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Methods for

The measurement of air pollution —

Part 5: Directional dust gauges

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British Mechanical Engineering Confederation	Institute of Fuel*
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Electricity Council, the Central Electricity Generating Board and Area Boards in England and Wales*	

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 British Standard:

Association of Municipal Corporations	Department of Trade and Industry — Warren Spring Laboratory
Association of Public Health Inspectors	Institution of Electrical Engineers
British Railways Board	Institution of Municipal Engineers
Department of Employment — Factory Inspectorate	London Transport Executive
Department of Trade and Industry — Laboratory of the Government Chemist	National Society for Clean Air

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Foreword

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 Standard:

BS 2751, *Vulcanized butadiene/acrylonitrile rubber compounds*.

Serious damage or reduction of amenity may be caused by polluting materials discharged into the atmosphere from various sources. Such emissions can adversely affect agricultural land and crops, can soil clothing and buildings, can corrode metal installations and can have a harmful effect on the health of the community.

It was suggested, therefore, by interested authorities that, to assist those engaged in dealing with this national problem, the British Standards Institution should undertake the standardization of apparatus for the measurement of air pollution. It was further suggested that such apparatus should be convenient for use by technical colleges and similar institutions in order to promote widespread knowledge of the extent of air pollution.

The pollutants emitted into the air may be arbitrarily classified as follows.

- 1) Particulate material, liquid or solid, coarse enough to settle out fairly rapidly under the influence of gravity or as a result of impingement upon any projection from the Earth's surface. The quantity of such material may be assessed by the method described in Part 1 or that in Part 5 of this standard.
- 2) Finer material which tends to remain suspended in the air but can be collected by filtration; such material is commonly known as "smoke". A method of quantitative assessment will be found in Part 2 of this standard.
- 3) Gaseous impurities, which can be separated from the air by chemical means. An example of such impurities is sulphur dioxide, which causes corrosion and presents a health hazard. A method for the determination of this pollutant will be found in Part 3 of this standard and the determination of some other harmful gaseous constituents of the atmosphere is dealt with in Part 4 of this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

Methods of assessing the deposition of coarse particulate material were considered before those for fine materials and gaseous impurities and a specification covering the construction and use of deposit gauges was issued in 1951.

Experience with these gauges has shown that they collect only very coarse dust adequately under light wind conditions, but are inefficient collectors at higher wind speeds and may even lose some of their previously collected dust under strong wind conditions. They do not adequately take account of the fact that pollution by dust, particularly of vertical surfaces, takes place even with fairly strong winds. A different type of gauge, which until recently has been known as the C.E.R.L. Directional Dust Gauge, has been developed and is the subject of this Part of this standard.

The gauge measures the tendency of objects to become dirty in a dusty atmosphere. It collects the dust that is likely to impinge on objects on the Earth's surface (and does not collect fine material as defined in 2) above). If the measurement of the collected dust and any associated liquid is made by absorptiometer then the "covering power", i.e. the tendency of the dust to soil objects near ground level, is assessed. Alternatively, the collected solid matter can be filtered off, dried and weighed, and an analysis of both residue and filtrate can be carried out, if required. The period of exposure of the gauge for long term measurements is commonly a calendar month, but this may conveniently be expressed in terms of 10 day periods¹⁾. The gauge may also be used in certain circumstances for individual short term measurements.

The gauge will, in fact, only measure the dust pollution at its own position. If the result is intended to be representative of an area rather than the measurement at a point, then the position chosen should be as typical as possible of the area and buildings or other elevated objects should be at typical distances. The deposition of dust can vary considerably over distances of 10 – 100 m and results can only be representative of an area in a statistical sense.

The precise measurement of the particulate material at any particular site is difficult and it should be noted that the amount collected and retained in the gauge is influenced by factors such as the height of the gauge above ground, the nature of the site and the meteorological conditions, e.g. wind force and rainfall. These factors have to be borne in mind when any comparison is made of the quantity of the deposit measured at different sites or even on the same site under varying weather conditions, although such comparisons may be valid in relation to known circumstances, especially when results are averaged over several months. The wind direction is also an important factor and it is a feature of the new type of gauge that its results can be interpreted in terms of direction, which is of value when the gauge is used for diagnostic purposes.

1 Scope

This part of this British Standard covers the construction, installation and use of the directional dust gauge for the collection and measurement of atmospheric impurities that are deposited by their own weight or inertia, or are brought down by natural precipitation.

2 Apparatus

2.1 Assembly. The complete directional dust gauge outfit shall comprise the following:

- 1) one vertical supporting post (with stand, if required);
- 2) four collecting heads;
- 3) eight collecting bottles;
- 4) one squeegee;
- 5) one wash bottle.

