Breathing System Filters

An assessment of 104 breathing system filters

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INTRODUCTION

In this issue of Evaluation, we review breathing system filters (BSFs) available on the UK market from leading manufacturers. A Product Description and Technical Evaluation are provided in the Product Summaries section of the report for each filter tested.

BACKGROUND

Intended use Breathing systems filters are intended to protect a patient from inhaling infective or hazardous particles when the upper airways are bypassed by a tracheal or tracheostomy tube or other airway device. A new breathing system filter must be used for each patient during anaesthesia [1].

Reference


DECLARATION OF FILTRATION EFFICIENCY

Traditionally, manufacturers have declared filtration efficiency against an un-specified microbiological test method. Currently, there are no national or international standards that challenge BSFs with micro-organisms. The following factors would need to be standardised in order to be able to produce comparable test results:

• the test organism, how it is grown and prepared;
• the equipment used for aerosolising the microbiological culture;
• the time of exposure to the challenge;
• the method used to recover and incubate the test organism.

The CEN committee responsible for developing the standard for BSFs was unable to reach consensus on an acceptable microbiological test method. In the absence of a standardised method, manufacturers can set their own test conditions. Consequently the filtration efficiency claimed by manufacturers cannot be used to directly compare one manufacturer’s products with another, or to guarantee suitability for a particular clinical application.

The committee eventually agreed that using a microbiological challenge neither offered any advantages over, nor had any greater clinical relevance than, the already well-established particulate methods used in other industries.

The standard published in 2001 (BS EN 13328-1) describes a test method based on the well-established NIOSH protocol for respiratory protective devices [1]. In the test the BSF is challenged with sodium chloride particles within the range 0.1 to 0.3 μm which are considered to be the most penetrating particle size and,
consequently, it is not necessary to subject the filter to a bio-aerosol as a condition of test.

Use of this method enables an objective comparison to be made between filters supplied by different manufacturers. However, the standard does not give pass/fail criteria. Further research is needed to establish the relationship between this test method and the suitability of a BSF for a particular clinical application.

Reference

PRODUCT DESCRIPTION

Filter name and code number The name of each filter and its associated manufacturer’s code number are given in the product summaries. The code number refers to the product evaluated. For some devices, a wide range of options are available, for example with or without a gas sampling port. Please check with the supplier for further information.

List price The list price is the cost of an individual product, excluding VAT. The minimum order may be one box or one case (containing a number of boxes). The number of filters supplied in one box is also stated. Substantial discounts may be available for large orders. Please check with the supplier for further information.

Type Filters are made from one of two basic types of material: either a sheet of high density fibres which is pleated to reduce the resistance to gas flow (pressure drop); or a flat sheet of electrostatic fibres. The filters are intended for use with different patient groups depending on the recommended tidal volume range, which, in turn, depends on the internal volume of the filter. Some devices also include a separate layer of material that acts as a heat and moisture exchanger to increase the level of humidity of the inspired gas, by returning a portion of the exhaled moisture.

Tidal volume range This is the range over which the manufacturer declares that the product can be used safely. Using the product for patients with tidal volumes outside of this range may cause an unacceptable reduction in performance, particularly with regard to resistance to gas flow and the amount of rebreathing.

TECHNICAL EVALUATION

Penetration Filtration performance was determined by measuring the penetration of sodium chloride particles through each filter. A low penetration value indicates that the filter effectively reduces the risk of the patient inhaling infective or hazardous particles. A minimum level of penetration is not stated in BS EN 13328-1.

Penetration of particles through filter material varies with the size of the particle. The most penetrating particle size for filter material is about 0.3 µm. The mass median aerodynamic particle size for the aerosol in the challenge to the filters in this study was close to 0.3 µm. The test therefore measures the “worst-case” level of performance.

Penetration is the probability, in percent, that a particle will pass through the filter. Filtration efficiency can be derived from penetration using 100 – penetration (%) (Table 1).

Penetration (%) Efficiency (%)

| 10 | 90 |
| 1  | 99 |
| 0.1| 99.9 |
| 0.01| 99.99 |
| 0.001| 99.999 |

Table 1. Conversions between penetration and efficiency values.

Penetration varies as the load on the filter increases (more particles in the total challenge) and increases as the flow increases [1,2].

A TSI filter tester is given in BS EN 13328-1 as an example of equipment that can be used to measure filtration performance, and has been used previously [3]. However, a Moore’s filter tester was used to determine the filtration performance of the breathing system filters for this issue of Evaluation. A study has demonstrated that results obtained using the Moore’s test rig and the TSI test rig are comparable, enabling the filters to be put into the same rank order [4].

Five unused samples of each different filter were tested. A flow of either 15 or 30 L.min⁻¹ was used for filters intended for use with paediatric or adult patients, respectively. The mass concentration of particles in the challenge was 13 mg.m⁻³, or 0.013 mg.L⁻¹ (the manufacturer’s calibration figure). The penetration value was recorded after 30 ± 5 seconds from commencing the challenge, giving a total challenge of either 0.1 or 0.2 mg (the range in the standard is 0.05 to 0.15 and 0.1 to 0.3 mg for filters intended for paediatric and adult patients, respectively). The flow of air containing the particles entered the machine port of the filter, so that the filtration performance is related to protecting the patient from inhaling gas-borne particles.
Overall Comparison

The standard for breathing system filters specifies two test conditions depending on the intended use of the filter: one each for paediatric and adult patients. Most filters or their packaging were marked with the tidal volume with which they are intended for use. However, for some, the appropriate test had to be assumed. An identical filter tested using both the 'paediatric' and 'adult' test conditions will generally have a higher penetration using the 'adult' test condition as both the total challenge and the flow used are greater.

In addition, three samples of each filter were conditioned before testing by connecting the filters to a patient model 'breathing' with either a tidal volume of 0.25 L, a frequency of 20 breaths per minute and an I:E ratio of 1:1 or a tidal volume of 0.5 L, a frequency of 15 breaths per minute and an I:E ratio of 1:1 for filters intended for use with paediatric and adult patients, respectively. The patient model 'expired' air fully saturated with water vapour at 34 ± 1°C. The air on the machine side of the filter was fully saturated with water vapour at 26 ± 1°C, as specified in the standard. Each filter was conditioned for 3 hours. The standard specifies conditioning each filter for the manufacturer’s maximum recommended time of use for the filter (usually 24 hours). However, to complete testing on as many filters as possible, this period was reduced. Conditioning the filter for three hours covers the period most filters will be used during anaesthesia, and will therefore provide a 'worst-case' value for the majority of filter use.

The mean penetration values of the five unused filters and of the three conditioned filters are stated. In addition, to provide an indication of the variability of the products, the range, from minimum to maximum, is also given.

References

Pressure drop A high pressure drop increases the work of breathing and may also affect the triggering of some ventilators. A maximum limit for pressure drop is not specified in BS EN 13328-2:2002 or BS EN ISO 9360-1:2000.

The pressure drop values quoted in the product summaries are those measured in the inspiratory direction through the filter under test in an unused condition and after 3 hours simulated use.

The pressure drops across the filters were measured at flows of either 15 or 30 L.min⁻¹ for devices intended for paediatric and adult use, respectively, and are quoted in units of pascals (Pa, where 100 Pa = 1.02 cmH₂O). For some devices, the pressure drop increased markedly during use as condensation collected within the device.

Moisture output A high moisture output reduces the risk of mucosal damage and thickening of secretions in a patient ventilated through an artificial airway. A minimum limit for moisture output is not specified in the International standard for HMEs, BS EN ISO 9360-1:2000.

The moisture output of the filters was measured using a spontaneously-breathing patient model. The patient model “inspired” dry air through the filter. The moisture output values are therefore those that would be obtained when using a non-rebreathing breathing system, for example in intensive care. However, with circle breathing systems used during anaesthesia, gas entering the machine side of the filter will have some moisture, which will augment that delivered to the patient by the filter.

The maximum recommended time of use for nearly all the filters included in this evaluation was 24 hours. Values of moisture output, where measured, were obtained over 23 hours, following a one hour period to allow the test rig and the filter to stabilize. The moisture output varies with the tidal volume. The tidal volume used to determine the moisture output is stated. Three samples of each tidal volume were tested.

Weight A heavy filter will drag on the breathing system and the tracheal tube or laryngeal mask airway.

The weight was measured in a dry, unused condition. Any condensation that collects within the filter adds to its weight. The increase in weight after three hours’ simulated use is also stated.

Dimensions With the filter orientated so that the connectors of the patient and machine ports are in line horizontally, the length is the distance between the extreme ends of the connectors, the width is the maximum distance across the casing horizontally, and the height is the maximum distance across the casing vertically. The diameter is stated for those filters with a circular cross-section. The provision of a gas sampling port increases the dimensions on some filters.

Internal volume The internal volume adds to the deadspace, which increases the magnitude of rebreathing. It also contributes slightly to the compliance of the breathing system.

