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**SPECIFICATION FOR
CLOTHING FOR PROTECTION
AGAINST INTENSE HEAT
FOR SHORT PERIODS**

BRITISH STANDARDS INSTITUTION

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BRITISH STANDARDS INSTITUTION

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 476. Fire tests on building materials and structures. Part 1. Fire tests on building materials and structures.
- BS 729. Zinc coatings on iron and steel articles.
- BS 915. High alumina cement.
- BS 1224. Electroplated coatings of nickel and chromium.
- BS 1615. Anodic oxidation coatings on aluminium.
- BS 1651. Industrial gloves.
- BS 1706. Electroplated coatings of cadmium and zinc on iron and steel.
- BS 2095. Industrial safety helmets (light duty).
- BS 2826. Industrial safety helmets (heavy duty).
- BS 3120. Performance requirements of materials for flame-proof clothing.
- BS 4202. Determination of the dimensional changes of fabrics containing wool on soaking in water.
- BS Handbook No. 11. Methods of test for textiles.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee reference PSM/8/2 Draft for comment 69/4809

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CO-OPERATING ORGANIZATIONS

The Personal Safety Equipment Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

British Footwear Manufacturers' Federation
 British Ironfounders' Association
 British Occupational Hygiene Society
 British Red Cross Society
 British Rubber Manufacturers' Association Ltd.
 British Safety Council
 British Steel Industry
 Cement Makers' Federation
 Chemical Industries Association
 Consumers' Association
 Consumer Council
 Council of Ironfoundry Associations
 *Department of Employment and Productivity, H.M. Factory Inspectorate
 Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales
 Engineering Employers' Federation
 Federation of Civil Engineering Contractors
 Glass Manufacturers' Federation
 Industrial Safety (Personal Equipment) Manufacturers' Association
 Institute of British Foundrymen
 Institution of Civil Engineers
 Institution of Engineering Inspection
 Institution of Industrial Safety Officers
 Institution of Mechanical Engineers
 Institution of Production Engineers
 Iron and Steel Trades Confederation
 *Medical Research Council
 National Federation of Building Trades Operatives
 Paintmakers' Associations of Great Britain
 Royal Society for the Prevention of Accidents
 Shoe and Allied Trades Research Association
 Trades Union Congress
 United Kingdom Atomic Energy Authority

The Government department and organization marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

Chief Fire Officers' Association
 Engineering Equipment Users' Association
 Fire Protection Association
 Home Office
 Ministry of Defence (Air Force Department)
 Ministry of Defence (Army Department)
 Ministry of Technology
 Ministry of Technology and Fire Offices' Committee
 Joint Fire Research Organization
 National Coal Board
 Oil Companies' Materials' Association
 Textile Institute
 Welding Institute
 Wool Industries Research Association
 Individual advisers

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BRITISH STANDARD SPECIFICATION FOR CLOTHING FOR PROTECTION AGAINST INTENSE HEAT FOR SHORT PERIODS

FOREWORD

This British Standard, which was first published in 1964, has been revised to relate protective values of clothing more closely to the various hazards and to extend the list of hazards against which protection is available by including short term immersion in fire. The opportunity has also been taken to include requirements for the resistance of helmets and boots to the ingress of flame, and to make certain necessary changes to the test procedures.

Among the hazards to be expected in conditions of intense heat are:

- (1) the effects of heat on the body, face and hands;
- (2) the danger of clothing catching fire.

Particularly in fire fighting, the following are important:

- (3) the effects on the lungs of combustion products and the vapours used for fire extinction;
- (4) reduced visibility owing to smoke or to lighting failure;
- (5) electric shock;
- (6) falling objects;
- (7) the effects of high rates of heating by conduction caused by contact with hot surfaces;
- (8) falling and slipping.

Because of the diverse nature of these hazards, the protective clothing specified in this standard should only be worn by a trained operator aware of the limitations of the clothing.

Attention is particularly drawn to the notes on design, maintenance and operating conditions given in Appendix A of this standard.

