International Standard 6942

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

Clothing for protection against heat and fire — Method of evaluation of thermal behaviour of materials and material assemblies when exposed to a source of radiant heat

Vêtements de protection contre la chaleur et le feu — Méthode d'évaluation du comportement thermique de matériaux simples et d'assemblages de matériaux exposés à une source de chaleur radiante

First edition — 1981-10-15

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981

UDC 614.895.5 : 614.873 **Ref. No. ISO 6942-1981 (E)**

Descriptors : protective clothing, heat protection, fire protection, tests, testing conditions, test equipment, test specimens.

Price based on 15 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

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 6942 was developed by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, and was circulated to the member bodies in May 1980.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981

It has been approved by the member bodies of the following countries :

Australia
Austria
Belgium
Canada
Czechoslovakia
Egypt, Arab rep. of
France
Germany, F.R.
Hungary
Ireland
Israel
Italy
New Zealand
Poland
Romania
South Africa, Rep. of
Spain
Sweden
Switzerland

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Japan
United Kingdom

© International Organization for Standardization, 1981 ●

Printed in Switzerland

Clothing for protection against heat and fire — Method of evaluation of thermal behaviour of materials and material assemblies when exposed to a source of radiant heat

1 Scope and field of application

This International Standard specifies two complementary methods of evaluation of the thermal radiation behaviour of materials used for clothing for protection against radiant heat. These methods allow :

a) observation of the possible changes in the appearance of the material, and

b) determination of the heat transmission factor in the conditions specified in this International Standard.

The test conditions are conventional and, though the heat transmission factor reflects the efficiency of the materials, the sole aim of the tests described in this International Standard is to classify the materials. The results obtained are not necessarily applicable directly to practical working conditions.

The tests generally apply to a representative specimen of the layer(s) of fabric, or other materials making up the protective garment. They may also be applicable to specimens which constitute the whole of the garments worn (for example protective garments worn over workwear and underwear).

The methods involve the testing of materials exposed to high radiation while the air temperature remains close to ambient temperature. They are not applicable to testing materials at higher air temperatures.

2 Reference

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*.

3 Definitions

3.1 heat transmission factor (*TF*) : A measure of the percentage of heat transmitted through a specimen exposed to a source of radiant heat. It is numerically equal to the ratio of the transmitted to the incident heat flux density.

3.2 specimen : Specimen consisting of one or several layers of fabric or other materials.

3.3 change in appearance of the specimen : All changes in the appearance of the material (shrinkage, formation of char, discoloration, scorching, glowing, melting, etc.).

4 Principle

4.1 Method A

A test sample is fixed to a supporting frame and exposed to a specific radiation level. Changes in the appearance of the sample are recorded.

4.2 Method B

The heat transmission factor (*TF*) of the test sample is measured under specified test conditions by measuring the incident and transmitted heat flux densities by means of a calorimeter of known characteristics on which the sample is mounted.

5 Apparatus

The test apparatus shall comprise :

Method A :

a) a metal supporting frame for the specimen (5.1);

b) a source of radiant heat (5.2);

c) a test frame (5.5).

Method B :

a) a source of radiant heat (5.2);

b) a receiving calorimeter (5.3);