The minimum tidal volume with which the device is recommended for use should be a function of the
internal volume. However, manufacturers who do provide a lower limit for the recommended tidal volume range use different criteria. Some recommend a minimum tidal volume of about five times the internal volume, others three times, or even only twice the internal volume. Clearly, in this latter case, the amount of rebreathing with a tidal volume only twice that of the internal volume is 50%, which, ignoring any other deadspace, would lead to elevated levels of \( P_\text{CO}_2 \), unless corrected for by increasing the tidal volume.

**Connectors** A correctly dimensioned connector helps to ensure that a secure connection is made between the filter and other components, such as tracheal tubes, masks and breathing systems. An incorrectly dimensioned connector increases the risk of disconnection which would interrupt ventilation of the patient.

The 15 and 22 mm conical connectors were tested for compliance with BS EN 1281-1:1997. This specifies that the end of the connector must lie within a certain tolerance on a plug (for female connectors) or ring (for male connectors) gauge when an axial force of 50 ± 5 N is applied for 22 mm connectors and 35 ± 3.5 N for 15 mm connectors, whilst rotating the gauge in or around the connector by 20°.

The following are used in the Product Summaries: 'm': male; 'f': female; ☺ all samples of the connector complied; ✗ not all samples of the connector complied; ☞ none of the samples complied.

A secure connection between a filter and other components of the breathing system is only made, even with connectors that do comply, if the correct 'push and twist' technique is used with the appropriate force and rotation.

**Gas sampling ports** The MHRA are encouraging manufacturers to supply tethered caps on gas sampling ports to reduce the risk of blockage.

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### COMPARISON OF THE BREATHING SYSTEM FILTERS

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<th>Penetration (%)</th>
<th>Pressure drop (Pa)</th>
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## Overall Comparison

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<td>Penetration (%)</td>
<td>Pressure drop (Pa)</td>
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MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who responded as follows:

Air Safety are currently in the process of changing all gas sampling caps to a self retained type which are coloured red to meet current recommendations. All tolerances on the moldings have been checked and amended as necessary.

COMFORT FIT 8866/01

- **List price**: £1.30
- **Type**: adult electrostatic filter
- **Tidal volume range**: ≥ 200 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.69 [0.54 to 1.13] %
  - After 3 h simulated use: 0.57 [0.54 to 0.60] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 83 Pa
  - Increase after 3 h simulated use: 7 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 37 g
  - Increase after 3 h simulated use: 2.6 g
- **Dimensions** (H × W × L): 37 × 61 × 118 mm
- **Internal volume**: 74 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

COMFORT FIT HMEF 8866/100

- **List price**: £1.85
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: ≥ 200 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.73 [0.61 to 1.16] %
  - After 3 h simulated use: 0.63 [0.60 to 0.66] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 98 Pa
  - Increase after 3 h simulated use: 14 Pa
- **Moisture output** at 0.5 L tidal vol.: 29 g.m⁻³
- **Weight**
  - Unused: 38 g
  - Increase after 3 h simulated use: 2.4 g
- **Dimensions** (H × W × L): 37 × 61 × 119 mm
- **Internal volume**: 76 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
COMFORT FIT PLEAT 8666/200

- List price £2.50
- Type adult pleated filter with HME
- Tidal volume range ≥ 300 mL
- Number of filters / box 50

HMEF 9000/100

- List price £1.50
- Type adult electrostatic filter with HME
- Tidal volume range ≥ 200 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.009 [0.008 to 0.012] %
  - After 3 h use 0.009 [0.002 to 0.015] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 117 Pa
  - Increase after 3 h simulated use 25 Pa
- **Moisture output** Not measured
- **Weight**
  - Unused 58 g
  - Increase after 3 h simulated use 2.5 g
- **Dimensions** (H × W × L) 53 × 61 × 122 mm
- **Internal volume** 121 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

COMFORT FIT PLEAT 8666/300

- List price £2.50
- Type adult pleated filter with HME
- Tidal volume range ≥ 300 mL
- Number of filters / box 50

HMEF 9000/100

- List price £1.50
- Type adult electrostatic filter with HME
- Tidal volume range ≥ 200 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.017 [0.009 to 0.044] %
  - After 3 h use 0.037 [0.017 to 0.072] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 125 Pa
  - Increase after 3 h simulated use 2 Pa
- **Moisture output** at 0.5 L tidal vol. 31 g.m⁻³
- **Weight**
  - Unused 55 g
  - Increase after 3 h simulated use 2.7 g
- **Dimensions** (H × W × L) 53 × 61 × 122 mm
- **Internal volume** 124 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.55 [0.51 to 0.63] %
  - After 3 h simulated use 0.61 [0.57 to 0.64] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 93 Pa
  - Increase after 3 h simulated use 3 Pa
- **Moisture output** at 0.5 L tidal vol. 34 g.m⁻³
- **Weight**
  - Unused 36 g
  - Increase after 3 h simulated use 2.5 g
- **Dimensions** (Diameter × L) 66 × 83 mm
- **Internal volume** 84 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺
MAXIPLEAT 8222/01

- List price £2.00
- Type adult pleated filter
- Tidal volume range ≥ 200 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.011 [0.008 to 0.012] %
  - After 3 h use 0.009 [0.008 to 0.010] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 142 Pa
  - Increase after 3 h simulated use 6 Pa
- **Moisture output** at 0.5 L tidal vol. 20 g.m⁻³
- **Weight**
  - Unused 52 g
  - Increase after 3 h simulated use 2.2 g
- **Dimensions** (Diameter × L) 66 × 84 mm
- **Internal volume** 67 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

MINIPLEAT 9898

- List price £2.00
- Type paediatric pleated filter
- Tidal volume range ≥ 120 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused 0.098 [0.063 to 0.166] %
  - After 3 h use 0.113 [0.070 to 0.166] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused 173 Pa
  - Increase after 3 h simulated use 12 Pa
- **Moisture output** at 0.25 L tidal vol. 20 g.m⁻³
- **Weight**
  - Unused 27 g
  - Increase after 3 h simulated use 1.7 g
- **Dimensions** (Diameter × L) 51 × 73 mm
- **Internal volume** 39 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺
  - Machine end 15 m ☺ 22 f N/A

MULTIPLEAT 6500/01

- List price £2.00
- Type adult pleated filter
- Tidal volume range ≥ 120 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.018 [0.015 to 0.024] %
  - After 3 h use 0.017 [0.015 to 0.018] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 159 Pa
  - Increase after 3 h simulated use 8 Pa
- **Moisture output** Not measured
- **Weight**
  - Unused 31 g
  - Increase after 3 h simulated use 1.8 g
- **Dimensions** (H × W × L) 52 × 52 × 72 mm
- **Internal volume** 52 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺
Air Safety

NEONATAL 9080

- **List price**: £1.95
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: ≥ 25 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 7.89 [7.68 to 8.29] %
  - After 3 h simulated use: 7.11 [5.97 to 7.98] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 163 Pa
  - Increase after 3 h simulated use: 43 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 9 g
  - Increase after 3 h simulated use: 0.9 g
- **Dimensions (H × W × L)**: 38 × 44 × 48 mm
- **Internal volume**: 11 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m N/A
  - Machine end: 15 m ☺ 22 f N/A

PAEDIATRIC HMEF 9064/100

- **List price**: £1.50
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: ≥ 120 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 0.51 [0.47 to 0.53] %
  - After 3 h simulated use: 0.55 [0.53 to 0.58] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 71 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output** at 0.25 L tidal vol.: 34 g.m⁻³
- **Weight**
  - Unused: 20 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions (Diameter × L)**: 51 × 74 mm
- **Internal volume**: 49 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A

PAEDIATRIC SLIM 9070/01

- **List price**: £1.20
- **Type**: paediatric electrostatic filter
- **Tidal volume range**: ≥ 90 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 0.55 [0.47 to 0.69] %
  - After 3 h simulated use: 0.51 [0.45 to 0.56] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 65 Pa
  - Increase after 3 h simulated use: 3 Pa
- **Moisture output** at 0.25 L tidal vol.: 15 g.m⁻³
- **Weight**
  - Unused: 17 g
  - Increase after 3 h simulated use: 1.3 g
- **Dimensions (Diameter × L)**: 51 × 60 mm
- **Internal volume**: 30 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A
Air Safety

SLIM PLEAT 8777/01

- **List price**: £2.00
- **Type**: adult pleated filter
- **Tidal volume range**: ≥ 150 mL
- **Number of filters / box**: 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.024 [0.010 to 0.051] %
  - After 3 h use: 0.012 [0.005 to 0.017] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 197 Pa
  - Increase after 3 h simulated use: 11 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 45 g
  - Increase after 3 h simulated use: 1.9 g
- **Dimensions** (Diameter × L): 67 × 73 mm
- **Internal volume**: 46 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

SLIM PLEAT 8777/02

- **List price**: £1.90
- **Type**: adult pleated filter
- **Tidal volume range**: ≥ 150 mL
- **Number of filters / box**: 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.53 [0.30 to 1.30] %
  - After 3 h simulated use: 0.62 [0.17 to 1.49] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 129 Pa
  - Increase after 3 h simulated use: 7 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 43 g
  - Increase after 3 h simulated use: 2.2 g
- **Dimensions** (Diameter × L): 67 × 73 mm
- **Internal volume**: 47 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

