

**Please be aware that this PDF has been created from the original hardcopy document, which might not be in good condition and so the PDF might reflect this.**

Sup. 2. 1937 revised to 1957

BRITISH STANDARD 2831 : 1957

METHODS OF TEST FOR  
AIR FILTERS  
USED IN  
AIR-CONDITIONING AND  
GENERAL VENTILATION



BRITISH STANDARDS INSTITUTION

BRITISH STANDARD SPECIFICATION

METHODS OF TEST  
FOR AIR FILTERS USED IN  
AIR-CONDITIONING  
AND GENERAL VENTILATION

B.S. 2831 : 1957

Price 7/6 net

BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

BRITISH STANDARDS HOUSE, 2 PARK ST., LONDON, W.1

TELEGRAMS: STANDARDS, AUDLEY, LONDON      TELEPHONE: MAYFAIR 9000

THIS BRITISH STANDARD, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 7th February, 1957.

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 2500, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 12s. 6d.

This standard makes reference to the following British Standards :

B.S. 1042. Code for flow measurement.

B.S. 1780. Pressure gauges: *benin the pressure vacuum gauges*

B.S. 2577. Methylene blue particulate tests for respirator canisters.

*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 B.S.I. references relate to the work on this standard:—  
Committee reference MEE/95 and MEE/95/3  
Draft for comment CV(MEE)922.

### CO-OPERATING ORGANIZATIONS

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:—

- \*Admiralty
- Air Ministry
- Associated Offices' Technical Committee
- Association of Consulting Engineers (incorporated)
- British Chemical Plant Manufacturers' Association
- \*British Compressed Air Society
- British Electrical and Allied Manufacturers' Association
- British Engineers' Association
- \*British Internal Combustion Engine Manufacturers' Association
- British Iron and Steel Federation
- British Railways, The British Transport Commission
- Central Electricity Authority and Area Boards
- Crown Agents for Oversea Governments and Administrations
- D.S.I.R.—Mechanical Engineering Research Laboratory
- Engineering Equipment Users' Association
- Gas Council
- High Commission of India
- Institute of Marine Engineers
- Institute of Petroleum
- Institution of Civil Engineers
- Institution of Gas Engineers
- \*Institution of Heating and Ventilating Engineers
- Institution of Mechanical Engineers
- Institution of Mechanical Engineers (Automobile Division)
- Institution of Production Engineers
- Locomotive and Allied Manufacturers' Association of Great Britain
- Machine Tool Trades' Association
- Ministry of Fuel and Power
- \*Ministry of Labour and National Service (Factory Department)
- \*Ministry of Supply
- Ministry of Transport and Civil Aviation
- \*Ministry of Works
- National Coal Board
- National Physical Laboratory (D.S.I.R.)
- Radio Industry Council
- War Office

The government departments and scientific and industrial 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:—

- British Internal Combustion Engine Research Association
- Council of British Manufacturers of Petroleum Equipment
- D.S.I.R.—Building Research Station
- D.S.I.R.—Fuel Research Station
- Fan Manufacturers' Association
- Imperial College of Science and Technology
- London Transport Executive, The British Transport Commission
- Manchester Joint Research Council
- Motor Industry Research Association
- National College for Heating, Ventilating, Refrigeration and Fan Engineering
- National Institute of Agricultural Engineering
- Society of British Aircraft Constructors
- Technical Section of the British Paper and Board Makers Association
- Individual filter manufacturers

BRITISH STANDARD SPECIFICATION

METHODS OF TEST  
FOR AIR FILTERS USED IN  
AIR-CONDITIONING  
AND GENERAL VENTILATION

B.S. 2831 : 1957

Price 7/6 net

BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

BRITISH STANDARDS HOUSE, 2 PARK ST., LONDON, W.1

TELEGRAMS: STANDARDS, AUDLEY, LONDON TELEPHONE: MAYFAIR 9000

## CONTENTS

	Page
Foreword	6
<b>SPECIFICATION</b>	
SECTION ONE : GENERAL	
1. Scope	7
SECTION TWO : METHYLENE BLUE EFFICIENCY TEST	
2. Definitions	8
3. Methods of test	8
4. Apparatus for production of test dust	
<i>a.</i> Atomizer	8
<i>b.</i> Compressed air flowmeter	9
<i>c.</i> Pressure gauge	9
<i>d.</i> Regulator valve	9
<i>e.</i> Compressed air supply	9
<i>f.</i> Accessory items	9
<i>g.</i> Connections	10
<i>h.</i> Calibration of compressed air flowmeter	10
<i>j.</i> Filling of atomizer	10
5. Test rig	10
6. Ancillary equipment	11
7. Condition of air	12
8. Procedure	13
<i>a.</i> Preliminary adjustments	13
<i>b.</i> Test	13
9. Calculations	14
<i>a.</i> Volume of samples	14
<i>b.</i> Optical density of stain	14
<i>c.</i> Value of methylene blue efficiency	15
SECTION THREE : DUST-HOLDING CAPACITY AND GRAVIMETRIC EFFICIENCY TEST	
10. Definitions	16
11. Method of test	16
12. Apparatus for dispersal of test dusts 2 and 3	17
13. Test rig	17
14. Ancillary equipment	17
15. Condition of air	17
4	
<b>SPECIFICATION</b>	
16. Procedure	18
<i>a.</i> Preliminary adjustments	18
<i>b.</i> Determination of initial filter resistance	18
<i>c.</i> Determination of oil carryover characteristics	18
<i>d.</i> Determination of gravimetric efficiency	18
17. Reporting	20
<b>APPENDICES</b>	
A. Notes on maintenance of atomizer	21
B. Example of calculation of the value of methylene blue efficiency	22
C. Specimen test report form	23
D. Specification of esparto paper	25
<b>FIGURES</b>	
Fig. 1. Atomizer head and nut	26
Fig. 2. Atomizer tube and sleeve	27
Fig. 3. Atomizer nozzle	27
Fig. 4. Assembly of atomizer	28
Figs. 5 and 6. Details of compressed air flowmeter	29-30
Figs. 7 and 8. Filter paper clamp	31-32
Fig. 9. General arrangement of test rig	33
Fig. 10. Alternative method of flow measurement using flowmeters	34
Fig. 11. Diagram of air supply connections to atomizer	35
Fig. 12. Dust injector	36
Fig. 13. Wander lead	37
Fig. 14. Variation of resistance with air flow—clean filter.	38
Fig. 15. Variation of resistance with dust load at air flow rating.	38
Fig. 16. Variation of efficiency with dust load at maximum air flow rating.	38
Fig. 17. Variation of methylene blue efficiency with various loads at maximum air flow rating.	39
Fig. 18. Dust feed mechanism.	40
Fig. 19. General arrangement of dust feed mechanism.	41