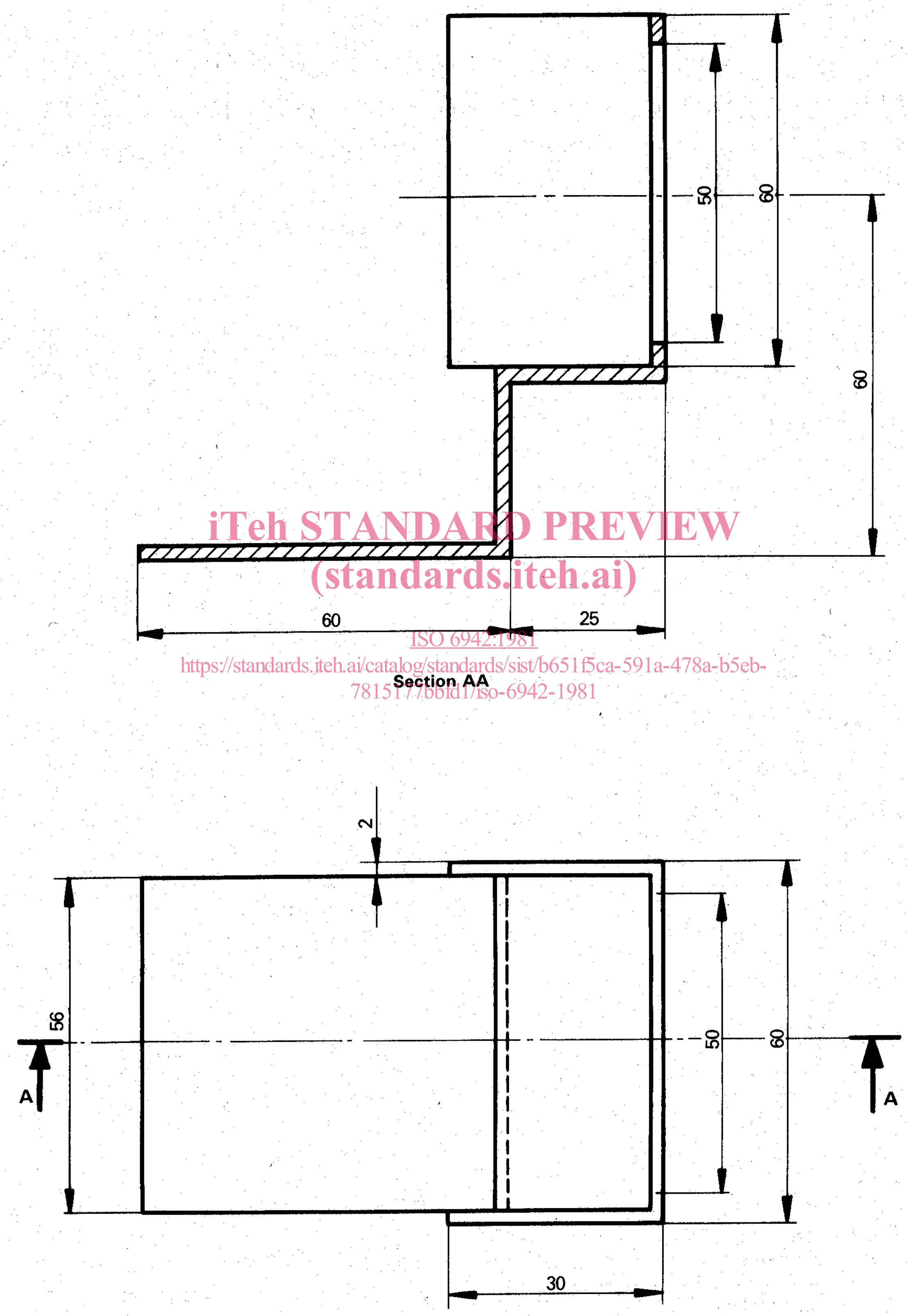
c) a measuring device (5.4);

d) a test frame (5.5).

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981

5.1 Metal supporting frame, for specimens for use in method A.

Dimensions in millimetres



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177b6fd1/iso-6942-1981

Figure 1 — Metal supporting frame for the specimen (Method A)

5.2 Source of radiant heat comprising six silicon carbide heating rods, the technical specifications of which are as follows :

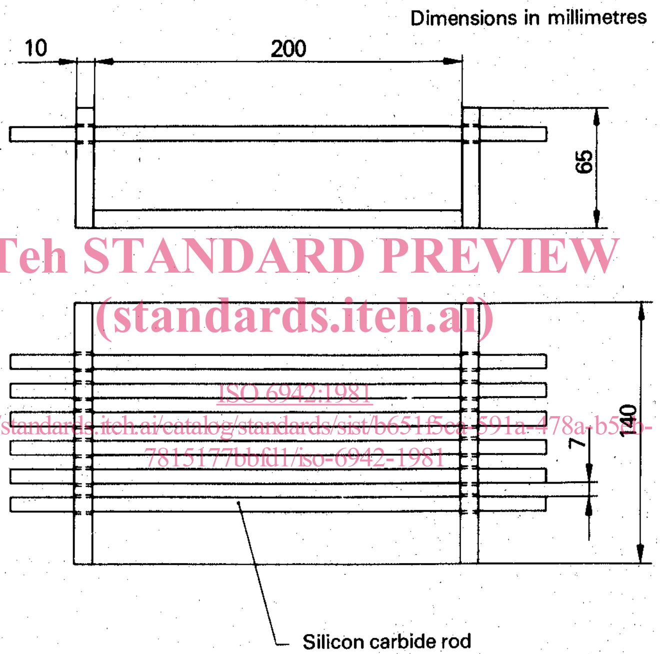
- total length : 356 mm;
- length of heating part : 178 mm;
- diameter : 7,9 mm;
- electrical resistance : 3,62 Ω ± 10 % at 1 071 °C.

These rods are placed in a support made of insulating, flame resistant material so that they are arranged horizontally and in the same vertical plane. Figure 2 shows the constructional details of the support and the arrangement of the heating rods, which shall be mounted very freely in the grooves of the support in order to avoid mechanical stress.

A diagram of the electricity supply for the heat source is shown in figure 3.

