BS 8520-2:2009

BSI Standards Publication

Equipment used in the controlled removal of asbestos-containing materials –

Part 2: Negative pressure units – Specification

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 December 2009. It was prepared by Subcommittee HS/1/1, *Asbestos* under the authority of Technical Committee HS/1 *Occupational health and safety management*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 8520 is based on PAS 60-2:2004, which is withdrawn.

Relationship with other publications

This British Standard is one part of a series, *Equipment used in the controlled removal of asbestos-containing materials,* the other parts of which are:

- *Part 1: Controlled wetting of Asbestos-containing materials – Specification;*
- *Part 3: Operation, cleaning and maintenance of class H vacuum cleaners – Code of practice.*

This British Standard is one of three parts developed from the PAS documents *Equipment used in the controlled removal of asbestos-containing materials*:

- *Part 1: Controlled wetting of asbestos-containing materials – Specification;*
- *Part 2: Negative Pressure Units – Specification;*
- *Part 3: Operation, cleaning and maintenance of class H vacuum cleaners – Code of practice.*

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

In particular, attention is drawn to the following statutory regulations.

The Control of Asbestos Regulations 2006 [1]

The Control of Asbestos Regulations (Northern Ireland) 2007 [2]

The Electrical Equipment (Safety) Regulations 1994 [3]

The Electricity at Work Regulations 1989 (as amended) [4]

The Electricity at Work Regulations (Northern Ireland) 1991 [5]

The Health and Safety at Work etc. Act 1974 (as amended) [6]

The Machinery Directive 98/37/EC (as amended) [7]

The Supply of Machinery (Safety) Regulations 2008 [8]

The Provision and Use of Work Equipment Regulations (as amended) 1998 [9]

The Provision and Use of Work Equipment Regulations (Northern Ireland) 1999 (as amended) [10]

The Simple Pressure Vessels (Safety) Regulations 1991 (as amended) [11]

The Control of Substances Hazardous to Health Regulations 2002 (as amended) [12]

The Management of Health & Safety at Work Regulations 1999 (as amended) [13]

The Special Waste (Scotland) Regulations 2004 (as amended) [14]

The Hazardous Waste Regulations (England and Wales) 2005 (as amended) [15]

The Hazardous Waste Regulations (Northern Ireland) 2005 (as amended) [16]

Introduction

This British Standard has been developed to provide negative pressure unit (NPU) manufacturers with a minimum specification for the manufacture of NPUs.

Although the manufacture of NPUs has previously met the expectations of the asbestos removal industry, no specifications or specific guidance existed. It was therefore felt that there was a need to provide the asbestos removal industry with a minimum specification to raise industry standards, with particular attention to health and safety issues.

1 Scope

This British Standard specifies requirements for portable and/or transportable negative pressure units (NPUs) incorporating HEPA filters covered by BS EN 1822 for use in the controlled removal of asbestos-containing materials (ACMs).

This British Standard is also applicable to NPUs designed to create negative pressure within a portable decontamination unit facility or working enclosure and two-part NPUs.

This British Standard is not applicable to local exhaust ventilation.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 60335-2-69, *Specification for safety of household and similar electrical appliances – Part 2: Particular requirements – Part 2.69: Wet and dry vacuum cleaners, including power brush, for industrial and commercial use*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 anemometer
instrument for measuring air velocity

3.2 damper
device used to restrict airflow

3.3 ducting
flexible tube attached to the NPU for ducting exhaust air, sometimes fitted with a roving head (**3.8**)

3.4 High Efficiency Particulate Air (HEPA)
highly efficient filter element

NOTE 1 The abbreviation HEPA is also used for High Efficiency Particulate Arrestor.

NOTE 2 HEPA filters are also known as essential filters.

3.5 manometer
instrument to measure pressure differential

3.6 non-return flaps
flaps installed to prevent reverse airflow

3.7 pre-filter
coarse filter installedused prior to the HEPA filter which removes most of the particulates to prevent blocking of, or damage to, the HEPA filter

3.8 roving head
free standing, portable device that, when connected by a flexible duct to the inlet area of a NPU using a temporary spigot plate (**3.13**), enables localized air intake within an asbestos enclosure close to the work area

NOTE The device also has provision for a pre-filter to be located within the roving head.

