INTERNATIONAL STANDARD

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Protective clothing — Assessment of resistance of materials to molten metal splash

Vêtements de protection — Évaluation de la résistance des matériaux à la projection de métal fondu

Reference number
ISO 9185:1990(E)

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.

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 9185 was prepared by Technical Committee ISO/TC 94, *Personal safety -- Protective clothing and equipment*.

Annexes A and B form an integral part of this International Standard.

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Introduction

There has been increasing interest in recent years in the flammability performance of textiles. In the metal industries the principal environmental hazards are heat and molten metal splash, and this International Standard is intended to provide a test method by which the protective ability of differing materials can be assessed.

The test takes into account the heat transfer properties of the material being tested and its dynamic resistance to penetration by the molten metal. The full test procedure is based on stepped increases in mass of metal but it is expected that performance specifications will simply require a specified mass of metal to be poured at which the material should not cause damage to the skin simulant.

It has been assumed in the drafting of this International Standard that its procedures are entrusted to appropriately qualified and experienced people. The principle of the test method is such that any metal can be used, but for particular molten metals (e.g. sodium), changes in the materials used for the apparatus will be necessary and additional safety measures needed.

If changes in sensitivity of the test are needed, for example to accommodate the assessment of materials as protection against a particular metal hazard, then two of the test conditions (pour height and specimen angle to the horizontal) can be varied. Recommended test conditions for a small range of metals are given in annex A.

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Protective clothing — Assessment of resistance of materials to molten metal splash

1 Scope

This International Standard describes a method for assessing the resistance of materials used in protective clothing to molten metal splash. It is important to note that good resistance of a material to a pure molten metal does not guarantee a good performance against slag.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 pour height: The vertical distance from the axis of rotation of the pouring ring to the centre of the pin frame.

2.2 molten metal splash index: A figure equal to the minimum mass of molten metal poured which just causes damage of the skin simulant.

2.3 damage: Any smoothing, modification of the embossing or pin-holing on the surface of the skin simulant extending in total for at least 5 mm across its width. Where the damage is in discrete spots, the widths of each spot are added across any horizontal section.

3 Principle

Materials are tested by pouring small quantities of molten metal on to the test specimen supported at an angle to the horizontal on a small pin frame. Damage is assessed by placing a PVC skin simulant directly behind the test specimen and noting damage to the skin simulant after pouring. Any adherence of the metal to the test specimen surface is also noted. Depending on the result, the test is repeated using a greater or smaller mass of metal, until the minimum quantity to cause damage to the skin simulant is observed.

4 Apparatus

4.1 Commercial grade metal, appropriate to the end use.

NOTE 1 It is recommended that coarse filings or small pieces cut from solid bar or sheet should be used, as fine filings have been found difficult to melt. A range of pouring temperatures appropriate to different metals is given in annex A.

4.2 PVC skin simulant, comprising an embossed PVC sheet, of mass per unit area 230 g/m² ± 10 g/m² which, when tested as described in annex B, shows no smoothing or modification of the embossing of the central area at a block temperature of 166 °C ± 2 °C, but shows smoothing or modification of the central area at a block temperature of 183 °C ± 2 °C.

4.3 Crucible[1], the approximate external dimensions being height 97 mm, top diameter 80 mm, bottom diameter 56 mm, and capacity (brim full) 190 ml.

4.4 Detachable crucible holder, to enable the crucible containing the molten metal to be quickly and safely removed from the furnace to the test apparatus.

4.5 Furnace, capable of operating at a temperature 100 °C above the pouring temperature specified in annex A. The furnace type may be either a muffle furnace or an induction type furnace.

NOTE 2 Muffle furnaces are capable of holding at least four crucibles, i.e. internal furnace size is approximately 135 mm × 190 mm × 780 mm, but take several hours to melt metals such as steel, iron and copper. Induction fur-

1) For most molten metals, a graphite impregnated material (if an induction furnace is used) or a ceramic material (if a muffle furnace is used) has been found suitable for the crucible.

naces melt a single crucible of these metals in less than 30 min.

4.6 Temperature probe, either a small thermocouple or an optical non-contact temperature device, capable of measuring molten metal temperatures up to 1 650 °C.

4.7 Pouring apparatus, pin frame and tray, shown in figure 1, consisting of a pouring device supported on adjustable legs, a specimen holder and a sand tray.

The sand tray shall have minimum dimensions of approximately 250 mm wide × 350 mm long × 50 mm deep and shall be filled with dry sand to a depth of 30 mm to 40 mm.