2.2 Support. The collecting heads may be attached to a post driven directly into the ground, or to a post that can be supported by three or four legs on surfaces not easily penetrable, and shall be situated so that their tops are 1.5 ± 0.1 m above ground level. Driven posts may be of wood, as shown in Figure 1 *a*, straight grained without knots or flaws, not less than 75 mm in diameter or side of square, or of metal tube, about 50 mm in diameter or about 40 mm square, at least 1.6 mm wall.

¹⁾ D.H Lucas and D.J. Moore. *J. Inst. Air Wat. Poll.*, Pergamon Press, 1964, 8, 441.

If the gauges are mounted on a post to be supported on legs, the legs should be of steel strip at least 20 mm by 3 mm, as shown in Figure 2 (or of wood, as shown in Figure 1b, or tubular metal of equivalent strength), meeting the post at an angle of 45° about 150 mm above ground level. The legs should be linked to each other about 50 mm above ground level or may be affixed to a base plate.

In order that the gauges attached to a post supported on legs may withstand severe wind forces (e.g. up to 40 m/s), a sufficient mass should be added to the legs or base plate as follows:

- 1) to prevent overturning — 40 kg;
- 2) to prevent sliding (e.g. on asphalt or smooth concrete) — 80 kg.

The support may, however, be fastened down with screws or bolts and may also be used on soft surfaces if anchored by long pins. Suitable protective treatment should be given to all wood and metal parts, not only to reduce corrosion but also to ensure that corrosion products do not enter the collecting heads.

The complete assembly (see Figure 2) consisting of post, collecting heads with bottles and legs, if any, shall have a sighting device to assist in orientation.

2.3 Collecting heads. The collecting heads shall be made of chemically resistant plastics material, e.g. PVC, and shall be to the dimensions shown in Figure 3. The four heads shall be firmly attached to the post at 90° to each other. If birds are found to create a nuisance, means may be employed to prevent this, provided that the access of naturally deposited material to the apertures is not impeded.

2.4 Collecting bottles. The bottles shall be made of suitable plastics material, preferably translucent (e.g. high density polyethylene), or of glass. They shall be attached to the collecting heads so that water running from the collecting head runs into the bottle. The capacity of the bottle should be such that it will not completely fill with rain (and washing water) in the situation where it is to be used. In most cases a capacity of one litre is adequate. Each bottle should be indelibly marked with a code that identifies both the site on which it is used and the direction in which the aperture of its collecting head points.

2.5 Squeegee. The squeegee shall be made from an aluminium rod, 12 mm diameter and 800 mm long, to which is attached at one end, by welding or by a suitable adhesive (e.g. epoxy resin), a disc of 35 – 50 mm diameter and 3 to 5 mm thick. To this is attached by a suitable impact adhesive a 150° segment of a concentric rubber disc, 3 mm thick and 75 ± 1 mm in diameter. This rubber disc is of nitrile rubber to BS 2751, Grade BAS (see Figure 4).

2.6 Wash bottle. A wash bottle of the type used in chemistry laboratories, filled with distilled water, is desirable for washing dust from the collecting head into the bottle and for washing the collected material out of the bottle into the measuring system.

3 Siting

The directional dust gauge shall be sited with the post vertical and, whenever possible, in an open space. The gauge stand, if used, should be securely fixed to the surface on which it stands so that individual orifices always face the preselected directions. If necessary the gauge may be sited above ground level, provided that the foregoing considerations are observed.

Gauges to assess nuisance should obviously be sited at the point of complaint; when required to assess source behaviour, a single assembly can be used or several can be distributed at convenient distances and directions from the source.

4 Operation

4.1 Preliminary. The gauge shall be put into operation on the chosen site as described in Clause 3 on the first day of a calendar month. If for any reason an operation is not carried out on the first day of the month, the fact shall be stated in the report. If light is prevented from reaching the contents of the collecting bottle algae should not develop, but it may be desirable to add a suitable inhibitor²⁾ to each of the collecting bottles in order to discourage the development of fungi or similar growths.

4.2 Final. On the first day of the following calendar month, any adherent dust in each collecting head shall be washed into the appropriate collecting bottle with the assistance of the squeegee, care being taken to avoid loss of material. The bottles are removed and a water-tight cap applied to each one. Clean bottles are substituted. The bottles containing the material collected are delivered for analysis with the following information:

- 1) particulars of site;

²⁾ If a chemical agent, e.g. 25 mg of copper sulphate, is used, its influence on subsequent analysis will need to be taken into account.