

BRITISH STANDARD 2091 : 1969

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**SPECIFICATION FOR
RESPIRATORS FOR
PROTECTION AGAINST HARMFUL
DUSTS AND GASES**

SPECIFICATION FOR
RESPIRATORS FOR
PROTECTION AGAINST HARMFUL
DUSTS, GASES AND
SCHEDULED AGRICULTURAL
CHEMICALS

BS 2091 : 1969

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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.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

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 410. Test sieves.

BS 2092. Industrial eye-protectors.

BS 2577. Methylene blue particulate test for respirator canisters.

BS 4555. High efficiency dust respirators.
chemicals.

BS 4400. Sodium chloride particulate test for respirator filters.

BS 3406. Methods for the determination of particle size of powders.

BS 4275. Recommendations for the selection, use and maintenance of respiratory protective equipment.

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 14. Draft for comment 67 25730.

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CO-OPERATING ORGANIZATIONS

The Personal Safety Equipment Standards Committee, under whose supervision these recommendations were 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 Steel Industry
- Cement Makers' Federation
- *Chemical Industries 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
- 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
- Textile Council
- Trades Union Congress
- *United Kingdom Atomic Energy Authority

The Government department and organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this standard.

Association of British Manufacturers of Agricultural Chemicals
 British Plastics Federation
 Council of British Manufacturers of Petroleum Equipment
 Engineering Equipment User's Association
 Home Office
 Institution of Gas Engineers
 Leathercloth and Coated Fabrics Manufacturers' Association
 Ministry of Agriculture, Fisheries and Food
 Ministry of Defence (Air Force Department)
 Ministry of Defence, Army Department
 Ministry of Power
 Ministry of Power—Safety in Mines Research Establishment
 National Coal Board
 Oil Companies Materials Association
 Royal Air Force Institute of Aviation Medicine
 Steel Castings Research and Trade Association
 Individual users of respiratory protective equipment

BRITISH STANDARD SPECIFICATION FOR RESPIRATORS FOR PROTECTION AGAINST HARMFUL DUSTS, GASES AND SCHEDULED AGRICULTURAL CHEMICALS

FOREWORD

*As amended
May, 1970*

This British Standard deals with respirators for protection against harmful dusts, gases and scheduled agricultural chemicals. It was first issued in 1954 and this revision has been undertaken to take account of improvements in the design and performance of respirators.

When determining the type of protection that should be provided for any particular conditions, reference should be made to BS 4275, 'Recommendations for the selection, use and maintenance of personal respiratory protective equipment'.

Respirators afford no protection against oxygen deficiency and have very definite limitations, and should only be issued and fitted under the supervision of a competent person aware of the conditions surrounding their use.

A British Standard is being prepared covering respirators for use against highly toxic materials (including radioactive substances) in particulate form.

NOTE. This standard is written in terms of metric (SI) units except for the use of sub-multiples of the bar for the expression of pressures ($1 \text{ bar} = 10^5 \text{ N/m}^2$), and gives metric (technical) and inch equivalents, which for the purposes of this standard are equally valid. The test apparatus was designed, and is therefore described, in inch units.

SPECIFICATION

1. INTRODUCTION

1.1 SCOPE

This British Standard specifies requirements for dust respirators giving protection against dusts and other particulate matter; it also specifies requirements for gas respirators (canister type) affording protection against the limited concentration of the gases listed in Tables 1 and 2, and gas respirators (cartridge type) providing protection against low concentrations of certain relatively non-toxic gases referred to in Table 3.

For the purposes of this standard the word 'dust' is taken to include other particulates such as mists and fumes, and the word 'gas' is taken to include vapour.

This standard does not cover mouthpiece type respirators for emergency escape, respirators for protection against radioactive and other highly toxic

particulate materials which are dealt with in BS 4555*

*As amended
May, 1970*

1.2 DEFINITIONS

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

(1) *Dust respirator*. Apparatus having a particulate filter to remove finely divided solid or liquid matter from the air inhaled by the wearer.