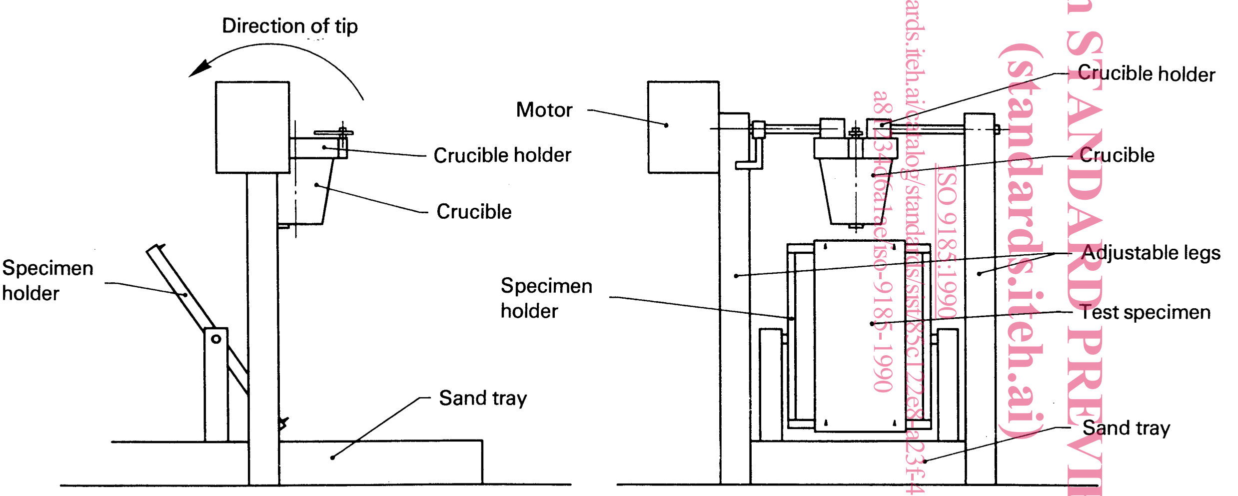


Figure 1 — Pouring apparatus

Dimensions in millimetres

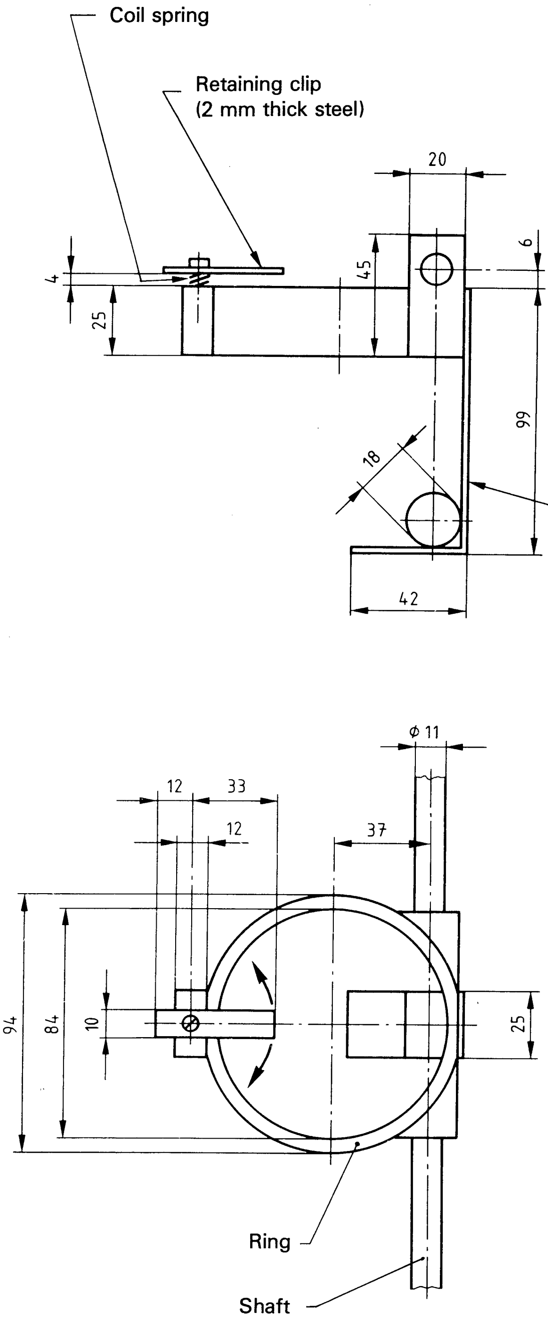


Figure 2 — Pouring device

The pouring device, consisting of crucible holder and drive shaft, shall be constructed in steel (see design in figure 2).