3.9 safety critical joints
joints that contain or retain the HEPA filter in position

3.10 skirt
light-weight temporary construction to smooth the airflow and allow more accurate anemometer readings

3.11 temporary spigot plate
device that enables a flexible duct to be secured to the NPU (pre-filter) inlet area, usually for the purpose of connecting a roving filter head

3.12 transit cover
close-fitting plate that protects the NPU pre-filter face during transit

3.13 working enclosure
structure erected to prevent the spread of asbestos and prevent exposure of people outside the enclosure to asbestos and maintain negative pressure within the enclosure

4 Design and construction

*COMMENTARY ON CLAUSE **4***
*The design and construction requirements in Clause **4** also relate to NPUs used for the provision of negative pressure within a portable decontamination facility and for two-part NPUs (see Figure 1).*

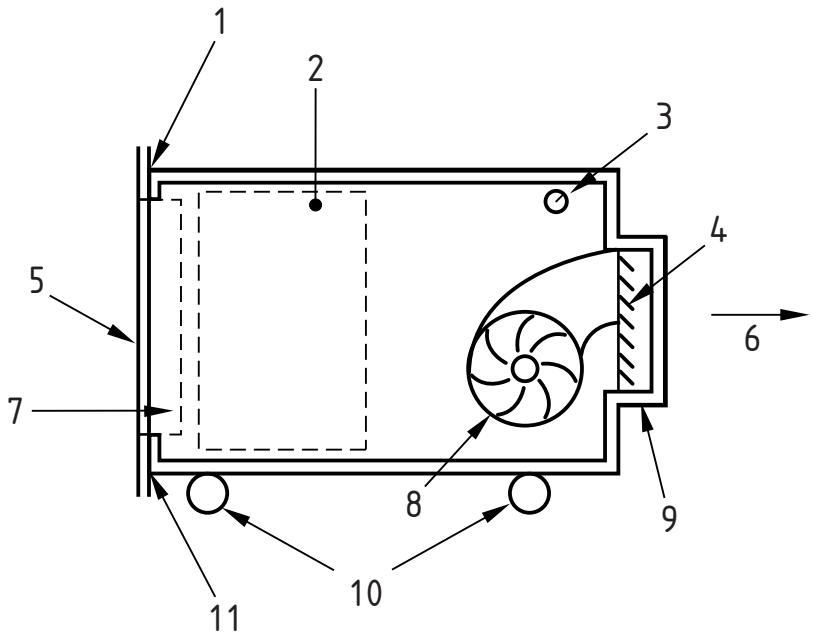
For equipment with electrical or moving parts, attention is drawn to the Supply of Machinery (Safety) Regulations *[8] which, in accordance with the* Machinery Directive (Directive 98/37/EC) *[7], require machinery to be CE marked.*

For equipment without electrical or moving parts, attention is drawn to Section 6 of the Health and Safety at Work etc. Act *[6].*

*The NPU has to remain intact if it is subjected to abuse by operators. Currently, however, no definitive test has been developed to verify durability of the NPU. The requirements of **4.1** to **4.8**, therefore, refer to the robustness of the component parts of the NPU and not to the fully assembled NPU.*

An example NPU is shown in Figure 1.

Figure 1 **Example negative pressure unit**



Key

1	Flange	7	Pre-filter
2	HEPA filter	8	Fan/motor
3	Manometer gauge	9	Exhaust air spigot
4	Non-return flaps	10	Casters
5	Transit cover	11	Flange
6	Airflow direction		

4.1 Outer case

The outer case of the NPU shall be designed to avoid dust traps and shall have an easily cleanable surface.

NOTE Attention is drawn to the Electrical Equipment (Safety) Regulations *1994 [3].*

4.2 Joints

All safety-critical joints made of plastic shall be triple-welded in order to prevent failure.

To minimize leaks, the outer case shall be designed and constructed with the minimum number of joints. All of the other outer case joints shall be welded throughout their entire length.

4.3 Non-return flaps

Non-return flaps shall be fitted to the NPU (at manufacture) to prevent reverse airflow when the NPU is switched off or is exposed to a backdraught.