SLIMLINE 4000/01

- **List price**: £1.20
- **Type**: adult electrostatic filter
- **Tidal volume range**: ≥ 150 mL
- **Number of filters / box**: 50

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.63 [0.51 to 0.83] %
  - After 3 h simulated use: 0.58 [0.54 to 0.62] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 90 Pa
  - Increase after 3 h simulated use: 4 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 31 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions** (Diameter × L): 67 × 69 mm
- **Internal volume**: 45 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

MHRA evaluation 04005, March 2004
SLIMLINE 4000/66

- List price: £1.40
- Type: adult electrostatic filter
- Tidal volume range: ≥ 150 mL
- Number of filters / box: 50

SLIMLINE HMEF 9040/01

- List price: £1.50
- Type: adult electrostatic filter with HME
- Tidal volume range: ≥ 150 mL
- Number of filters / box: 50

SLIM-PAEDIATRIC HMEF 9066/01

- List price: £1.40
- Type: paediatric electrostatic filter with HME
- Tidal volume range: ≥ 75 mL
- Number of filters / box: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.22 [0.19 to 0.28] %
  - After 3 h simulated use: 0.28 [0.21 to 0.35] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 143 Pa
  - Increase after 3 h simulated use: 10 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 31 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (Diameter × L): 67 × 69 mm
- **Internal volume**: 46 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.59 [0.51 to 0.70] %
  - After 3 h simulated use: 0.65 [0.61 to 0.69] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 116 Pa
  - Increase after 3 h simulated use: 10 Pa
- **Moisture output** at 0.5 L tidal vol.: 33 g.m\(^{-3}\)
- **Weight**
  - Unused: 32 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (Diameter × L): 66 × 68 mm
- **Internal volume**: 44 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 0.52 [0.49 to 0.54] %
  - After 3 h simulated use: 0.55 [0.53 to 0.58] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 70 Pa
  - Increase after 3 h simulated use: 1 Pa
- **Moisture output** at 0.25 L tidal vol.: 31 g.m\(^{-3}\)
- **Weight**
  - Unused: 18 g
  - Increase after 3 h simulated use: 1.3 g
- **Dimensions** (Diameter × L): 51 × 60 mm
- **Internal volume**: 29 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A
Cory Bros

CORY BROS FILTERS
MADE IN Sweden

SUPPLIER
Cory Bros
6 Bittacy Business Centre
Bittacy Hill
London
NW7 1BA

Tel: 020 8349 1081
Fax: 020 8349 1962
E-mail: mail@corybros.co.uk
Website: www.corybros.co.uk

MANUFACTURER'S COMMENTS
A draft copy of the report was sent to the manufacturer, who declined to comment.

CB8000

- List price £0.99
- Type adult electrostatic filter
- Tidal volume range 200 to 1500 mL
- Number of filters / box 25

TECHNICAL EVALUATION
- Penetration at 30 L.min⁻¹ (mean [range])
  Unused 73.6 [72.0 to 74.7] %
  After 3 h simulated use 60.9 [59.3 to 61.7] %
- Pressure drop at 30 L.min⁻¹
  Unused 71 Pa
  Increase after 3 h simulated use 10 Pa
- Moisture output Not measured
- Weight
  Unused 27 g
  Increase after 3 h simulated use 0.8 g
- Dimensions (Diameter × L) 64 × 89 mm
- Internal volume 75 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m N/A 22 f ☺

FILTERVENT CB8109

- List price £2.70
- Type adult electrostatic filter with HME
- Tidal volume range 200 to 1500 mL
- Number of filters / box 15

TECHNICAL EVALUATION
- Penetration at 30 L.min⁻¹ (mean [range])
  Unused 3.62 [3.17 to 4.23] %
  After 3 h simulated use 3.09 [2.26 to 4.36] %
- Pressure drop at 30 L.min⁻¹
  Unused 98 Pa
  Increase after 3 h simulated use 13 Pa
- Moisture output at 0.5 L tidal vol. 32 g.m⁻³
- Weight
  Unused 36 g
  Increase after 3 h simulated use 2.4 g
- Dimensions (H × W × L) 36 × 60 × 112 mm
- Internal volume 69 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺
FILTERVENT CHILD CB8129

- **List price**: £2.70
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 70 to 600 mL
- **Number of filters / box**: 30

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 7.92 [5.99 to 10.5] %
  - After 3 h simulated use: 5.66 [5.14 to 6.14] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 65 Pa
  - Increase after 3 h simulated use: 11 Pa
- **Moisture output** at 0.25 L tidal vol.: 27 g.m\(^{-3}\)
- **Weight**
  - Unused: 18 g
  - Increase after 3 h simulated use: 1.5 g
- **Dimensions** (H × W × L): 31 × 43 × 90 mm
- **Internal volume**: 25 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A

FILTERVENT FILTER CB8110

- **List price**: £1.59
- **Type**: adult electrostatic filter
- **Tidal volume range**: 200 to 1500 mL
- **Number of filters / box**: 15

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 3.95 [2.96 to 5.29] %
  - After 3 h simulated use: 3.29 [1.88 to 4.49] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 64 Pa
  - Increase after 3 h simulated use: 13 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 34 g
  - Increase after 3 h simulated use: 3.0 g
- **Dimensions** (H × W × L): 36 × 60 × 112 mm
- **Internal volume**: 68 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

FILTERVENT FILTER CHILD CB8120

- **List price**: £2.60
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 70 to 600 mL
- **Number of filters / box**: 30

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 6.17 [5.71 to 6.73] %
  - After 3 h simulated use: 3.67 [2.67 to 4.59] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 50 Pa
  - Increase after 3 h simulated use: 8 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 17 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions** (H × W × L): 31 × 43 × 90 mm
- **Internal volume**: 24 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A
HEPA FILTER CB8112

- List price £2.60
- Type adult pleated filter
- Tidal volume range 250 to 1500 mL
- Number of filters / box 10

TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused 0.066 [0.013 to 0.265] %
  - After 3 h use 0.086 [0.023 to 0.129] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused 117 Pa
  - Increase after 3 h simulated use 9 Pa
- **Moisture output** at 0.5 L tidal vol. 24 g.m\(^{-3}\)
- **Weight**
  - Unused 45 g
  - Increase after 3 h simulated use 2.8 g
- **Dimensions** (H × W × L) 49 × 60 × 114 mm
- **Internal volume** 114 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f N/A

HEPA FILTER/HME CB8111

- List price £3.25
- Type adult pleated filter with HME
- Tidal volume range 250 to 1500 mL
- Number of filters / box 10

TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused 0.006 [0.005 to 0.009] %
  - After 3 h use 0.012 [0.011 to 0.013] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused 131 Pa
  - Increase after 3 h simulated use 4 Pa
- **Moisture output** at 0.5 L tidal vol. 32 g.m\(^{-3}\)
- **Weight**
  - Unused 46 g
  - Increase after 3 h simulated use 2.8 g
- **Dimensions** (H × W × L) 49 × 60 × 114 mm
- **Internal volume** 116 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f N/A
DATEX-OHMEDA FILTERS
MADE IN Sweden

SUPPLIER
Datex-Ohmeda Ltd
71 Great North Road
Hatfield
Herts
AL9 5EN
Tel: 01707 263570
Fax: 01707 260065
E-mail: helen.betteridge@uk.datex-ohmeda.com
Website: www.Datex-Ohmeda.com

MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who responded as follows.

Datex-Ohmeda is now a part of GE Medical Systems.

DatexOhmeda recommends the use of the Uni-Filter when a low resistance filter is required.

Datex-Ohmeda does not specify a tidal volume range for its filter products.

In early 2004, Datex-Ohmeda will introduce angled versions of the HMEF 1000, HMEF 750 and Uni-Filter/S.