(2) *Gas respirator*

- a. *Canister type*. Apparatus that removes limited concentrations of certain toxic gases from the air inhaled by the wearer, by use of a filter contained in a replaceable canister connected to a full facepiece. This type may also incorporate a particulate filter to remove dust.
- b. *Cartridge type*. Apparatus that removes low concentrations of certain relatively non-toxic gases and vapours from the air inhaled by the wearer, by use of a replaceable cartridge filter usually fitted to a half-mask (or i-nasal facepiece). This type also incorporates a particulate filter to remove dust.

1.3 APPLICATION

Every respirator shall comply with the general requirements of Section 2 and with the specific requirements of the particular section applicable to the respirator type as follows:

Dust respirators	Section 3
Gas respirators, canister type	Section 4
Gas respirators, cartridge type	Section 5

2. GENERAL REQUIREMENTS

2.1 CONSTRUCTION

2.1.1 The respirator shall be constructed of materials suited to withstand normal usage and exposure to extremes of environmental temperature and humidity.

2.1.2 The materials used shall be such that every component has a probable effective shelf life of at least five years if properly stored and maintained (two years in the case of canisters of types, S.H.C. and D (see Table 1), and any canister of which the seal has been broken), or, in the case of filter units, the shelf life marked on them in accordance with clause 3.5.3 (4).

*As added
Jan. 1978*

2.1.3 No materials of a highly flammable nature, of the same order as cellulose nitrate, shall be used.

* BS 4555, 'High efficiency dust respirators.'

2.1.4 Materials that may come into contact with the skin shall be non-staining, soft and pliable, and shall not contain known dermatitic substances.

2.1.5 Hazardous substances (e.g. asbestos) shall not be used as a filtering medium.

2.2 FACEPIECE

2.2.1 Full facepieces shall cover the eyes, nose and mouth and half-masks shall cover the nose and mouth. Both types shall be secured in position by means of an easily adjustable head harness.

2.2.2 The facepiece shall be designed to meet the following requirements:

(1) the airtightness of the seal on the face (with facelet if provided) shall meet the requirements for fit specified in the appropriate section. Full facepieces shall permit the wearing of spectacles of special design and shall still meet the face seal leakage requirement. A half-mask shall permit the wearing of spectacles or eye-protectors without mutual interference;

(2) it shall reduce as far as practicable the proportion of air exhaled within the facepiece that can be re-breathed;

(3) it shall be compact and light in weight and shall cause the least possible interference with vision and freedom of movement;

(4) it shall be capable of withstanding repeated cleaning and sterilizing by one of the methods described in Appendix D or by any method of equivalent effectiveness specified by the manufacturer;

(5) full facepieces shall have suitable and, preferably, replaceable eyepieces or eye shields complying with the optical requirements of BS 2092*, and

(6) it shall be comfortable to wear for long periods. Fabric facelets may be provided for half-masks to improve comfort in adverse conditions.

2.3 HARNESS

2.3.1 The head harness shall hold the facepiece firmly and comfortably in position and shall be capable of ready cleansing, sterilization or decontamination.

2.3.2 The head harness of a full facepiece shall be adjustable and, if the harness consists only of straps, have adjustable straps not less than 19 mm ($\frac{3}{4}$ in nominal) width, at the points in contact with the head, designed so that they have to be slackened on removing. This ensures that the wearer must readjust the straps before each occasion of use.

• BS 2092, 'Industrial eye protectors'.

2.3.3 The head harness of a half-mask shall, if consisting only of straps, have adjustable straps not less than 19 mm ($\frac{3}{4}$ in nominal) width, at the points in contact with the head, with the adjustment in a position that will not interfere with the comfort or fit of a safety helmet. After adjustment the harness shall permit the removal of the mask to a position round the neck and its replacement on the face, preferably without loss of correct adjustment.