The six rods are arranged into two groups of three rods placed in series. The groups can either be connected in parallel or in series. The electrical connections of the heating rods shall be made carefully by means of aluminium strips. Precautions shall be taken to avoid short circuits between the rods.

Dimensions in millimetres



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b55b-7815177bbfd1/iso-6942-1981

Figure 2 — Support for heating rods

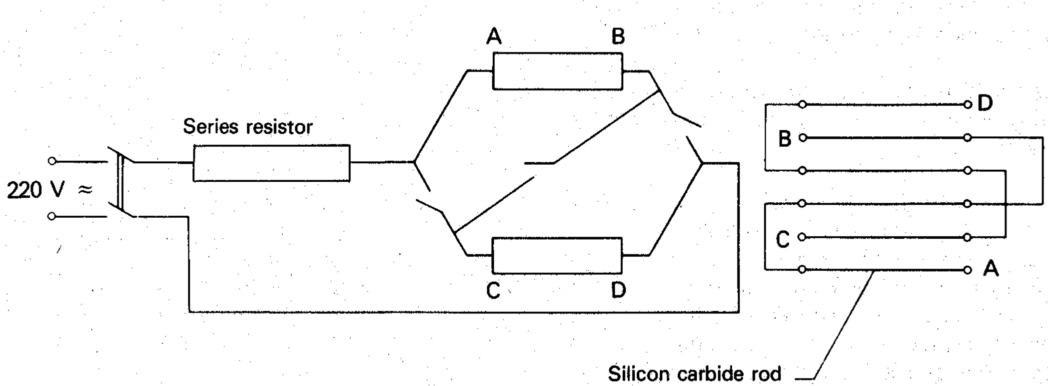


Figure 3 — Circuit diagram for heat source

An additional resistance, intended to limit the voltage supply to the heating rods is placed in series with the heat source. It is composed of two heating rods of silicon carbide in parallel, having the following technical specifications :

- total length : 270 mm;
- length of heating part : 96 mm;
- diameter of heating part : 7,9 mm;
- diameter of the ends : 13 mm;
- resistance : 2,4 Ω ± 10 % at 1 400 °C.

5.3 Receiving calorimeter comprising a block of pure aluminium of dimensions as given in figure 4.

In the aluminium block are set :

- two platinum resistance thermometers complying with the requirements of annex C;
- a heating coil consisting of a constantan resistance wire wound round an aluminium cylinder.

The dimensions of the heating coil are given in figure 5. The resistance of the constantan wire, of approximately 700 Ω, shall be measured to the nearest ± 1 %.

The thermometric probe and heating coil are sealed in the calorimeter (for example by means of ceramic glue) and the mass of the cylinder shall then be determined. The bore for the thermometric resistor probe, adapted to suit the required dimensions, shall be located as shown in figure 4. After connecting up the heating coil, the front surface of the calorimeter is machined to a radius of 130 mm and sanded.

The receiving calorimeter is insulated, except for the front surface, using flexible expanded polyurethane of density 40 kg/m³ and thickness 20 mm. To prevent burning of the front side of the insulator, the expanded polyurethane shall be replaced over a length of 20 mm by insulating mineral fibre material of density 120 kg/m³ as shown in figure 4.

The calorimeter and its insulating lagging are placed in a stand made of brass of thickness 1 mm as shown in figure 6.

The stand has two screws whose ends provide a stop for the rear surface of the calorimeter and prevent compression of the back of the insulator.

The stand is fixed on a base that slides between two slide bars fixed to the frame, so that the receiving calorimeter lies in the axis of the opening of the front shield of the frame. The longitudinal axis of the calorimeter shall be horizontal and perpendicular to the radiant source. During the test the calorimeter is kept in position by means of a stop. Figure 6 shows the arrangement of the various items. A device that does not adversely affect the insulating properties of the lagging shall be used for strict positioning of the calorimeter with respect to the frame. The position of the calorimeter shall be the same for all tests.

If the calorimeter is made exclusively of aluminium and its thermal losses are zero, the relation between the amount of heat absorbed, Q_a, expressed in joules, and the rise in temperature is as follows :

$$Q_a = m C_{Al} \Delta T$$

where

m is the mass of calorimeter, in kilograms;

C_{Al} is the heat capacity of aluminium in joules per kilogram kelvin;

ΔT is the rise in temperature of the calorimeter, in kelvins.

