedure

4.1 Test liquids

4.1.1 Choice of test liquid

If information is required about the behaviour of a plastic in contact with a specific liquid, that liquid shall be used. The test liquid shall be of analytical quality.

Industrial liquid chemicals are not generally of absolutely constant composition. The tests shall be carried out using defined chemical products, either on their own or as a mixture, which are as representative as possible of the products under consideration in their effect on the plastic material concerned. When technical-grade chemicals are used, they shall be of agreed origin and quality, and care shall be taken that only one manufacturing batch is used for all measurements in any one series.

NOTE If conducting a series of tests in a liquid of doubtful composition, it is important to take all the samples of the liquid from the same container.

4.1.2 Types of test liquid

Types of test liquid are given in annex A.