The pouring apparatus shown in figure 1 is fitted with an electric motor. An alternative version is shown in figure 3 with a circuit diagram for the motor drive shown in figure 4.

A metal bar is attached to the pouring device to serve as a stop to prevent the crucible rotating before the molten metal is poured.

The drive shaft shall be firmly supported and be adjustable in height so that the specified pour height (see annex A) can be achieved.

The specimen holder shall consist of a rectangular pin frame, 160 mm ± 5 mm wide × 248 mm ± 2 mm deep made from 8 mm square steel. It shall have four tenter pins, two on the top edge and two on the bottom edge, spaced 80 mm ± 2 mm apart and 40 mm ± 2 mm from the respective corners. The pin frame shall be supported on a suitable frame which enables the angle of the specimen to the horizontal to be varied (see annex A) and the position of the test specimen relative to the pouring device to be adjusted so that the main impact of the molten metal is near the centre of the test specimen.

Dimensions in millimetres

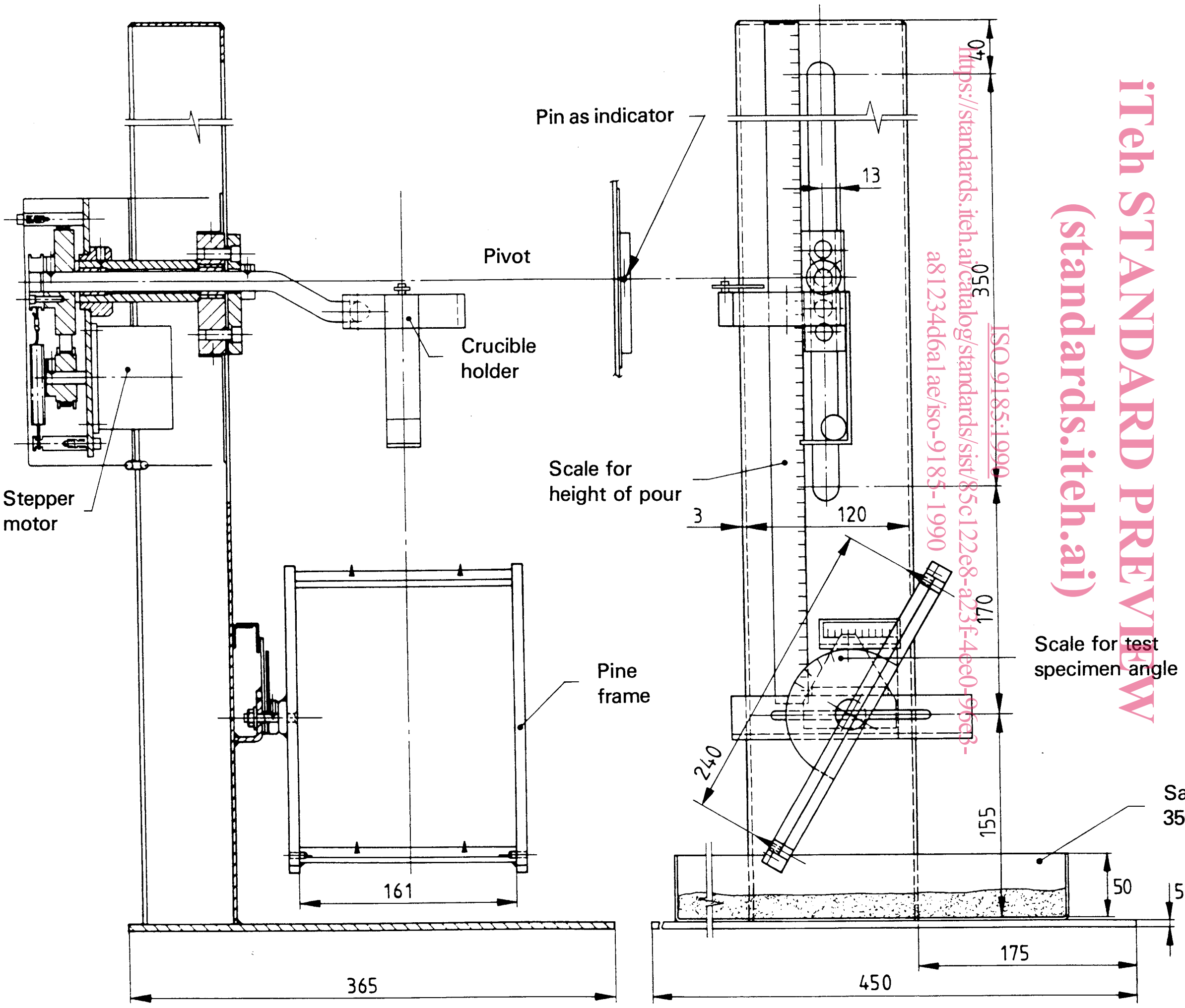
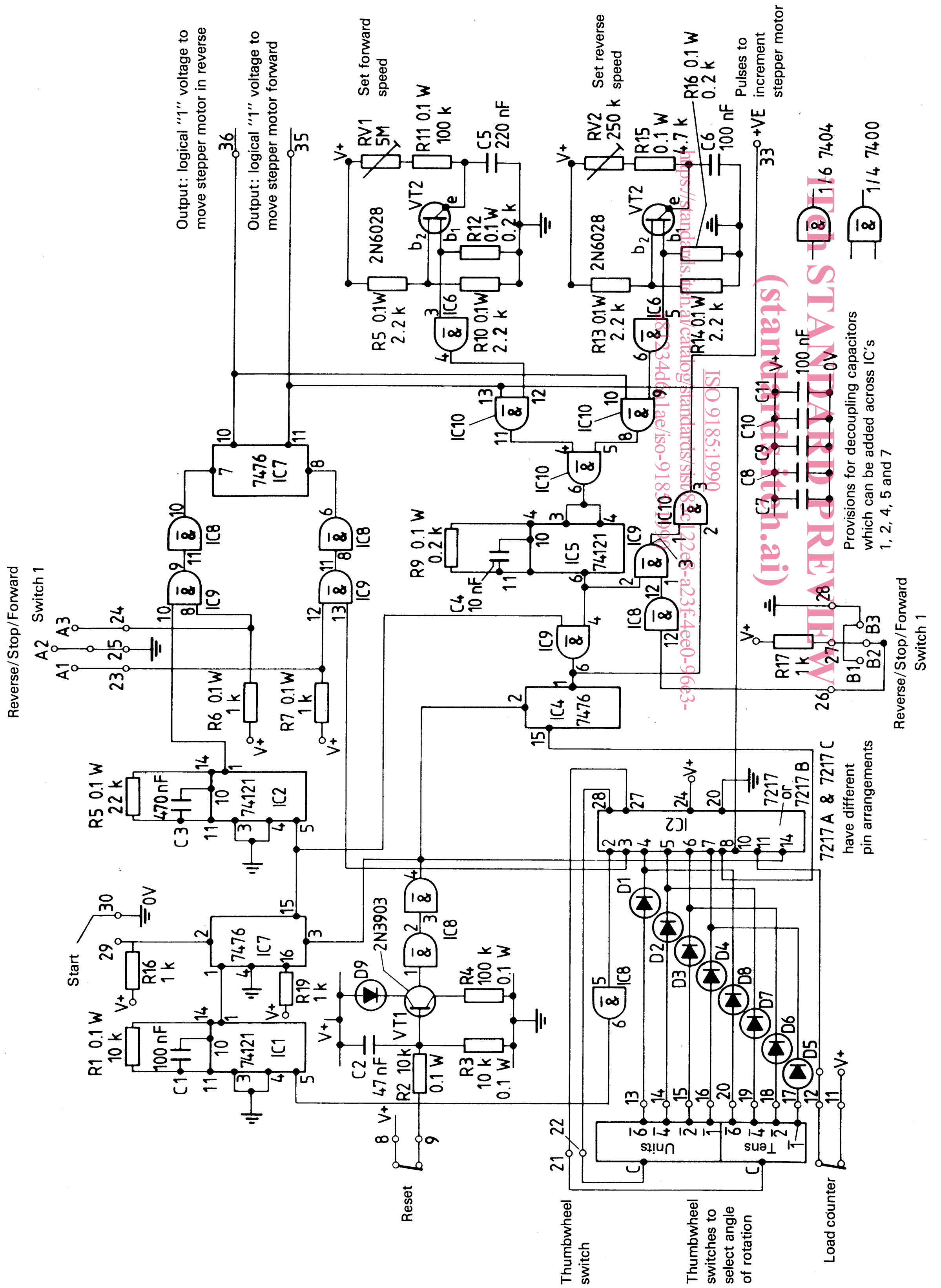


Figure 3 — Motorized pouring apparatus



NOTE — This circuit used in conjunction with a stepper motor and associated drive board will rotate the crucible through a preset angle before returning to the test position. A motor with a holding torque of 0,125 kg·m and a rotation of 1,8° per step is recommended. In this case the angle of rotation is the number selected on the thumbwheel switches × 1,8°.

Figure 4 — Circuit diagram for motor drive