TECHNICAL EVALUATION

HMEF MINI 8004231

- List price £0.88
- Type adult & paed. electrostatic filter + HME
- Tidal volume range 60 to 500 mL
- Number of filters / box 50

HMEF 1000 557070100

- List price £0.91
- Type adult electrostatic filter with HME
- Tidal volume range 300 to 1000 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- Penetration at 15 L.min⁻¹ (mean [range])
  Unused 2.07 [1.88 to 2.26] %
  After 3 h simulated use 2.16 [2.04 to 2.31] %
- Pressure drop at 15 L.min⁻¹
  Unused 78 Pa
  Increase after 3 h simulated use 8 Pa
- Moisture output at 0.25 L tidal vol. 32 g.m⁻³
- Weight
  Unused 14 g
  Increase after 3 h simulated use 1.1 g
- Dimensions (Diameter × L) 45 × 65 mm
- Internal volume 22 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺
**Datex-Ohmeda**

**HMEF500 557070500**
- List price: £0.91
- Type: adult & paed. electrostatic filter + HME
- Tidal volume range: 120 to 500 mL
- Number of filters / box: 75

**MINI-FILTER/S M1003345**
- List price: £0.78
- Type: adult and paediatric electrostatic filter
- Tidal volume range: not specified
- Number of filters / box: 50

**UNI-FILTER 557021200**
- List price: £0.78
- Type: adult electrostatic filter
- Tidal volume range: not specified
- Number of filters / box: 45

**TECHNICAL EVALUATION**
- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 1.10 [0.86 to 1.29] %
  - After 3 h simulated use: 1.18 [1.05 to 1.35] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 78 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output** at 0.25 L tidal vol.: 32 g.m⁻³
- **Weight**
  - Unused: 16 g
  - Increase after 3 h simulated use: 1.9 g
- **Dimensions** (Diameter × L): 45 × 74 mm
- **Internal volume**: 32 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

**UNI-FILTER 557021200**
- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 5.24 [3.97 to 7.54] %
  - After 3 h simulated use: 4.24 [3.39 to 5.56] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 38 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output**:
  - Not measured
- **Weight**
  - Unused: 27 g
  - Increase after 3 h simulated use: 1.8 g
- **Dimensions** (Diameter × L): 86 × 73 mm
- **Internal volume**: 61 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺
Datex-Ohmeda

UNI-FILTER JUNIOR M1003346

- List price £0.78
- Type adult and paediatric electrostatic filter
- Tidal volume range not specified
- Number of filters / box 50

TECHNICAL EVALUATION
- Penetration at 15 L.min⁻¹ (mean [range])
  Unused 0.47 [0.40 to 0.57] %
  After 3 h simulated use 0.43 [0.36 to 0.49] %
- Pressure drop at 15 L.min⁻¹
  Unused 37 Pa
  Increase after 3 h simulated use 3 Pa
- Moisture output Not measured
- Weight
  Unused 16 g
  Increase after 3 h simulated use 1.3 g
- Dimensions (Diameter × L) 62 × 64 mm
- Internal volume 37 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺

UNI-FILTER/S 557022500

- List price £0.81
- Type adult and paediatric electrostatic filter
- Tidal volume range not specified
- Number of filters / box 60

TECHNICAL EVALUATION
- Penetration at 30 L.min⁻¹ (mean [range])
  Unused 0.98 [0.92 to 1.05] %
  After 3 h simulated use 1.02 [0.96 to 1.07] %
- Pressure drop at 30 L.min⁻¹
  Unused 87 Pa
  Increase after 3 h simulated use 7 Pa
- Moisture output Not measured
- Weight
  Unused 17 g
  Increase after 3 h simulated use 1.5 g
- Dimensions (Diameter × L) 62 × 64 mm
- Internal volume 37 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺
MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who declined to comment.

TECHNICAL EVALUATION
- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 1.37 [0.94 to 2.26] %
  - After 3 h simulated use: 0.74 [0.73 to 0.75] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 84 Pa
  - Increase after 3 h simulated use: 1 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 44 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (Diameter × L)
  - 82 × 78 mm
- **Internal volume**: 106 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

TECHNICAL EVALUATION
- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 1.12 [0.77 to 1.48] %
  - After 3 h simulated use: 0.88 [0.62 to 1.18] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 51 Pa
  - Increase after 3 h simulated use: 4 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 22 g
  - Increase after 3 h simulated use: 1.4 g
- **Dimensions** (H × W × L)
  - 59 × 71 × 66 mm
- **Internal volume**: 33 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
**F300 (PROFILE PART NO. 3416)**

- **List price**: £2.98
- **Type**: adult pleated filter
- **Tidal volume range**: not specified
- **Number of filters / box**: 100

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.015 [0.014 to 0.015] %
  - After 3 h use: 0.035 [0.012 to 0.080] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 116 Pa
  - Increase after 3 h simulated use: 6 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 42 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (H x W x L): 60 x 79 x 87 mm
- **Internal volume**: 106 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

**F400 (PROFILE PART NO. 3417)**

- **List price**: £3.32
- **Type**: adult pleated filter
- **Tidal volume range**: not specified
- **Number of filters / box**: 100

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.012 [0.009 to 0.015] %
  - After 3 h use: 0.008 [0.002 to 0.011] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 136 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 44 g
  - Increase after 3 h simulated use: 2.5 g
- **Dimensions** (H x W x L): 60 x 79 x 87 mm
- **Internal volume**: 107 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

**HMEF6 (PROFILE PART NO. 3408)**

- **List price**: £2.01
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: not specified
- **Number of filters / box**: 100

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 1.31 [0.96 to 2.15] %
  - After 3 h simulated use: 1.79 [0.94 to 2.80] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 96 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 45 g
  - Increase after 3 h simulated use: 2.2 g
- **Dimensions** (Diameter x L): 82 x 79 mm
- **Internal volume**: 106 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

21  MHRA evaluation 04005, March 2004
**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 8.92 [8.13 to 10.2]\%  
  - After 3 h simulated use: 7.79 [7.39 to 8.29]\%  
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 66 Pa  
  - Increase after 3 h simulated use: 1 Pa  
- **Moisture output** Not measured  
- **Weight**
  - Unused: 10 g  
  - Increase after 3 h simulated use: 0.9 g  
- **Dimensions** (H × W × L) 41 × 52 × 52 mm  
- **Internal volume** 15 mL  
- **Connectors** compliance with BS EN 1281-1  
  - Patient end: 15 f ☺ 22 m N/A  
  - Machine end: 15 m ☺ 22 f N/A

**HMEF6/N (PROFILE PART NO. 3409)**

- **List price** £1.57  
- **Type** paediatric electrostatic filter with HME  
- **Tidal volume range** not specified  
- **Number of filters / box** 100

**HMEF6/P (PROFILE PART NO. 3415)**

- **List price** £2.01  
- **Type** paediatric electrostatic filter with HME  
- **Tidal volume range** not specified  
- **Number of filters / box** 100
FISHER & PAYKEL FILTER

MADE IN                New Zealand

SUPPLIER

Fisher & Paykel Healthcare Limited
Unit 16, Cordwallis Park
Clivemont Road
Maidenhead
SL6 7BU

Tel: 01628 626 136
Fax: 01628 626 146
E-mail: info@fphcare.co.uk
Website: www.fphcare.com

MANUFACTURER'S COMMENTS

A draft copy of the report was sent to the manufacturer, who had not responded by the time the report went to publication.

RT020

• List price not known
• Type adult electrostatic filter
• Tidal volume range N/A
• Number of filters / box not known

TECHNICAL EVALUATION

• Penetration at 30 L.min⁻¹ (mean [range])
  Unused 3.09 [2.47 to 3.65] %
  After 3 h simulated use 3.55 [3.23 to 3.97] %
• Pressure drop at 30 L.min⁻¹
  Unused 74 Pa
  Increase after 3 h simulated use 17 Pa
• Moisture output Not measured
• Weight
  Unused 23 g
  Increase after 3 h simulated use 1.1 g
• Dimensions (Diameter × L) 67 × 77 mm
• Internal volume 45 mL
• Connectors compliance with BS EN 1281-1
  Patient end 15 f N/A 22 m ☺
  Machine end 15 m N/A 22 f ☹
FLEXICARE MEDICAL FILTERS

MADE IN UK

SUPPLIER

Flexicare Medical Ltd
Cynon Valley Business Park
Mountain Ash
CF45 4ER

Tel: 01443 474647
Fax: 01443 474222
E-mail: enquires@flexicare.com
Website: www.flexicare.com

MANUFACTURER’S COMMENTS

A draft copy of the report was sent to the manufacturer, who responded as follows:

Flexicare are in the process of changing the filter media to reduce the level of Sodium Chloride Penetration. Small modifications to tooling have been actioned to bring the slight oversized connectors within tolerance.

ADULT FILTER 038-41-365

- List price £1.00
- Type adult electrostatic filter
- Tidal volume range ≥ 223 mL
- Number of filters / box 50

ADULT HME FILTER 038-41-355

- List price £1.10
- Type adult electrostatic filter with HME
- Tidal volume range ≥ 217 mL
- Number of filters / box 50

TECHNICAL EVALUATION

- Penetration at 30 L.min⁻¹ (mean [range])
  Unused 1.18 [1.09 to 1.31] %
  After 3 h simulated use 1.32 [1.29 to 1.35] %
- Pressure drop at 30 L.min⁻¹
  Unused 98 Pa
  Increase after 3 h simulated use 8 Pa
- Moisture output at 0.5 L tidal vol. 15 g.m⁻³
- Weight
  Unused 32 g
  Increase after 3 h simulated use 2.2 g
- Dimensions (Diameter × L) 68 × 82 mm
- Internal volume 67 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺

- Penetration at 30 L.min⁻¹ (mean [range])
  Unused 1.38 [1.27 to 1.46] %
  After 3 h simulated use 1.25 [1.12 to 1.35] %
- Pressure drop at 30 L.min⁻¹
  Unused 112 Pa
  Increase after 3 h simulated use 5 Pa
- Moisture output at 0.5 L tidal vol. 33 g.m⁻³
- Weight
  Unused 38 g
  Increase after 3 h simulated use 2.6 g
- Dimensions (Diameter × L) 68 × 82 mm
- Internal volume 65 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m ☺ 22 f ☺
PAEDIATRIC FILTER 038-42-365