3. DUST RESPIRATORS

3.1 GENERAL

This standard covers two types of dust respirator, Types A and B. Type A respirators are low resistance respirators in that the test requirements impose a maximum inhalation resistance of 2 mbar* (20 mmH₂O; 0.8 in H₂O) when tested in accordance with the method described in 3.4. They are intended for use against dusts of low toxicity in work conditions where low breathing resistance is important. Type B are higher resistance respirators and the test requirements impose a maximum inhalation resistance of 3.2 mbar* (32 mmH₂O; 1¼ in H₂O); they are required to be more efficient in stopping particles of fine dusts than are Type A respirators.

3.2 DESIGN AND CONSTRUCTION

The design and construction of dust respirators shall be such that they will provide protection against solid particles or, in certain cases, mists, where no toxic gas or vapour is present. Dust respirators shall consist of:

- (1) a facepiece held securely in position by a head harness;
- (2) a filter(s) through which all the inhaled air passes. Filters shall be readily replaceable, and shall be capable of being fitted without edge leakage or other loss of efficiency; they may be encapsulated. For some applications it is desirable that readily replaceable pre-filters shall be available, and
- (3) a valve system such that all air inhaled by the wearer passes through the filter(s). The exhaled air shall pass direct to the surrounding atmosphere through a non-return valve.

3.3 FIT

When tested in accordance with Appendix C the fit of the respirator, together with the fabric facelet where provided, shall ensure that the leakage of the test contaminant between the facepiece and the wearers' faces shall not exceed a mean value of 5% for the ten test subjects.

* 1 mbar = 10³ N/m².

3.4 PERFORMANCE REQUIREMENTS

Respirators shall be capable of meeting the following performance requirements.

3.4.1 Resistance

3.4.1.1 Inhalation. The respirator shall be connected in an airtight manner to a hollow former of suitable shape; the air shall be drawn through the filter from the atmosphere at the rate of 85 l/min (3 ft³/min). The resistance imposed by the respirator to the stream of air shall not exceed 2 mbar* (20 mmH₂O; 0.8 in H₂O) for Type A respirators nor 3.2 mbar* (32 mmH₂O; 1¼ in H₂O) for Type B respirators.

3.4.1.2 Exhalation. The respirator shall be connected in an airtight manner to a hollow former of suitable shape; the air shall be blown into the former at the rate of 85 l/min (3 ft³/min) and passed to the atmosphere through the respirator. The resistance imposed by the respirator to the stream of air shall not exceed 1.25 mbar* (12.5 mmH₂O; ½ in H₂O) for Types A and B.

3.4.2 Protection against dust. The effectiveness of the initial protection afforded by the filter system against dust shall be assessed by the method described in BS 2577† or BS 4400‡ and the penetration at a flow rate of 30 l/min (1 ft³/min) shall not exceed 10 % for Type A respirators; for Type B it shall not exceed 2 % for resin wool filters, 3.5 % for resin felt filters and 5 % for mechanical filters. (The differing values take account of the loss of electrostatic charge during storage.)

3.4.3 Valve leakage. The outlet valve system when dry shall not have a leakage exceeding 30 ml/min when tested at a constant suction head of 2.5 mbar* (25 mmH₂O; 1 in H₂O) in accordance with Appendix A.

3.4.4 Resistance to clogging by dust and humidity When respirators are required to be resistant to clogging in conditions of high humidity they shall be tested in accordance with Appendix B. When so tested, the average weight of dust collected on the filter or filters under either dry or humid conditions shall not be less than 4 g at a resistance of 4 mbar* (40 mmH₂O; 1.6 in H₂O) for Type A respirators, and 5 mbar* (50 mmH₂O; 2 in H₂O) for Type B respirators. Respirators complying with this requirement shall be additionally marked (see 3.5).

3.4.5 Resistance of filters to rough usage. After being shaken in accordance with Appendix E the filter assembly shall show no visible deterioration and shall continue to comply with the requirements of 3.4.1 and 3.4.2 and, if applicable, 3.4.4.

* 1 mbar = 10³ N/m².

† BS 2577, 'Methylene blue particulate test for respirator canisters'.

‡ BS 4400, 'Sodium chloride particulate test for respirator filters'.