Dimensions in millimetres

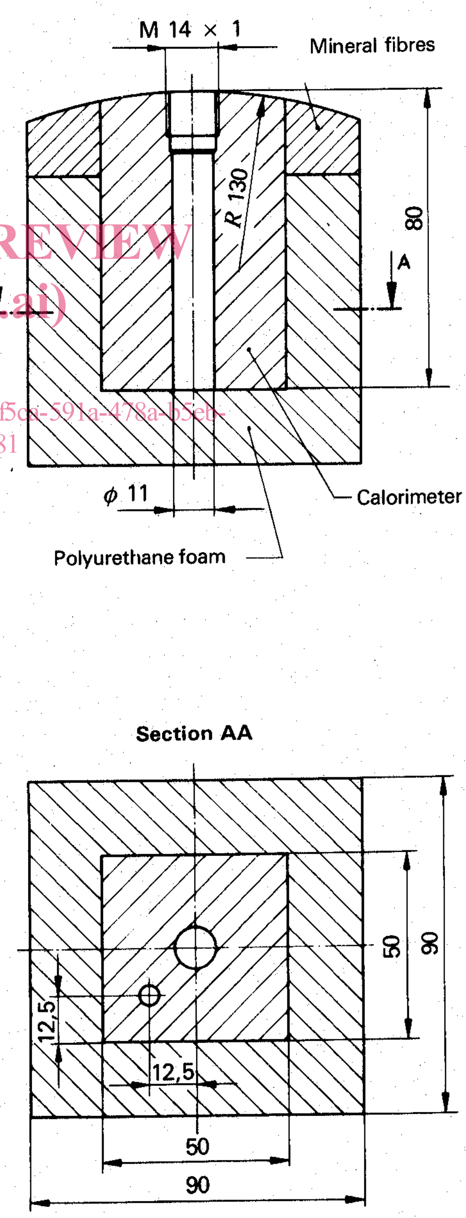


Figure 4 — Receiving calorimeter

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7f15f77bbfd1/iso-6942-1981

Dimensions in millimetres

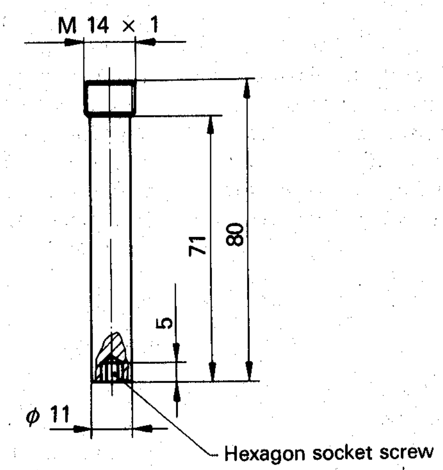


Figure 5 — Heating coil

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b6511bca-591a-478a-b5eb-7815177bbbf1/iso-6942-1981