- List price: £1.06
- Type: paediatric electrostatic filter
- Tidal volume range: ≥ 93 mL
- Number of filters / box: 50

TECHNICAL EVALUATION

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 1.20 [1.09 to 1.35] %
  - After 3 h simulated use: 1.26 [1.07 to 1.57] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 74 Pa
  - Increase after 3 h simulated use: 8 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 21 g
  - Increase after 3 h simulated use: 1.0 g
- **Dimensions** (Diameter × L): 51 × 66 mm
- **Internal volume**: 28 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

PAEDIATRIC HME FILTER 038-42-355

- List price: £1.16
- Type: paediatric electrostatic filter with HME
- Tidal volume range: ≥ 93 mL
- Number of filters / box: 50

TECHNICAL EVALUATION

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 1.63 [0.88 to 2.69] %
  - After 3 h simulated use: 2.39 [1.03 to 3.49] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 108 Pa
  - Increase after 3 h simulated use: 6 Pa
- **Moisture output** at 0.25 L tidal vol.: 32 g.m⁻³
- **Weight**
  - Unused: 24 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (Diameter × L): 51 × 67 mm
- **Internal volume**: 28 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
ANEST GUARD 28812

- **List price**: £1.20
- **Type**: adult electrostatic filter
- **Tidal volume range**: N/A
- **Number of filters / box**: 20

HUMID-VENT FILTER COMPACT 19402

- **List price**: £1.30
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 150 to 1000 mL
- **Number of filters / box**: 25

**MANUFACTURER’S COMMENTS**

A draft copy of the report was sent to the manufacturer, who declined to comment.

**TECHNICAL EVALUATION**

**ANEST GUARD 28812**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 3.74 [3.33 to 4.13] %
  - After 3 h simulated use: 3.53 [3.39 to 3.76] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 65 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 33 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (H × W × L): 67 × 67 × 70 mm
- **Internal volume**: 61 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

**HUMID-VENT FILTER COMPACT 19402**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 5.20 [4.86 to 5.56] %
  - After 3 h simulated use: 4.82 [4.59 to 5.28] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 108 Pa
  - Increase after 3 h simulated use: 10 Pa
- **Moisture output** at 0.5 L tidal vol.: 31 g.m⁻³
- **Weight**
  - Unused: 32 g
  - Increase after 3 h simulated use: 3.1 g
- **Dimensions** (Diameter × L): 60 × 70 mm
- **Internal volume**: 49 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
HUMID-VENT FILTER PEDI 11012

- **List price**: £3.90
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 50 to 250 mL

**Number of filters / box**: 20

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 16.8 [16.3 to 17.2] %
  - After 3 h simulated use: 14.5 [14.2 to 15.0] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 83 Pa
  - Increase after 3 h simulated use: 32 Pa
- **Moisture output** at 50 mL tidal vol. 31 g.m⁻³
- **Weight**
  - Unused: 14 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions** (H × W × L) 35 × 52 × 59 mm
- **Internal volume**: 16 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺ 15 m ☺ 22 f N/A

HUMID-VENT FILTER SMALL 19501

- **List price**: £1.32
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 150 to 1000 mL

**Number of filters / box**: 20

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 5.48 [5.29 to 5.70] %
  - After 3 h simulated use: 5.89 [5.16 to 6.95] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 106 Pa
  - Increase after 3 h simulated use: 8 Pa
- **Moisture output** at 0.25 L tidal vol. 32 g.m⁻³
- **Weight**
  - Unused: 21 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (Diameter × L) 49 × 66 mm
- **Internal volume**: 29 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺ 15 m ☺ 22 f N/A

ISO-GARD FILTER 19212

- **List price**: £1.28
- **Type**: adult electrostatic filter
- **Tidal volume range**: 150 to 1000 mL

**Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 2.99 [2.67 to 3.45] %
  - After 3 h simulated use: 3.12 [2.50 to 3.97] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 84 Pa
  - Increase after 3 h simulated use: 5 Pa
- **Moisture output** at 0.5 L tidal vol. 11 g.m⁻³
- **Weight**
  - Unused: 23 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions** (Diameter × L) 60 × 61 mm
- **Internal volume**: 37 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺ 15 m ☺ 22 f ☺ 15 f ☺ 22 m ☺ 15 m ☺ 22 f N/A
ISO-GARD FILTER SMALL 19511

- List price £1.30
- Type paediatric electrostatic filter
- Tidal volume range 100 to 600 mL
- Number of filters / box 20

TECHNICAL EVALUATION

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused 6.24 [5.43 to 7.68] %
  - After 3 h simulated use 5.84 [5.29 to 6.25] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused 83 Pa
  - Increase after 3 h simulated use 4 Pa
- **Moisture output** at 0.25 L tidal vol. 13 g.m\(^{-3}\)
- **Weight**
  - Unused 15 g
  - Increase after 3 h simulated use 1.1 g
- **Dimensions** (Diameter × L) 49 × 58 mm
- **Internal volume** 23 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

ISO-GARD HEPA LIGHT 28011

- List price £1.62
- Type adult pleated filter
- Tidal volume range 300 to 1200 mL
- Number of filters / box 20

TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused 0.010 [0.008 to 0.011] %
  - After 3 h use 0.010 [0.010 to 0.011] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused 117 Pa
  - Increase after 3 h simulated use 4 Pa
- **Moisture output** at 0.5 L tidal vol. 25 g.m\(^{-3}\)
- **Weight**
  - Unused 36 g
  - Increase after 3 h simulated use 1.9 g
- **Dimensions** (H × W × L) 49 × 75 × 81 mm
- **Internal volume** 107 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

ISO-GARD HEPA SMALL 28062

- List price £1.45
- Type paediatric pleated filter
- Tidal volume range 150 to 800 mL
- Number of filters / box 25

TECHNICAL EVALUATION

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused 0.035 [0.027 to 0.040] %
  - After 3 h use 0.050 [0.037 to 0.061] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused 118 Pa
  - Increase after 3 h simulated use 5 Pa
- **Moisture output** at 0.25 L tidal vol. 24 g.m\(^{-3}\)
- **Weight**
  - Unused 23 g
  - Increase after 3 h simulated use 1.3 g
- **Dimensions** (H × W × L) 40 × 50 × 73 mm
- **Internal volume** 44 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f N/A
MANUFACTURER’S COMMENTS

A draft copy of the report was sent to the manufacturer, who responded as follows:

As a manufacturer of breathing filters, which are designed to retain bacterial and viruses, we favour a bacterial and viral challenge such as described in Anaesthesia 2000; 55: 458-65 for the validation of these products. We currently use a sodium chloride challenge routinely as a manufacturing tool to ensure the integrity of our pleated membrane filters before packaging.

CLEAR-GUARD 3 1544

• List price £1.85
• Type adult electrostatic filter
• Tidal volume range 150 to 1500 mL
• Number of filters / box 150

CLEAR-GUARD II 1844

• List price £2.00
• Type adult electrostatic filter
• Tidal volume range 200 to 1500 mL
• Number of filters / box 35
CLEAR-GUARD MIDI 1644

- List price: £1.80
- Type: adult electrostatic filter
- Tidal volume range: 100 to 1500 mL
- Number of filters / box: 100

TECHNICAL EVALUATION

- Penetration at 30 L.min⁻¹ (mean [range])
  - Unused: 2.87 [2.50 to 3.23] %
  - After 3 h simulated use: 4.08 [3.34 to 4.72] %
- Pressure drop at 30 L.min⁻¹
  - Unused: 92 Pa
  - Increase after 3 h simulated use: 33 Pa
- Moisture output: Not measured
- Weight
  - Unused: 19 g
  - Increase after 3 h simulated use: 1.6 g
- Dimensions (Diameter × L): 60 × 60 mm
- Internal volume: 35 mL
- Connectors: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

CLEAR-THERM 1841

- List price: £2.30
- Type: adult electrostatic filter with HME
- Tidal volume range: 200 to 1500 mL
- Number of filters / box: 35

TECHNICAL EVALUATION

- Penetration at 30 L.min⁻¹ (mean [range])
  - Unused: 1.12 [0.94 to 1.19] %
  - After 3 h simulated use: 0.64 [0.58 to 0.72] %
- Pressure drop at 30 L.min⁻¹
  - Unused: 99 Pa
  - Increase after 3 h simulated use: 18 Pa
- Moisture output at 0.5 L tidal vol.: 32 g.m⁻³
- Weight
  - Unused: 32 g
  - Increase after 3 h simulated use: 3.8 g
- Dimensions (Diameter × L): 62 × 72 mm
- Internal volume: 59 mL
- Connectors: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

CLEAR-THERM 3 1541

- List price: £2.10
- Type: adult electrostatic filter with HME
- Tidal volume range: 150 to 1500 mL
- Number of filters / box: 150