4.4 Transit cover

The NPU shall be fitted with a transit cover (**3.12**) (at manufacture) that protects the entire pre-filter face. The transit cover shall be designed so that it can be securely fixed to ensure that the pre-filter face is sealed during transit.

4.5 Casters and handles

The casters and handles of the NPU shall be securely fixed to or through the outer case and shall be capable of bearing the weight of the NPU. The NPU shall have a minimum of two braked casters per unit.

To prevent asbestos leaks from the NPU, care shall be taken when fitting casters and handles, which shall either have a seal under the fixing or another means to prevent fibres exiting the unit via the caster or handle-fittings areas.

4.6 HEPA filter

4.6.1 General

When tested for filtration efficiency in accordance with BS EN 60335-2.69, the HEPA filter shall allow a maximum penetration of 0.005%, when fully assembled in a NPU.

4.6.2 HEPA filter protection

The HEPA filter inlet face shall be protected by a metal mesh grille or by other means (for example, an intermediate filter or pre-filter) to prevent accidental damage to the HEPA filter when in use.

If a metal mesh grille is used, it shall be rigid with a maximum mesh size of 13 mm and be affixed immediately in front of the HEPA filter media on the inlet face.

4.6.3 HEPA filter position

The design shall ensure that HEPA filter is mechanically retained/fixed in position and supported within the outer case in such a way that it cannot move in normal use or in transit.

4.7 Flange

The NPU shall have an integral flange (see Figure 1) located at the air inlet point of the NPU as part of the outer case, to facilitate the fixing of the working enclosure (**3.12**) to the NPU.

4.8 Two-part NPUs

A NPU can be constructed in two parts to assist with handling; where this so, both parts shall be capable of being securely joined together when in operation, with features designed to prevent the escape of asbestos fibres.

5 Control equipment

NOTE 1 The NPU airflow can be controlled by a variable speed controller or by a damper.

5.1 The NPU shall have a manometer on the outer case to indicate if the HEPA filter is blocked or partially blocked, i.e. when the airflow decreases by 20% or more from its optimal performance (see **8.1**).

5.2 If the NPU's earthed components are not easily accessible, the NPU shall be fitted with an earth test point to facilitate electrical safety testing.

NOTE 2 Attention is drawn to the Electrical Equipment (Safety) Regulations *[3], the* Provision and Use of Work Equipment Regulations *[9], [10].*

6 Instructions for installation, operation and maintenance

*COMMENTARY ON CLAUSE **6***
*A NPU can be operated with a roving pre-filter module. This enables localized air extraction within the enclosure when a pre-filter module is connected to the NPU via a flexible duct attached to a temporary spigot plate (**3.11**) fixed to the pre-filter inlet area of the NPU.*

*It should be emphasised that the use of ancillary items such as roving filter heads (**3.8**) and/or exhaust ducts can significantly reduce air flow through the NPU and significantly reduce the amount of negative pressure within the working enclosure. This might require the provision of additional NPUs to mitigate any shortfall in performance.*

The accurate monitoring of the negative pressure created can only be achieved using an external monitoring device. The manometer within the NPU does not indicate the existence of negative pressure.

6.1 Instructions for installation and operation

The following instructions for installation and operation shall be provided with the NPU.

a) How to operate the NPU correctly including how to change the pre-filter, airflow performance, handling and storage.

   NOTE Attention is drawn to the Control of Asbestos Regulations*, Regulation 13 [1], [2].*

b) A statement that airflow performance will be reduced by the use of ducting attached to the NPU (including roving heads).

c) A statement that the exhaust of the NPU should be ducted outside of the building, where practicable.

d) A statement that the NPU is to be operated under the supervision of competent and trained operators.

   NOTE Attention is drawn to the Control of Asbestos Regulations*, Regulation 13 [1], [2].*

e) A statement that maintenance procedures and advice for the procedures are to be adhered to.

   NOTE Attention is drawn to the Electrical Equipment (Safety) Regulations *[3] and the* Provision and Use of Work Equipment Regulations *[9], [10].*

f) A statement that the system should be examined or, where deemed necessary by the manufacturer, serviced at least once every six months by a competent person.

NOTE Attention is drawn to the Control of Asbestos Regulations*, Regulations 2, 11 and 13 [1], [2].*

g) Advice on transporting the NPU, with an emphasis on securing the NPU while in transit, and safe handling while inserting and removing the NPU from the vehicle.