Dimensions in millimetres

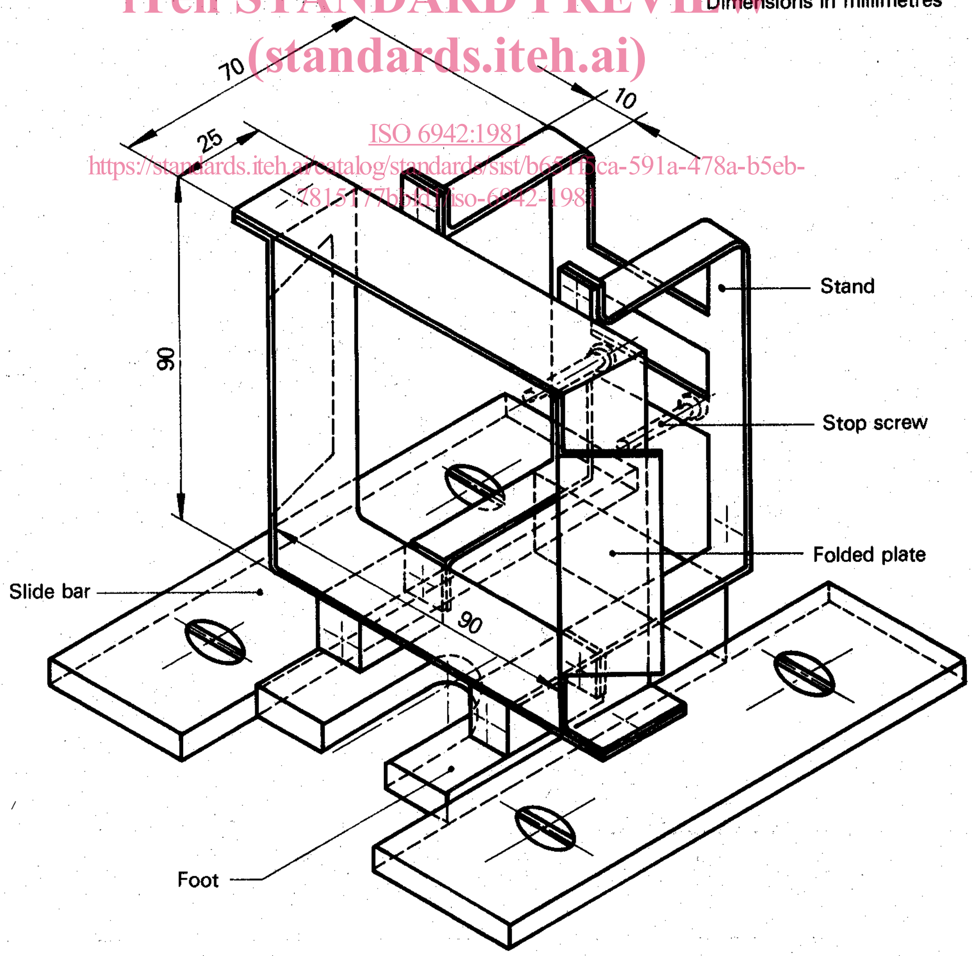


Figure 6 — Calorimeter stand

The presence in the calorimeter of elements other than aluminium and the inevitable thermal losses make it necessary to introduce a correction factor K, approximately equal to unity, in the above formula.

The front surface of the calorimeter shall be insulated beforehand in the same way as the other surfaces. The calorimeter is then heated by means of its heating coil which is supplied with a constant current of about 150 mA until a temperature rise of about 10 K is obtained. The time of heating is measured. The quantity of heat dissipated in the calorimeter, Q_e, is given, in joules, by the formula

$$Q_e = RI^2t$$

where

R is the resistance of the heating coil, in ohms;

I is the supply current of the heating coil, in amperes;

t is the duration of heating, in seconds.

This amount of heat Q_e is compared with the amount of heat measured, $Q_a = mC_{Al}\Delta T$.

i.e. $K \stackrel{\text{def}}{=} \frac{Q_e}{Q_a}$.

To calculate Q_a, the rise in temperature ΔT is measured as follows.

The temperature variation curve when measuring Q_e is shown in figure 7 as the solid line. After heating has finished, the heat losses bring about a slow cooling of the calorimeter. It is necessary to prolong the straight lines for the initial and final temperatures, i.e. A to the right and E to the left. A perpendicular is dropped to the line prolonged from A, giving the two triangles ABC and CDE, of equal areas. The segment BD represents the rise in temperature ΔT to be introduced in the formula Q_a.

5.4 Measuring equipment, comprising :

5.4.1 A stabilized supply, capable of delivering a continuous current of 0,1 A at about 12 V.

5.4.2 A measuring bridge, allowing the conversion of the resistance of the thermometric probe into continuous voltage measured by a recorder. Annex B gives, for information, an example of a suitable measuring bridge.

5.4.3 A recording potentiometer, with 10 mV full scale deflection.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981