TECHNICAL EVALUATION

- Penetration at 30 L.min⁻¹ (mean [range])
  - Unused: 1.76 [1.63 to 1.92] %
  - After 3 h simulated use: 1.07 [0.91 to 1.20] %
- Pressure drop at 30 L.min⁻¹
  - Unused: 100 Pa
  - Increase after 3 h simulated use: 15 Pa
- Moisture output at 0.5 L tidal vol.: 30 g.m⁻³
- Weight
  - Unused: 30 g
  - Increase after 3 h simulated use: 3.6 g
- Dimensions (Diameter × L): 66 × 69 mm
- Internal volume: 58 mL
- Connectors: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
CLEAR-THERM MICRO 1441

• List price £3.00
• Type paediatric electrostatic filter with HME
• Tidal volume range 20 to 100 mL
• Number of filters / box 20

TECHNICAL EVALUATION

- Penetration at 15 L.min\(^{-1}\) (mean [range])
  Unused 2.06 [1.83 to 2.58] %
  After 3 h simulated use 1.44 [1.24 to 1.79] %
- Pressure drop at 15 L.min\(^{-1}\)
  Unused 171 Pa
  Increase after 3 h simulated use 91 Pa
- Moisture output Not measured
- Weight Unused 12 g
  Increase after 3 h simulated use 0.9 g
- Dimensions (H × W × L) 39 × 47 × 48 mm
- Internal volume 12 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m N/A
  Machine end 15 m ☺ 22 f N/A

CLEAR-THERM MIDI 1641

• List price £2.05
• Type adult electrostatic filter with HME
• Tidal volume range 100 to 1500 mL
• Number of filters / box 100

TECHNICAL EVALUATION

- Penetration at 30 L.min\(^{-1}\) (mean [range])
  Unused 3.02 [2.38 to 3.51] %
  After 3 h simulated use 3.80 [3.62 to 4.06] %
- Pressure drop at 30 L.min\(^{-1}\)
  Unused 111 Pa
  Increase after 3 h simulated use 76 Pa
- Moisture output at 0.5 L tidal vol. 22 g.m\(^{-3}\)
- Weight Unused 19 g
  Increase after 3 h simulated use 1.6 g
- Dimensions (Diameter × L) 60 × 60 mm
- Internal volume 34 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m N/A 22 f ☺

CLEAR-THERM MINI 1831

• List price £3.25
• Type paediatric electrostatic filter with HME
• Tidal volume range 75 to 200 mL
• Number of filters / box 40

TECHNICAL EVALUATION

- Penetration at 15 L.min\(^{-1}\) (mean [range])
  Unused 1.79 [1.51 to 1.97] %
  After 3 h simulated use 1.31 [1.15 to 1.47] %
- Pressure drop at 15 L.min\(^{-1}\)
  Unused 91 Pa
  Increase after 3 h simulated use 16 Pa
- Moisture output at 0.25 L tidal vol. 31 g.m\(^{-3}\)
- Weight Unused 22 g
  Increase after 3 h simulated use 2.3 g
- Dimensions (Diameter × L) 50 × 63 mm
- Internal volume 26 mL
- Connectors compliance with BS EN 1281-1
  Patient end 15 f ☺ 22 m ☺
  Machine end 15 m N/A 22 f ☺
# FILTA-GUARD 1944

- **List price**: £2.75
- **Type**: adult electrostatic filter
- **Tidal volume range**: 200 to 1500 mL
- **Number of filters / box**: 70

## TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.43 [0.31 to 0.56] %
  - After 3 h simulated use: 0.40 [0.38 to 0.43] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 119 Pa
  - Increase after 3 h simulated use: 3 Pa
- **Moisture output** at 0.5 L tidal vol.: 18 g.m\(^{-3}\)
- **Weight**
  - Unused: 40 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (H × W × L): 58 × 82 × 66 mm
- **Internal volume**: 68 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

# FILTA-THERM 1941

- **List price**: £3.35
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 200 to 1500 mL
- **Number of filters / box**: 70

## TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.42 [0.31 to 0.65] %
  - After 3 h simulated use: 0.15 [0.13 to 0.17] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 120 Pa
  - Increase after 3 h simulated use: 13 Pa
- **Moisture output** at 0.5 L tidal vol.: 28 g.m\(^{-3}\)
- **Weight**
  - Unused: 42 g
  - Increase after 3 h simulated use: 2.5 g
- **Dimensions** (H × W × L): 58 × 82 × 66 mm
- **Internal volume**: 67 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

# HYDRO-GUARD MINI 1744

- **List price**: £3.00
- **Type**: adult pleated filter
- **Tidal volume range**: 200 to 1500 mL
- **Number of filters / box**: 40

## TECHNICAL EVALUATION

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.012 [0.011 to 0.014] %
  - After 3 h use: 0.011 [0.010 to 0.013] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 176 Pa
  - Increase after 3 h simulated use: 10 Pa
- **Moisture output** at 0.5 L tidal vol.: 22 g.m\(^{-3}\)
- **Weight**
  - Unused: 37 g
  - Increase after 3 h simulated use: 1.3 g
- **Dimensions** (H × W × L): 45 × 58 × 82 mm
- **Internal volume**: 60 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
MALLINCKRODT DAR FILTERS

MADE IN Italy by Mallinckrodt DAR (Mirandola)

SUPPLIER

Tyco Healthcare
Medical Division
154 Fareham Road
Gosport
PO13 0AS

Tel: 01329 224226
Fax: 01329 224334
E-mail: terry.wardle@emea.tycohealthcare.com
Website: www.mallinckrodt.com

**TECHNICAL EVALUATION**

**BARRIERBAC 350/5422**

- List price £1.60
- Type adult electrostatic filter
- Tidal volume range 300 to 1500 mL
- Number of filters / box 25

**Penetration** at 30 L.min\(^{-1}\) (mean [range])

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>After 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>0.82 [0.69 to 0.99] %</td>
<td>0.92 [0.80 to 0.99] %</td>
</tr>
</tbody>
</table>
| Pressure drop at 30 L.min\(^{-1}\)

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>62 Pa</td>
<td>0 Pa</td>
</tr>
<tr>
<td>Moisture output at 0.5 L tidal vol.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>16 g.m(^{-3})</td>
<td>2.5 g</td>
</tr>
</tbody>
</table>
| Weight

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>35 g</td>
<td>2.5 g</td>
</tr>
</tbody>
</table>
| Dimensions (Diameter × L) 78 × 84 mm

**Connectors** compliance with BS EN 1281-1

<table>
<thead>
<tr>
<th></th>
<th>Patient end</th>
<th>Machine end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient end</td>
<td>15 f ☺ 22 m ☺</td>
<td>15 m ☺ 22 f ☺</td>
</tr>
<tr>
<td>Machine end</td>
<td>15 m ☺ 22 f ☺</td>
<td></td>
</tr>
</tbody>
</table>

**BARRIERBAC S 350/5879**

- List price £0.95
- Type adult electrostatic filter
- Tidal volume range 150 to 1200 mL
- Number of filters / box 25

**Penetration** at 30 L.min\(^{-1}\) (mean [range])

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>After 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>3.50 [2.55 to 4.72] %</td>
<td>3.15 [2.89 to 3.45] %</td>
</tr>
</tbody>
</table>
| Pressure drop at 30 L.min\(^{-1}\)

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>66 Pa</td>
<td>3 Pa</td>
</tr>
<tr>
<td>Moisture output at 0.5 L tidal vol.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>9 g.m(^{-3})</td>
<td>1.6 g</td>
</tr>
</tbody>
</table>
| Weight

<table>
<thead>
<tr>
<th></th>
<th>Unused</th>
<th>Increase after 3 h simulated use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused</td>
<td>19 g</td>
<td>1.6 g</td>
</tr>
</tbody>
</table>
| Dimensions (Diameter × L) 58 × 64 mm

**Connectors** compliance with BS EN 1281-1

<table>
<thead>
<tr>
<th></th>
<th>Patient end</th>
<th>Machine end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient end</td>
<td>15 f ☺ 22 m ☺</td>
<td>15 m ☺ 22 f ☺</td>
</tr>
<tr>
<td>Machine end</td>
<td>15 m ☺ 22 f ☺</td>
<td></td>
</tr>
</tbody>
</table>
## HYGROBABY 355/5427

- **List price**: £3.25
- **Type**: neonatal electrostatic filter with HME
- **Tidal volume range**: 30 to 100 mL
- **Number of filters / box**: 25

### TECHNICAL EVALUATION
- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 5.17 [3.76 to 7.18] %
  - After 3 h simulated use: 2.93 [2.15 to 4.04] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 251 Pa
  - Increase after 3 h simulated use: 224 Pa
- **Moisture output** at 50 mL tidal vol.: 28 g.m\(^{-3}\)
- **Weight**
  - Unused: 9 g
  - Increase after 3 h simulated use: 1.0 g
- **Dimensions** (Diameter × L): 38 × 48 mm
- **Internal volume**: 10 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m N/A
  - Machine end: 15 m ☺ 22 f N/A

## HYGROBAC 352/5805

- **List price**: £1.99
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 300 to 1500 mL
- **Number of filters / box**: 25