## BRITISH STANDARD SPECIFICATION FOR METHODS OF TEST FOR AIR FILTERS USED IN AIR-CONDITIONING AND GENERAL VENTILATION

### FOREWORD

Several criteria are available for expressing the efficiency of an air filter; these include consideration of the number of particles removed by the filter, the reduction of staining due to air pollution, and the weight of dust extracted from the air. No single criterion is equally suitable for every application of air-cleaning devices. It has been concluded that, so far as air conditioning and general ventilation are concerned, one of the most important factors is the dirtying effect of the atmosphere. Accordingly, this British Standard, prepared under the authority of the Mechanical Engineering Industry Standards Committee, incorporates a staining test for the determination of efficiency.

Natural dusts are variable in composition and size distribution, and are generally of low concentration. These factors would introduce difficulties in any test seeking to employ naturally occurring airborne dust, and in order to avoid these difficulties and to secure more reproducible results, the use of standard dusts has been adopted. The methylene blue dust chosen as a standard for one of the efficiency tests contains only fine particles. For this reason, the test is a severe one, and a filter exposed to normal atmospheric impurities would be expected to show higher efficiencies than those indicated by the test. Nevertheless, the test provides a fair comparison of the relative efficiencies of different filters when used under similar atmospheric conditions.

By working within the limits set in the standard for the staining test, an accuracy of  $\pm 5$  per cent can be assumed when assessing the performance of filters having efficiencies below about 60 per cent. Greater accuracy will be achieved in assessing the performance of filters having efficiencies higher than about 60 per cent.

Atmospheric pollution differs from the standard methylene blue dust cloud in that it may contain some coarse particles in addition to the fine ones; this small proportion of larger particles is believed to be mainly responsible for the clogging of a filter, with consequent increase of resistance and termination of its useful life. Since the life of a filter may be as important a characteristic as its efficiency, the methylene blue test is supplemented by a test for dust-holding capacity which employs two grades of coarse dust.

In certain applications, the efficiency of filtration of coarse dusts is also of interest. This British Standard, therefore, includes tests of

filtration efficiency ascertained gravimetrically with the two grades of coarse dusts.

The quantity of dust in the air stream leaving a filter is governed by the extent to which particles are carried through its interstices, without colliding with the filter elements, and also by some particles, which have collided, not being permanently retained but again becoming airborne.

These effects depend, amongst other things, upon the air speed and the nature of the filtering medium and of the particles. For example, a coarse dust might make more collisions than a fine one with the fibres of a cloth filter, but owing to the particles bouncing off again to a greater degree, the filter could still have a lower efficiency at large rates of flow. *See FOREWORD to BS 2831:11*

The performance of the filter against the aluminium oxide test dusts may give indications of such behaviour which would not necessarily be reproduced in service when operating against other dusts.

It is appreciated that the method of test for gravimetric efficiency specified in this British Standard is applicable only to filters which can be weighed accurately. For filters which cannot be weighed accurately, possible methods of assessing the weight of dust retained in the filter are as follows:—

- a. Sampling upstream and downstream of the filter.
- b. Use of an absolute filter downstream of the filter under test, the dust retained being assessed from the difference between that injected upstream and that retained on the absolute filter downstream.
- c. Recovery of the dust from the filter and weighing the dust.

By the use of these methods some indication of the gravimetric efficiency could be obtained, but these methods are outside the scope of this British Standard.

No attempt has been made to set desirable limits, whether high or low, to the efficiency of filters for specific applications. This is largely a matter of economics, and is therefore outside the scope of a British Standard.

It must be emphasized that the word 'efficiency' should not be used in connection with this British Standard without specifying the test dust to which it refers.

### SPECIFICATION

#### SECTION ONE : GENERAL

##### SCOPE

1. This British Standard relates solely to methods of testing air filters, and it does not purport to specify performance standards. It is primarily intended for bench testing filters used in air-conditioning and general ventilation. Two tests are included: the first deals with the determination of methylene blue efficiency using staining effect as a criterion, and this

*(with penetration not less than 0.01 per cent.)*