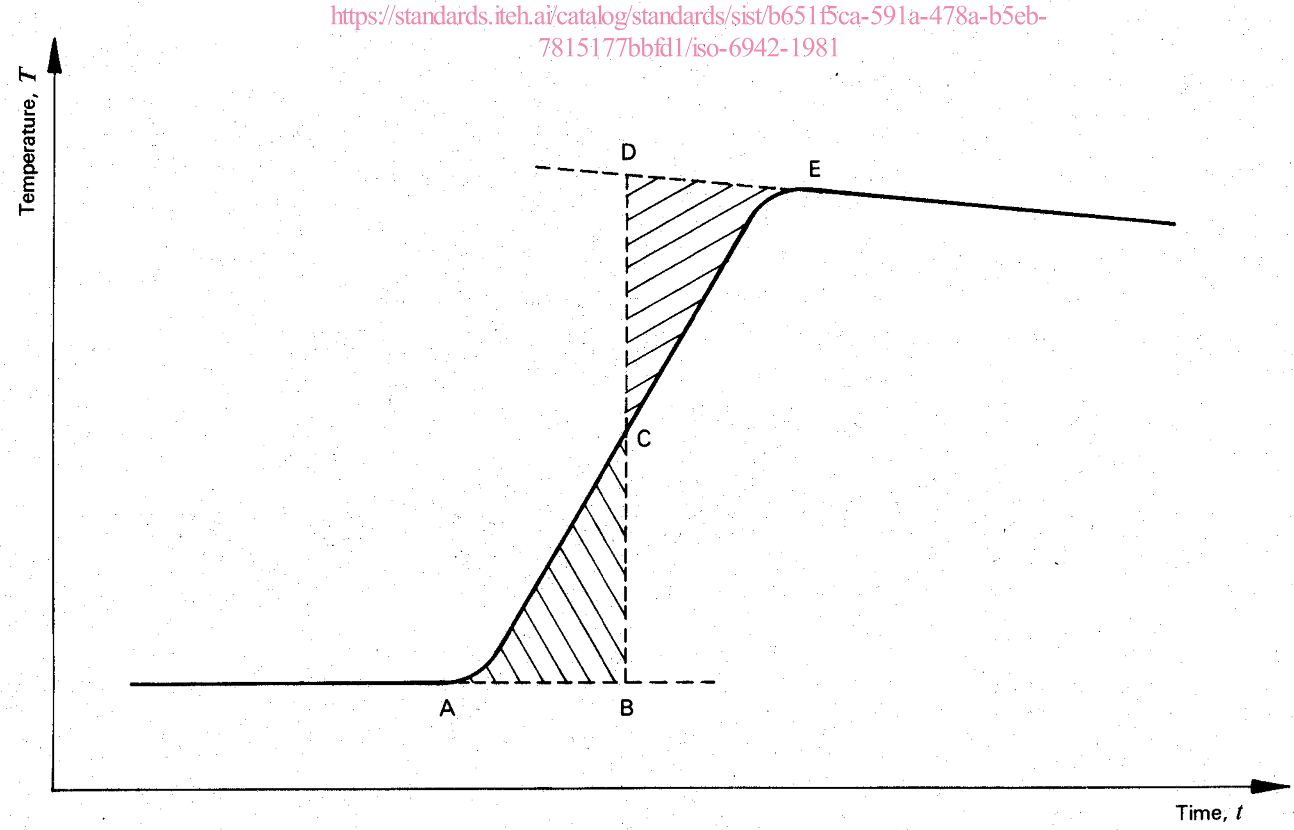


Figure 7 — Temperature variation curve

5.5 Frame, intended to support the calorimeter and the heat source and to shield the calorimeter from radiation during exposure periods.

The frame basically consists of two sheets of non-combustible board assembled as shown in figure 8.

The vertical surface of the frame is partially covered by a copper plate of thickness 2 mm, in which a square opening of sides 60 mm is made. This plate contains two vertical slide bars allowing the sliding of a movable screen made of copper. Copper pipes are welded on the vertical plate and the movable screen to ensure cooling by water circulation (see figure 9).

The screen is used to shield the calorimeter from the source of radiation before the test starts.

To reduce the heat absorbed by the movable screen, a sheet of aluminium foil is stuck onto the surface of the screen facing the heat source.

The heat source is supported and held at the appropriate distance by means of three threaded rods fixed to the front plate of the frame. When the heat source is at a distance from the frame, the strain shall be taken off the threaded rods by a supplementary device supporting the sources such as blocks placed beneath the rods. The slide bars for positioning the calorimeter and the device for tensioning the specimens are positioned on the horizontal part of the frame, as shown in figure 10.

The device for tensioning the specimen consists of two supports into each of which a spindle is slid. These spindles support and guide the wire connecting the specimen clamp and its 200 g tensioning mass (see figure 10). Each layer making up the sample is tensioned by means of an individual tensioning thread.

The opening made in the vertical plate shall be sufficiently large so that the calorimeter, its insulating lagging and the specimen cannot, when in a normal position, come into contact with the plate.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981

