# International Standard 4897

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## Cellular plastics — Determination of the coefficient of linear thermal expansion of rigid materials at sub-ambient temperatures

*Plastiques alvéolaires — Détermination du coefficient de dilatation linéique thermique des plastiques alvéolaires rigides aux températures inférieures à l'ambiante*

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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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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INTERNATIONAL STANDARD ISO 4897-1985 (E)

# Cellular plastics — Determination of the coefficient of linear thermal expansion of rigid materials at sub-ambient temperatures

## 1 Scope and field of application

This International Standard specifies two methods for determining the coefficient of linear thermal expansion of rigid cellular plastics at sub-ambient temperatures. Method A is the preferred method since it gives a value on a large sample at a chosen temperature which is more representative because of anisotropy, etc., of the material or product. In practice, difficulties may be encountered in accurately controlling the uniformity of the low temperature inside the test chamber at temperatures below −70 °C. Should this be the case, Method B should be employed to obtain an "average" coefficient for the temperature interval between the cryogenic temperature and the ambient temperature.

The values obtained in these tests are valid measurements only for the specific sample tested, at the time tested. They cannot be applied generally to a product and cannot be used to predict performance of the same material at a future date.

Care should also be taken in applying the value obtained in this test to calculate the overall coefficient of expansion of composite products of which the material under test is part.

Many rigid cellular products are not isotropic. This is usually ascribed to the fact that the cells in the material are elongated in a particular direction. This direction is referred to in these methods as the "direction of anisotropy". Tests carried out in this direction normally give results differing from those obtained from other test directions. The direction of anisotropy may vary within a product and thus the number of test specimens required for product specification will generally exceed those given in this International Standard.

## 2 References

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

ISO 1923, *Cellular plastics and rubbers — Determination of linear dimensions.*

## 3 Definition

**coefficient of linear thermal expansion :** The change in unit length per degree Celsius change in temperature.

## 4 Method A

### 4.1 Apparatus

An apparatus found suitable consists of the following:

#### 4.1.1 Test chamber and cooling system

The test chamber shall consist of a well-insulated box of approximate internal dimensions 400 mm × 1 000 mm × 150 mm, having viewing windows 900 ± 10 mm apart. These windows shall be insulated with plugs of insulation between readings to ensure good temperature distribution.

The chamber shall be fitted with a cooling system designed to give a sub-ambient internal temperature distribution complying with the requirements of 4.4. A suitable chamber and cooling system is described in the annex and illustrated in figures 1 and 2.

NOTE — Liquid nitrogen has been found in practice to be the most satisfactory coolant.

#### 4.1.2 Reference length material

Inside the box a reference length material of 880 ± 5 mm shall be positioned so that fiducial marks on the end are at the same level and in the same vertical plane as fiducial lines on the test specimens. The coefficient of expansion of the reference length material should be small and accurately known. A suitable material is silica in the form of a rod with ends ground to knife edges (see figure 3). It shall be adequately supported to prevent bowing.

#### 4.1.3 Measuring system

A travelling microscope or equivalent capable of measuring to 0,01 mm shall be provided. Care shall be taken to ensure that the direction of travel of the instrument is parallel to the edge of the test specimen.

#### 4.1.4 Temperature-measuring device

Any suitable temperature-measuring device may be used; it shall be calibrated over the required range to within 1 °C.

Temperatures in the box shall be measured by any suitable means in at least five positions equally spaced along the entire length of the test specimen.