### TECHNICAL EVALUATION
- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.99 [0.79 to 1.17] %
  - After 3 h simulated use: 0.76 [0.66 to 0.85] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 100 Pa
  - Increase after 3 h simulated use: 12 Pa
- **Moisture output** at 0.5 L tidal vol.: 33 g.m\(^{-3}\)
- **Weight**
  - Unused: 46 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (Diameter × L): 78 × 84 mm
- **Internal volume**: 94 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

## HYGROBAC S 352/5877

- **List price**: £1.55
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 150 to 1200 mL
- **Number of filters / box**: 25

### TECHNICAL EVALUATION
- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 2.39 [2.04 to 2.84] %
  - After 3 h simulated use: 1.97 [1.54 to 2.50] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 129 Pa
  - Increase after 3 h simulated use: 36 Pa
- **Moisture output** at 0.5 L tidal vol.: 33 g.m\(^{-3}\)
- **Weight**
  - Unused: 28 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (Diameter × L): 58 × 75 mm
- **Internal volume**: 53 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
HYGROBOY 355/5430

- **List price**: £2.99
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 75 to 300 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 2.75 [1.92 to 4.59] %
  - After 3 h simulated use: 1.84 [0.81 to 2.50] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 133 Pa
  - Increase after 3 h simulated use: 92 Pa
- **Moisture output** at 0.25 L tidal vol.: 31 g.m⁻³
- **Weight**
  - Unused: 21 g
  - Increase after 3 h simulated use: 1.0 g
- **Dimensions** (Diameter × L): 50 × 77 mm
- **Internal volume**: 28 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

HYGROSTER 354/5876

- **List price**: £3.30
- **Type**: adult pleated filter with HME
- **Tidal volume range**: 300 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.26 [0.23 to 0.31] %
  - After 3 h simulated use: 0.23 [0.21 to 0.26] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 109 Pa
  - Increase after 3 h simulated use: 24 Pa
- **Moisture output** at 0.5 L tidal vol.: 34 g.m⁻³
- **Weight**
  - Unused: 51 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (H × W × L): 51 × 80 × 94 mm
- **Internal volume**: 96 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

STERIVENT 351/5856

- **List price**: £2.20
- **Type**: adult pleated filter
- **Tidal volume range**: 300 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.036 [0.031 to 0.042] %
  - After 3 h use: 0.016 [0.015 to 0.017] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 63 Pa
  - Increase after 3 h simulated use: 8 Pa
- **Moisture output** at 0.5 L tidal vol.: 23 g.m⁻³
- **Weight**
  - Unused: 43 g
  - Increase after 3 h simulated use: 1.9 g
- **Dimensions** (H × W × L): 51 × 80 × 92 mm
- **Internal volume**: 102 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f N/A 22 m ☺
  - Machine end: 15 m N/A 22 f ☺
STERIVENT MINI 351/5979

- List price: £1.65
- Type: adult pleated filter
- Tidal volume range: 150 to 1200 mL
- Number of filters / box: 25

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.48 [0.40 to 0.62] %
  - After 3 h simulated use: 0.15 [0.12 to 0.20] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 115 Pa
  - Increase after 3 h simulated use: 9 Pa
- **Moisture output** at 0.5 L tidal vol.: 16 g.m⁻³
- **Weight**
  - Unused: 25 g
  - Increase after 3 h simulated use: 1.5 g
- **Dimensions** (H × W × L): 48 × 53 × 75 mm
- **Internal volume**: 44 mL
- **Connectors**
  - Compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

STERIVENT S 351/5834

- List price: £2.00
- Type: adult pleated filter
- Tidal volume range: 200 to 1500 mL
- Number of filters / box: 25

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.18 [0.15 to 0.21] %
  - After 3 h simulated use: 0.11 [0.10 to 0.12] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 75 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output** at 0.5 L tidal vol.: 21 g.m⁻³
- **Weight**
  - Unused: 37 g
  - Increase after 3 h simulated use: 1.8 g
- **Dimensions** (H × W × L): 51 × 80 × 81 mm
- **Internal volume**: 71 mL
- **Connectors**
  - Compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

MANUFACTURER'S COMMENTS

A draft copy of the report was sent to the manufacturer, who responded as follows:

Moisture output values for Barrierbac, Barrierbac S, Sterivent, Sterivent Mini and Sterivent S in the current evaluation are low. We would like to underline that these products are intended as plain filters with no humidifying performance.

All products are available also in the version with tethered cap on the CO₂ port.

Hygrobaby 355/5427 is intended mainly for use on neonatal patients. We therefore believe that measurement of filtration performance with a flow rate of 15 l/min does not reflect the clinical practice where the flow rate for this kind of patients would rarely exceed 10 l/min. The same concept applies to the tidal volume used to measure pressure drop.

Sterivent 351/5856 is also available in the version with patient end connectors 15F-22M and machine end connectors 15M-22F and CO₂ port under code 351/5410.

Sterivent S 351/5834 is also available in the version with patient end connectors 15F-22M and machine end connectors 15M-22F and CO₂ port under code 351/5878.
MANUFACTURER'S COMMENTS

A draft copy of the report was sent to the manufacturer, who declined to comment.

BARR-VENT 300 000 000

- **List price**: £1.00
- **Type**: adult electrostatic filter
- **Tidal volume range**: > 150 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 0.84 [0.62 to 1.33] %
  - After 3 h simulated use: 0.53 [0.39 to 0.63] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 62 Pa
  - Increase after 3 h simulated use: 2 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 35 g
  - Increase after 3 h simulated use: 2.3 g
- **Dimensions** (Diameter × L): 77 × 81 mm
- **Internal volume**: 98 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

BARR-VENT S 300 400 000

- **List price**: £0.95
- **Type**: adult electrostatic filter
- **Tidal volume range**: > 150 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 4.48 [3.62 to 5.00] %
  - After 3 h simulated use: 3.49 [2.89 to 4.01] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 69 Pa
  - Increase after 3 h simulated use: 3 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 22 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions** (Diameter × L): 63 × 65 mm
- **Internal volume**: 35 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
**Medisize**

**HYGROVENT 300 100 000**

- **List price** £1.50
- **Type** adult electrostatic filter with HME
- **Tidal volume range** > 150 mL
- **Number of filters / box** 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused 0.53 [0.35 to 0.77] %
  - After 3 h simulated use 0.46 [0.43 to 0.52] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused 92 Pa
  - Increase after 3 h simulated use 12 Pa
- **Moisture output** at 0.5 L tidal vol. 32 g.m\(^{-3}\)
- **Weight**
  - Unused 45 g
  - Increase after 3 h simulated use 2.9 g
- **Dimensions** (Diameter \(\times\) L) 77 \(\times\) 81 mm
- **Internal volume** 92 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

**HYGROVENT CHILD 300 500 000**

- **List price** £1.40
- **Type** paediatric electrostatic filter with HME
- **Tidal volume range** 50 to 250 mL
- **Number of filters / box** 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused 25.2 [20.5 to 30.1] %
  - After 3 h simulated use 33.1 [13.8 to 44.5] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused 250 Pa
  - Increase after 3 h simulated use 73 Pa
- **Moisture output** at 50 mL tidal vol. 30 g.m\(^{-3}\)
- **Weight**
  - Unused 11 g
  - Increase after 3 h simulated use 1.3 g
- **Dimensions** (H \(\times\) W \(\times\) L) 35 \(\times\) 44 \(\times\) 61 mm
- **Internal volume** 14 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f N/A

**HYGROVENT S 300 200 000**

- **List price** £1.35
- **Type** adult electrostatic filter with HME
- **Tidal volume range** > 150 mL
- **Number of filters / box** 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused 4.71 [3.90 to 6.39] %
  - After 3 h simulated use 3.58 [3.39 to 3.78] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused 173 Pa
  - Increase after 3 h simulated use 94 Pa
- **Moisture output** at 0.5 L tidal vol. 33 g.m\(^{-3}\)
- **Weight**
  - Unused 35 g
  - Increase after 3 h simulated use 2.2 g
- **Dimensions** (Diameter \(\times\) L) 58 \(\times\) 77 mm
- **Internal volume** 51 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

MHRA evaluation 04005, March 2004 38
MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who responded as follows:

- The Pall BB25 tested in this report was manufactured in 1997.
- The BB25 is intended for anaesthetic use and not for long-term adult mechanical ventilation.
- Specific tidal volume ranges are not quoted as the effect of mechanical dead-space should be evaluated individually for each patient as many clinical variables may be involved.
- List price refers to NHS Logistics pricing (BB100E = FTC276, BB22-15 = FTC009, BB25 = FTC036).