Protective clothing should not ignite easily, but, if ignited, it should cease to burn on removal from the igniting source. Many fabrics that are safe in the normal atmosphere may ignite easily and continue to burn in oxygen-enriched atmospheres or air under pressure, and great care is necessary in the choice of materials for clothing to be used under these conditions.

Protective clothing should have as high a thermal insulating value as possible. It may not be practicable to have a sufficiently high insulating value to provide complete protection against high rates of heating and use must then be made of the capacity of the clothing to absorb heat which, however, only delays the time at which heat flow into the skin reaches a dangerous level. Different types of clothing may be required for protection against heating by radiation and against heating caused by hot air and flame lick.

Metallized reflecting fabrics provide effective protection against radiant heat but if their surfaces become dirty or oxidised, creased or damaged, the reflecting power is reduced and, if the metallizing is destroyed, the protection will only be as much as is provided by the insulating power and heat storage capacity of the fabrics. With all types of protective clothing, garments made of light bulky materials which trap large quantities of air increase the thermal insulation. The wearing of certain types of underwear, e.g. those with an open mesh pattern, will give added protection. The thermal protective indices given in the table for clothing for protection against Class 2 hazards (see Table 1) apply to an assembly consisting of outer garment materials in conjunction with a cotton shirting material and string underwear material. The indices for clothing against Class 3 and Class 4 hazards apply to an assembly consisting of outer garment materials in conjunction with firemen's uniform material, cotton shirting material and string underwear material.

As far as is practicable, all the clothing, including the underwear, should be supplied as part of the uniform. *The complete assembly should be tested* and so specified. In some circumstances, additional clothing worn by the operator 'at the ready' may reduce his effectiveness by retaining his own body heat.

Tests are described in Appendices B to D for assessing the protection given by clothing against flames and against radiant heat; the results of these tests are expressed as thermal protective indices. These indices are intended to rank clothing assemblies in their relative order of merit and should on no account be taken as absolute measures of the protection afforded by the clothing.

An impact test for vizors and faceshields is given in Appendix G.

SPECIFICATION

1. GENERAL

1.1 SCOPE

This British Standard concerns the design, construction and use of clothing for protection for up to five minutes against radiant heat and flame licks, and for up to two minutes against flame immersion. It does not apply to liquid or air cooled suits. It does not deal with breathing apparatus which is covered in other British Standards.

This standard specifies the performance requirements and methods of test of protective clothing and also of the materials used in the construction of the clothing. It includes in Appendix A notes upon important points of design, maintenance and operating conditions.

1.2 DEFINITIONS

For the purposes of this British Standard the following definitions apply:

Thermal protective index (flame). A number equal to the time in seconds before the temperature of the back surface of the protective clothing assembly rises 25°C when exposed to a standard heat source burning hexane. The method of test is described in Appendix B (Appendix C for footwear).

Thermal protective index (radiation). A number equal to the time in seconds before the temperature of the back surface of the protective clothing assembly rises 25°C when exposed to a standard radiation source consisting of a radiant panel. The method of test is described in Appendix D.

1.3 THERMAL PROTECTION

The protection afforded by the clothing is assessed by the methods given in Appendices B, C, and D. The results are expressed as thermal protective indices (flame or radiation), as appropriate.

When a garment comprises several layers the protection afforded by the clothing shall be determined for all layers together in the order in which they occur. The garment may be backed by a lining and/or under-garments, providing that these are representative of the type of clothing worn for the proposed application. The test report shall include full details of the garment assembly tested.

1.3.1 Thermal protective indices. Protective clothing shall have thermal protective indices (flame and radiation) complying with the requirements specified in column 3 of Table 1.

1.3.2 Condition of assembly after removal of heat source. The fabric shall not flame or glow after the removal of the source of heat.

1.4 FASTENERS

1.4.1 All joinings of protective clothing shall have sufficient overlap to prevent ingress of heat and sparks, e.g. in the design of two-piece garments care shall be taken that no separation of any two parts is caused by the movements of the wearer. Similar attention shall be paid to joinings between body garments and accoutrements.

1.4.2 Fasteners shall be secure in use yet shall permit rapid removal of the clothing in an emergency.

1.4.3 All metal components shall be smoothly finished and adequately protected against corrosion. They shall withstand the most stringent conditions