NOTE Attention is drawn to the Control of Asbestos Regulations*, Regulation 13 [1], [2].*

h) Advice on manual handling, including how to handle the NPU with care and attention, and avoidance of manhandling the NPU while in operation.

i) Advice on storing the NPU, including avoidance of extremes of temperature, damp conditions and/or dusty conditions.

j) Advice on inspection and testing of electrical equipment.

NOTE Attention is drawn to the Electrical Equipment (Safety) Regulations *1994 [3] and the* Provision and Use of Work Equipment Regulations *[9], [10].*

k) Information on how to convert the airflow rate from cubic metres per hour (m^3/h) to cubic feet per minute (cfm) using the conversion 1.7 m^3/h = 1 cfm.

6.2 Instructions for maintenance

The following instructions shall be provided by the manufacturer.

a) Information on inspecting, testing and replacement of the HEPA filter.

b) Advice on inspection and maintenance of the casing(s) and fittings.

c) Advice on inspection, repairs and testing of electrical equipment.

d) Information on the supply of replacement parts.

NOTE Maintenance work on NPUs and other equipment contaminated with asbestos is covered by the licensing requirements of The Control of Asbestos Regulations *2006, Regulation 8 [1], [2]. Those involved in such work are reminded of the need for a licence, especially with regard to work on sites other than their own premises. Other asbestos regulations also apply to any work on asbestos-contaminated equipment. Further advice can be obtained from, for example, the Health and Safety Executive.*

7 Technical literature

The airflow rate of the NPU (see Annex A) shall be included in all technical literature provided by the manufacturer.

NOTE An example test report form is given in Annex B.

If the airflow specification of the NPU is changed, the technical literature shall include the new airflow rate.

The technical literature shall state that the airflow performance will be reduced when exhaust ducting is fitted to a NPU.

The technical literature shall specify the voltage, current requirements and power consumption of the NPU.

NOTE Attention is drawn to the Electrical Equipment (Safety) Regulations *1994 [3].*

8 Labelling

8.1 Airflow rate

The airflow rate of the NPU, measured in cubic metres per hour (m^3/h) (see **A.4**), shall be clearly stated on a rating plate attached to the outer case.

A label shall be affixed, on the manometer or on the outer case adjacent to the manometer display, stating the safe operating pressure range of the NPU.

8.2 Warning labels

Each NPU shall bear a securely attached label, in black, 14-point font on a yellow coloured background, reading:

"**WARNING**: For use by certified, trained operators only. Handle with care: high efficiency air filtering equipment. Not to be used within a working enclosure."

"**WARNING**: The manufacturer's instructions must be read, understood and followed in the use of this equipment."

The NPU shall bear a red and white H (hazardous) label, as specified in BS EN 60335-2.69.

9 Conformity marking

NPUs shall be clearly and permanently marked with the following information using a suitable method.

a) The number and date of this British Standard, i.e. BS 8520-2:2009 [1)];

b) The name or trademark of the manufacturer or their appointed agent;

c) The last two digits of the year of manufacture, e.g. 09 for 2009.

NOTE Moulding into the case, engraving, tags, plates and labels have been found to be suitable methods.

1) Marking BS 8520-2:2009 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity.

Annex A (normative) Airflow performance test

A.1 Principle

The airflow is measured on five identical NPUs to obtain an average, which is quoted in the technical literature and marked on the NPU (see Clause **7** and **8.1**).

A.2 Apparatus

A.2.1 *Skirt (**3.10**)*, at least twice the shortest HEPA filter face dimension, constructed from a suitable light material, for example cardboard, plywood or aluminium sheets.

NOTE The skirt is an extension of the HEPA filter face used to smooth out turbulence at the entry to the HEPA filter.

A.2.2 *Anemometer*, either vane or thermal.

A.2.3 *Five identical negative pressure units.*

NOTE To be identical in operating pressure, operation, etc.

A.3 Test procedure

A.3.1 Fix the skirt to the NPU with adhesive tape or similar material (see Figure A.1).

A.3.2 Obtain an average anemometer reading by dividing the opening into a number of imaginary rectangles (N), not fewer than four, and taking a reading in the centre of each rectangle. Record the manometer pressure.