Dimensions in millimetres

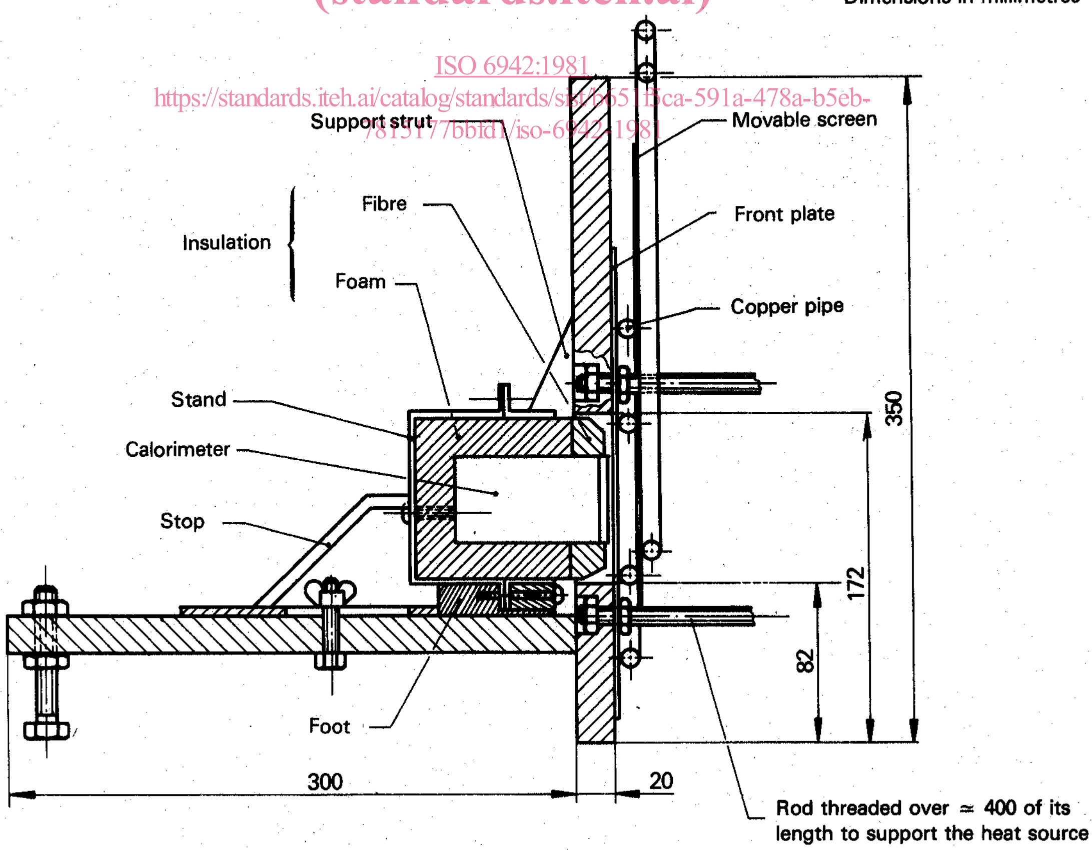
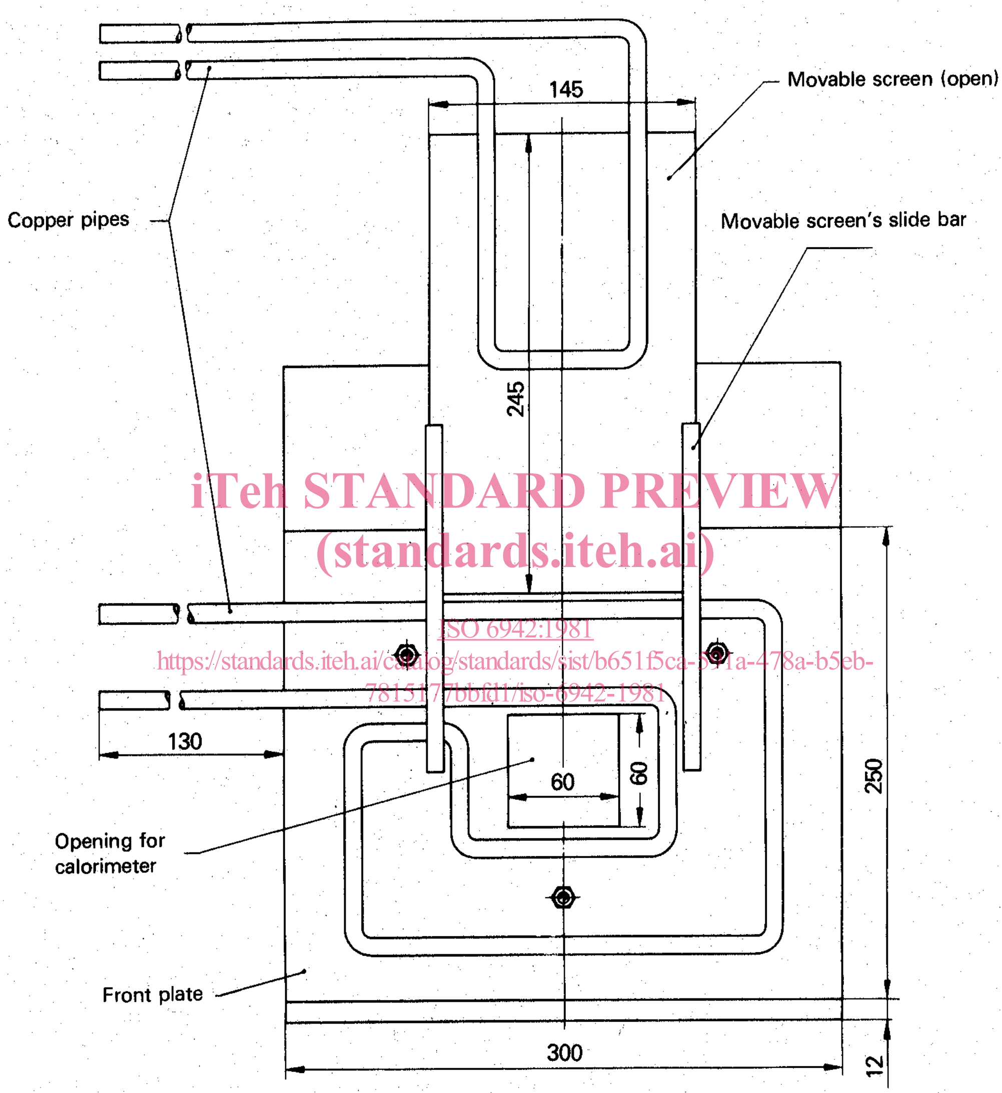


