

INTERNATIONAL STANDARD



2581

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

Plastics — Rigid cellular materials — Determination of “apparent” thermal conductivity by means of a heat-flow meter

*Matières plastiques — Matériaux alvéolaires rigides — Détermination de la conductivité thermique
«apparente» au moyen d'un fluxmètre thermique*

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FOREWORD

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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 2581 was drawn up by Technical Committee ISO/TC 61, *Plastics*, and circulated to the Member Bodies in February 1974.

It has been approved by the Member Bodies of the following countries :

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ERRATUM

Cover page

Replace the title by the following :

**“Rigid cellular plastics — Determination of apparent
thermal conductivity by means of a heat-flow meter”**

and the sub-title by the following :

“Plastiques alvéolaires rigides — Détermination de la conductivité thermique apparente au moyen d’un fluxmètre thermique”

Page 1

Replace the title by the following :

**“Rigid cellular plastics — Determination of apparent
thermal conductivity by means of a heat-flow meter”**

Plastics — Rigid cellular materials — Determination of "apparent" thermal conductivity by means of a heat-flow meter

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies a method for the determination of the "apparent" thermal conductivity of rigid cellular plastic materials.

NOTE — In cellular plastics an important part of the heat transfer is due to passage of heat radiation through their structure. This results in values of thermal conductivity being measured which are not independent of the thickness of specimen tested. Therefore the term "apparent" thermal conductivity should be used.

The method, which is comparatively rapid, is based on preliminary and routine calibration of the apparatus by the use of test specimens the "apparent" thermal conductivity of which has been determined in a standard apparatus of the guarded hot-plate type.

Two arrangements of the apparatus are given both of which have been widely used with satisfactory results :

- a) the arrangement shown in figure 1 (symmetrical arrangement — method S), in which the heat-flow meter is placed centrally between two identical test specimens;
- b) the arrangement shown in figure 2 (asymmetrical arrangement — method AS), in which the heat-flow meter is placed alongside the single test specimen.

NOTE — Test results obtained using this International Standard are not comparable internationally between countries where different types of guarded hot-plate are used as calibration standards.

1.2 For practical purposes, this International Standard applies to specimens having a thermal conductance of not more than $2,5 \text{ W}/(\text{m}^2 \cdot \text{K})$ (method S) or $5 \text{ W}/(\text{m}^2 \cdot \text{K})$ (method AS).

1.3 For ordinary purposes, the suggested limiting temperatures of the surfaces in contact with the heat-flow meter are -50°C and $+100^\circ\text{C}$. These limits may be extended in both directions, subject to appropriate precautions being taken in relation to the materials of construction, the calibration procedure and the conduct of the test.

1.4 Experience has shown that the results obtained by this method agree satisfactorily with those obtained with a guarded hot-plate apparatus for temperature gradients ranging between $4^\circ\text{C}/\text{cm}$ and $10^\circ\text{C}/\text{cm}$ across the test specimen, subject to a minimum temperature difference between the hot and cold plates of 15°C (see 8.1).

1.5 The long-term reproducibility of measurements obtained with apparatus constructed and used in accordance with this method can be better than 3 %, as many previous experiments have already shown.

2 REFERENCE

ISO/R 291, *Plastics — Standard atmospheres for conditioning and testing.*

3 DEFINITIONS

3.1 **heat flow rate** : The quotient of the quantity of heat flowing through a surface and the time.

3.2 **density of heat flow rate through a surface** : The quotient of the heat flow rate through a surface and the area of that surface.

3.3 **thermal conductivity** : The quotient of the density of heat flow rate through a surface and the temperature gradient. (This is a fundamental property of a material, independent of the thickness of specimen tested.)

3.4 **thermal conductance** : The quotient of the density of the heat flow rate and the temperature difference which maintains this heat flow under steady-state conditions.

3.5 **apparent thermal conductivity** : The quotient of the heat flow rate, inclusive of any heat transmitted through the specimen by radiation, through unit area and the temperature gradient in the direction perpendicular to the surface of the test specimen. (This is not a fundamental property of the material and is dependent on the thickness of the specimen tested which should always be quoted in conjunction with the value.)

4 PRINCIPLE

From two isothermal surfaces at constant upper and lower temperatures, a heat flow is established through a single test specimen (method AS) or through a pair of test specimens (method S) of identical shape and equal thickness and density, cut from the cellular material under test.