*NOTE The sum of the readings divided by N gives the average air velocity at the skirt inlet of the NPU with a HEPA and pre-filter in place (see **A.4.1**).*

A.3.3 Repeat procedures **A.3.1** and **A.3.2** for each NPU.

A.4 Calculation of results

A.4.1 Calculate the airflow as follows:

$$A \times 3600 \times Y = \text{airflow } (m^3/h)$$

where:

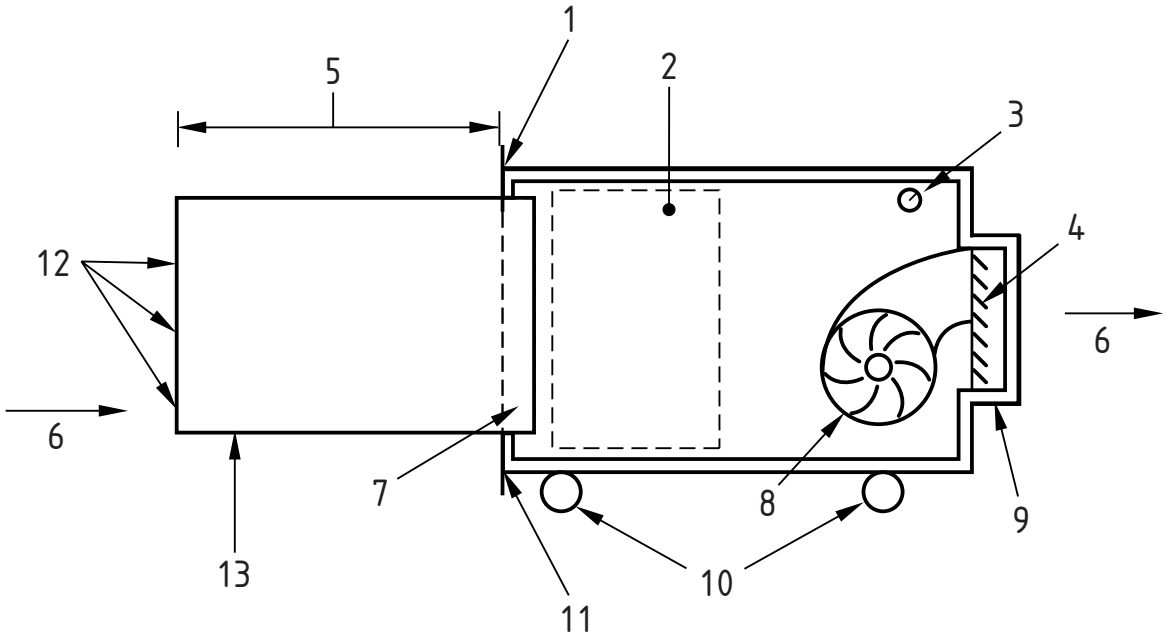
A = the open area of the skirt (m^2)

Y = the average face velocity (m/s).

NOTE Multiplying by 3600 converts the reading from m/s to m/h.

A.4.2 Take an average of the five maximum airflow measurements on the five identically specified NPUs.

Figure A.1 **Airflow performance test**



Key

1 Flange
2 HEPA filter
3 Manometer gauge
4 Non-return flaps
5 Twice shortest HEPA filter face dimension
6 Airflow direction
7 Pre-filter
8 Fan/motor
9 Exhaust air spigot
10 Casters
11 Flange
12 Anemometer traverse plane
13 Skirt

Annex B (informative) Airflow performance test report

Figure B.1 shows an example of an airflow performance test report for up to five NPUs.

Figure B.1 **Example of an airflow performance test report**

	NPU 1	NPU 2	NPU 3	NPU 4	NPU 5	
NPU Serial no.						
Manometer reading						
Open area of skirt in m^2 (A)						
Average face Velocity in m/s (Y)						
Maximum airflow performance (m^3/h)						
Calculation Note: Airflow performance for each unit is calculated as in **A.4.1**, (A x 3 600 x Y), average airflow is calculated as in **A.4.2**.						Performance: .....m^3/hour
Model tested:			Anemometer type:			
Test by:			Manufacturer's name and address:			
Test date:			Tester's signature:			

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