

Guide to

Laboratory methods for sampling and analysis of particulate matter generated by arc welding consumables

Committees responsible for this British Standard

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- British Compressed Gases Association
- British Occupational Hygiene Society
- Health and Safety Executive
- Power Generation Contractors' Association (BEAMA Ltd.)
- Process Plant Association
- Society of Motor Manufacturers and Traders Limited
- Welding Institute
- Welding Manufacturers' Association (BEAMA Ltd.)

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Foreword

This British Standard has been prepared under the direction of the Welding Standards Policy Committee. The prime concern of this guide is to recommend procedures to be used for sampling particulate matter generated by arc welding consumables. The data obtained using this technique can be useful in assessing work place fume concentrations but it is not a substitute for work place sampling (see BS 6691-1 and BS 6691-2).

It is also important for the consumable manufacturer, fabricator and occupational hygienist to have information on the amount of fume generated during the use of certain arc welding consumables. Suggested analysis techniques are given for the component elements to be found in the fume. It is important that such an analysis should include all substances of occupational hygienic significance.

It is assumed that the execution of the tests is entrusted to appropriately qualified and experienced personnel.

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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.

1 Scope

This British Standard provides guidance on methods for the measurement of the fume emission rate of particulate fume from manual metal-arc (MMA), tungsten inert gas (TIG), flux-cored arc (FCA), metal inert gas (MIG) and metal active gas (MAG) welding processes, using a fume box technique, and gives recommended analysis methods for samples collected in the fume box.

NOTE 1 Advice on the sampling and analysis of breathing zone and background fume samples taken during welding may be obtained from BS 6691-1 and BS 6691-2. Details of recommended reading are given in Appendix A.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Test equipment

2.1 Description of fume box

2.1.1 General

The fume box should consist of a top section containing a filter, a welding chamber and a chamber base. A possible arrangement is illustrated in Figure 1 and described in 2.1.2 to 2.1.4.

2.1.2 Top section

The top section should be made of steel sheet (at least 1 mm thick), with smooth uncoated internal surfaces. The top part should be conical, and connected to a pump, as described in 2.2. It should be provided with a stainless steel wire mesh, supporting a filter, as described in 2.3. The top part should be capable of being opened and sealed by a convenient locking or clamping system to the upper part of the welding chamber, using an O-ring gasket.

NOTE 1 A possible arrangement is illustrated in Figure 2.

NOTE 2 A suggested thickness for the supporting stainless steel wire mesh is 0.7 mm.

NOTE 3 The recommended material for the O-ring gasket is chloroprene rubber.

2.1.3 Welding chamber

The welding chamber should be made of 1 mm mild steel sheet, with smooth, uncoated internal surfaces. It should consist of a cylindrical upper part on the top of a chamber in which welding occurs. The front of the welding chamber should have the facility to be opened or detached, to allow means of input of welding test pieces (see 2.4) and the cleaning of the inside of the box. An aperture should be positioned in the front of the welding chamber to allow insertion of the welding consumable to be tested, and, if relevant, part of the torch or holder and the ingress of air. The edges of the aperture should be electrically insulated to prevent inadvertent arcing onto the box.

NOTE If a system with an exterior traverse is to be used, then it is recommended that the aperture is not less than 50 mm high and 300 mm long, so as to be large enough to admit the welding electrode or torch. Too large an opening should be avoided, e.g. not more than 30 000 mm², since fume may otherwise have a tendency to escape through the welding aperture.

2.1.4 Chamber base

The chamber base should be mild steel, at least 2 mm thick, reinforced beneath for stability. A copper sheet at least 2 mm thick clamped on top will improve electrical contact and enhance spatter removal. The chamber base should be provided with a terminal for electrical connection to the welding set. The upper surface of the base should be provided with a means of restraining test pieces to inhibit slipping during welding, and to improve electrical contact. The minimum height of the filter above the base should be 0.6 m (to prevent spatter reaching the filter) and the maximum height should be 1 m. The minimum base area should be 0.1 m², and the maximum 0.2 m², but the dimensions used should accommodate the test piece type to be selected (see Figure 3).

2.2 Pump requirements

The pump should be of a type and size capable of being used attached to, or in conjunction with, the chamber. The pump should have a suction characteristic such that on starting the test with throttling on the suction side (equivalent to the resistance of the filter at 0 mg of fume) an air volume of 27 L/s at 10 000 Pa (0.1 bar) is obtained. At the end of the test, an air volume of at least 5 L/s at 16 000 Pa to 22 000 Pa should be obtained.

NOTE 1 The precise characteristics of the pump are not considered to be critical, provided the flow is adequate to contain the fume within the box to clear the fume box of fume after completion of welding, within the time specified (see 3.3).

NOTE 2 In the fume box illustrated in Figure 1 the pump is conveniently housed under the fume box in a cupboard which is lagged with noise insulation material.

2.3 Filters

The filtering medium should be capable of withstanding the pressure drop and should be between 150 mm and 300 mm in diameter. For gravimetric estimations weight stability with respect to humidity is essential and glass fibre filter types are recommended. The type of filter for the analysis sample should be such that it is free from relevant contaminants and compatible with subsequent analysis procedures. A paper filter (Whatman 41) is recommended.