Figure 8 — Supporting frame for calorimeter and heat source (Methods A and B)

Dimensions in millimetres



iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-541a-478a-b5eb-7815177bbfd1/iso-6942-1981

Figure 9 — Cooling system

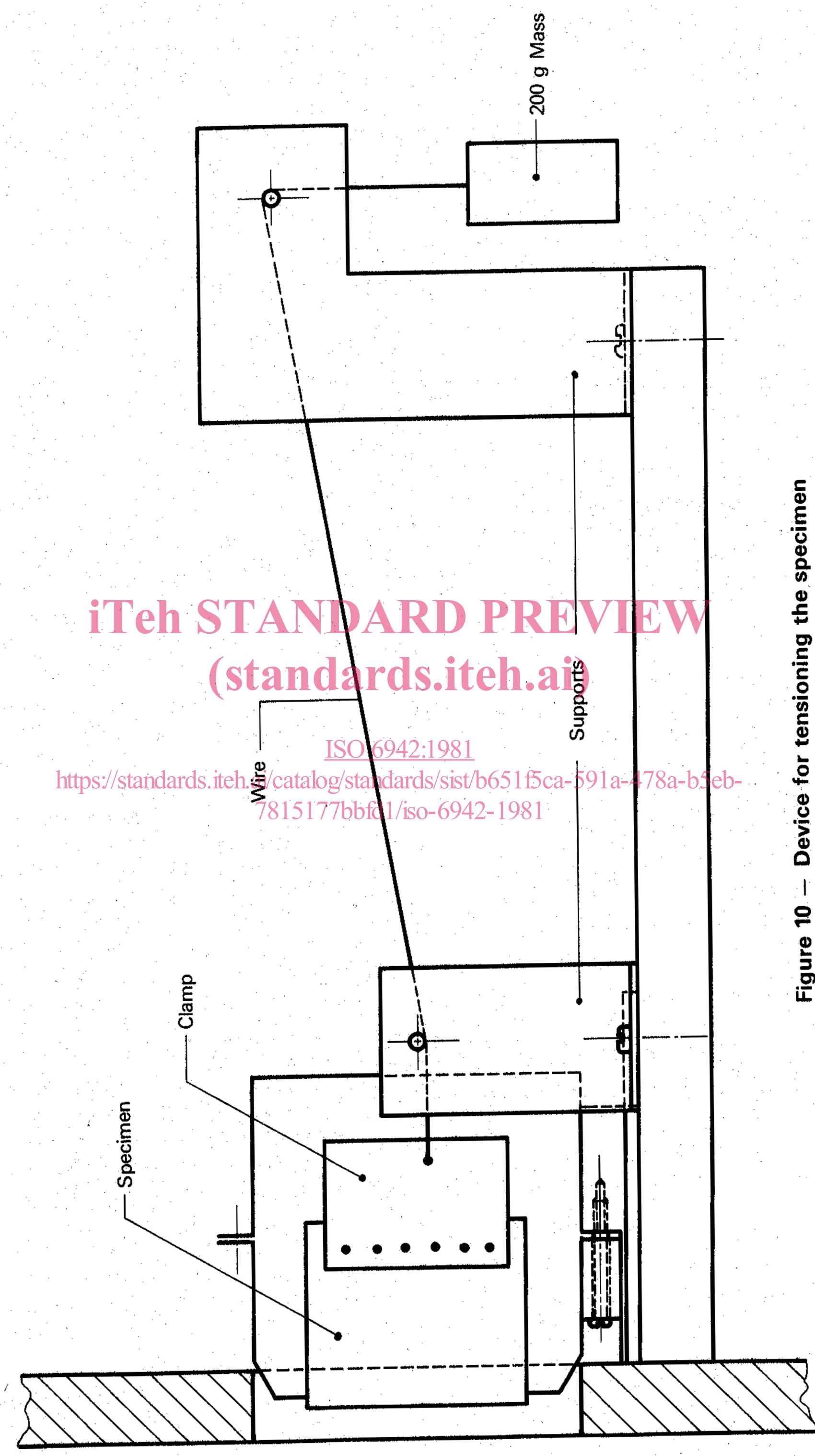


Figure 10 — Device for tensioning the specimen

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 6942:1981
https://standards.iteh.ai/catalog/standards/sist/b651f5ca-591a-478a-b5eb-7815177bbfd1/iso-6942-1981