INTERNATIONAL STANDARD

ISO 9151

First edition
1995-05-15

Protective clothing against heat and flame — Determination of heat transmission on exposure to flame

Vêtements de protection contre la chaleur et les flammes — Détermination de la transmission de chaleur à l'exposition d'une flamme

Reference number
ISO 9151:1995(E)

Contents

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

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 9151 was prepared by Technical Committee ISO/TC 94, *Personal safety – Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

This International Standard is equivalent to the European Standard EN 367:1992, *Protective clothing — Protection against heat and fire — Method of determining heat transmission on exposure to flame*.

Annexes A, B and C of this International Standard are for information only.

Introduction

This method has been developed from an American Society for Testing and Materials (ASTM) method which was based on the Du Pont thermal protective index (TPI) method. It has been considerably modified from previous versions following extensive interlaboratory trials carried out by ISO/TC 94/SC 13/WG 2.

Heat transmission through clothing is largely determined by its thickness including any air gaps trapped between the different layers. The air gaps can vary considerably in different areas of the same clothing assembly. The present method provides a grading of materials when tested under standard test conditions.

The following major modifications have been made from previous versions of this test method.

a) The air gap between the back of the test specimen and the calorimeter has been eliminated. This was found to increase all the values recorded, to provide a wider range of values and to distort the results with some materials more than others.

b) The specimen size has been increased and the mass of the location plate has been specified. The mass of the location plate is used to hold the specimen in position so that the specimen is compressed by a standard mass and is also restricted from shrinking.

c) The method of measuring the heat transmission has been drastically simplified and a new term "heat transfer index (HTI)" has been introduced to avoid confusion with the thermal protective index (TPI) or other terms used in previous versions of this test. This change makes it easier to perform the test and reduces the possibility of mathematical errors in calculating the results. The heat transfer index provides a method of grading materials which does not imply that the material tested will give any precise protection time under actual use conditions.

d) Other methods of restraining the test specimens using clamps or pins have been rejected on the basis of interlaboratory trials because of practical difficulties which were believed to increase the interlaboratory variability.

e) All terminology which implies that the test method measures the protection time provided by the test material has been eliminated. The protection provided under actual use conditions will vary considerably, depending on the severity of the actual flame source and the thickness of the clothing, including intermediate air gaps, in the exposed area.

Protective clothing against heat and flame — Determination of heat transmission on exposure to flame

1 Scope

This International Standard specifies a method for comparing the heat transmission through materials or material assemblies used in protective clothing. Materials are ranked by calculation of a heat transfer index, which is an indication of the relative heat transmission under the specified test conditions. The heat transfer index should not be taken as a measure of the protection time given by the tested materials under actual use conditions.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

IEC 584-1:1977, *Thermocouples — Part 1: Reference tables.*

3 Definitions

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

3.1 test specimen: All the layers of fabric or other materials arranged in the order and orientation as used in practice and including undergarments.

3.2 incident heat flux density: Amount of energy incident per unit time on the exposed face of the specimen, expressed in kilowatts per square metre (kW/m^2).

3.3 heat transfer index (flame): Whole number calculated from the mean time in seconds to achieve a temperature rise of (24 ± 0,2) °C when testing by this method using a copper disc of mass (18 ± 0,05) g and a starting temperature of (25 ± 5) °C.

4 Principle

A horizontally oriented test specimen is partially restrained from moving and subjected to an incident heat flux of 80 kW/m^2 from the flame of a gas burner placed beneath it. The heat passing through the specimen is measured by means of a small copper calorimeter on top of and in contact with the specimen.

The time, in seconds, for the temperature in the calorimeter to rise (24 ± 0,2) °C is recorded. The mean result for three test specimens is calculated as the "heat transfer index (flame)".

5 Apparatus

The apparatus consists of

— a gas burner;

— a copper disc calorimeter;

— a specimen support frame;

— a calorimeter location plate;