TECHNICAL EVALUATION

**BB100E**
- **List price**: £2.82
- **Type**: adult pleated filter with HME
- **Tidal volume range**: not specified
- **Number of filters / box**: 50
- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.006 [0.003 to 0.010] %
  - After 3 h use: 0.008 [0.003 to 0.010] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 82 Pa
  - Increase after 3 h simulated use: 13 Pa
- **Moisture output** at 0.5 L tidal vol.: 27 g.m⁻³
- **Weight**
  - Unused: 47 g
  - Increase after 3 h simulated use: 2.6 g
- **Dimensions** (H × W × L): 46 × 74 × 86 mm
- **Internal volume**: 93 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

**BB22-15**
- **List price**: £2.78
- **Type**: adult pleated filter
- **Tidal volume range**: not specified
- **Number of filters / box**: 50
- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.017 [0.015 to 0.018] %
  - After 3 h use: 0.014 [0.012 to 0.015] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 81 Pa
  - Increase after 3 h simulated use: 11 Pa
- **Moisture output** at 0.5 L tidal vol.: 26 g.m⁻³
- **Weight**
  - Unused: 41 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (H × W × L): 57 × 74 × 87 mm
- **Internal volume**: 97 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
BB25

- **List price** £1.44
- **Type** adult pleated filter
- **Tidal volume range** not specified
- **Number of filters / box** 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 0.046 [0.036 to 0.055] %
  - After 3 h use 0.023 [0.022 to 0.027] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 151 Pa
  - Increase after 3 h simulated use 28 Pa
- **Moisture output** at 0.5 L tidal vol. 17 g.m⁻³
- **Weight**
  - Unused 27 g
  - Increase after 3 h simulated use 1.9 g
- **Dimensions** (H × W × L) 46 × 55 × 72 mm
- **Internal volume** 39 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺
MANUFACTURER’S COMMENTS

A draft copy of the report was sent to the manufacturer, who responded as follows:

We are in the process of reviewing the dimensions of the 22m connection of our 020-345 and 020-360 products.

TECHNICAL EVALUATION

010-350 ADULT HME FILTER

- List price: £0.65
- Type: adult electrostatic filter with HME
- Tidal volume range: 350 to 1500 mL
- Number of filters / box: 20

010-350M ADULT MINI HME FILTER

- List price: £0.65
- Type: small volume electrostatic filter with HME
- Tidal volume range: 100 to 1000 mL
- Number of filters / box: 25
010-360 ADULT FILTER

- **List price**: £0.55
- **Type**: adult electrostatic filter
- **Tidal volume range**: 350 to 1500 mL
- **Number of filters / box**: 20

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 2.98 [2.58 to 3.49] %
  - After 3 h simulated use: 2.34 [1.47 to 2.85] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 59 Pa
  - Increase after 3 h simulated use: 0 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 33 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (Diameter × L): 63 × 89 mm
- **Internal volume**: 90 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

010-360M ADULT MINI FILTER

- **List price**: £0.55
- **Type**: small volume electrostatic filter
- **Tidal volume range**: 100 to 1000 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 2.23 [1.83 to 3.33] %
  - After 3 h simulated use: 1.48 [1.33 to 1.61] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 47 Pa
  - Increase after 3 h simulated use: 1 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 18 g
  - Increase after 3 h simulated use: 1.4 g
- **Dimensions** (Diameter × L): 48 × 73 mm
- **Internal volume**: 42 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A

020-345 PAEDIATRIC FILTER WITH CO₂ PORT

- **List price**: £0.72
- **Type**: paediatric electrostatic filter
- **Tidal volume range**: 100 to 1000 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 2.63 [1.93 to 3.44] %
  - After 3 h simulated use: 2.25 [1.97 to 2.58] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 46 Pa
  - Increase after 3 h simulated use: 5 Pa
- **Moisture output** at 0.25 L tidal vol.: 12 g.m⁻³
- **Weight**
  - Unused: 14 g
  - Increase after 3 h simulated use: 1.3 g
- **Dimensions** (Diameter × L): 48 × 58 mm
- **Internal volume**: 24 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A
### 020-360 PAEDIATRIC FILTER

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<td>Number of filters / box</td>
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</tbody>
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### TECHNICAL EVALUATION

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 3.00 [2.04 to 3.71] %
  - After 3 h simulated use: 1.86 [1.51 to 2.37] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 43 Pa
  - Increase after 3 h simulated use: 3 Pa
- **Moisture output**
  - Not measured
- **Weight**
  - Unused: 13 g
  - Increase after 3 h simulated use: 1.2 g
- **Dimensions** (Diameter × L)
  - 48 × 58 mm
- **Internal volume**
  - 24 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A
Pharma Systems

**PHARMA SYSTEMS FILTERS**

**MADE IN** Sweden

**SUPPLIER**

Armstrong Medical Limited
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E-mail: info@armstrongmedical.net
Website: www.armstrongmedical.net

**MANUFACTURER’S COMMENTS**

A draft copy of the report was sent to the manufacturer, who declined to comment.

**BACT-TRAP BASIC 7010**

- **List price**: £0.90
- **Type**: adult electrostatic filter
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration at 30 L.min⁻¹ (mean [range])**
  - Unused: 0.86 [0.79 to 0.99] %
  - After 3 h simulated use: 1.27 [1.20 to 1.33] %
- **Pressure drop at 30 L.min⁻¹**
  - Unused: 71 Pa
  - Increase after 3 h simulated use: 4 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 27 g
  - Increase after 3 h simulated use: 2.1 g
- **Dimensions** (Diameter × L)
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺
- **Internal volume**: 83 mL

**BACT-TRAP HEPA BASIC 7070**

- **List price**: £1.95
- **Type**: adult pleated filter
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration at 30 L.min⁻¹ (mean [range])**
  - Unused: 0.018 [0.015 to 0.020] %
  - After 3 h use: 0.014 [0.013 to 0.015] %
- **Pressure drop at 30 L.min⁻¹**
  - Unused: 53 Pa
  - Increase after 3 h simulated use: 11 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 36 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (Diameter × L)
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺
- **Internal volume**: 75 mL

**Connectors** compliance with BS EN 1281-1

**BACT-TRAP HEPA HME BASIC 7030**

- **List price**: £2.50
- **Type**: adult pleated filter with HME
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.017 [0.015 to 0.020] %
  - After 3 h use: 0.015 [0.015 to 0.015] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 71 Pa
  - Increase after 3 h simulated use: 8 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 36 g
  - Increase after 3 h simulated use: 2.3 g
- **Dimensions** (Diameter × L): 63 × 86 mm
- **Internal volume**: 81 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺

**BACT-TRAP MINI 7055**

- **List price**: £0.85
- **Type**: small volume electrostatic filter
- **Tidal volume range**: 50 to 700 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 1.83 [1.70 to 2.04] %
  - After 3 h simulated use: 2.46 [1.93 to 3.49] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 92 Pa
  - Increase after 3 h simulated use: 10 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 14 g
  - Increase after 3 h simulated use: 1.2 g
- **Dimensions** (H × W × L): 39 × 52 × 69 mm
- **Internal volume**: 25 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f N/A

**BACT-VIRAL/HME 6000**

- **List price**: £1.25
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 25

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 1.07 [0.84 to 1.22] %
  - After 3 h simulated use: 0.59 [0.51 to 0.62] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 83 Pa
  - Increase after 3 h simulated use: 5 Pa
- **Moisture output** at 0.5 L tidal vol.: 33 g.m⁻³
- **Weight**
  - Unused: 29 g
  - Increase after 3 h simulated use: 2.7 g
- **Dimensions** (Diameter × L): 63 × 86 mm
- **Internal volume**: 84 mL
- **Connectors**: compliance with BS EN 1281-1
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m N/A 22 f ☺
**MINI 6120**

- **List price** £0.95
- **Type** small volume electrostatic filter with HME
- **Tidal volume range** 50 to 700 mL
- **Number of filters / box** 25

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min$^{-1}$ (mean [range])
  - Unused 1.94 [1.74 to 2.20] %
  - After 3 h simulated use 0.89 [0.66 to 1.12] %
- **Pressure drop** at 15 L.min$^{-1}$
  - Unused 111 Pa
  - Increase after 3 h simulated use 8 Pa
- **Moisture output** at 0.25 L tidal vol.
  - 31 g.m$^{-3}$
- **Weight**
  - Unused 15 g
  - Increase after 3 h simulated use 1.4 g
- **Dimensions** (H × W × L)
  - 39 × 52 × 69 mm
- **Internal volume** 24 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f N/A
RÜSCH FILTERS
MADE IN Italy and France

SUPPLIER
Vital Signs Limited
Sussex Business Village
Lake Lane
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PO22 0AL

Tel: 08456 444955
Fax: 08456 444966
E-mail: vitalcare@vital-signs.co.uk, info@rusch.uk.com
Website: www.ruesch.de, www.vital-signs.com

MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who declined to comment.

ARIOS FILTER 191648-000000

- List price £1.50
- Type adult electrostatic filter
- Tidal volume range ≥ 150 mL
- Number of filters / box 25

ARIOS HME FILTER 191651-000000

- List price £1.95
- Type adult electrostatic filter with HME
- Tidal volume range ≥ 150 mL
- Number of filters / box 25

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 2.13 [1.97 to 2.26] %
  - After 3 h simulated use 2.33 [2.09 to 2.47] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 61 Pa
  - Increase after 3 h simulated use 5 Pa
- **Moisture output** at 0.5 L tidal vol. 12 g.m⁻³
- **Weight**
  - Unused 20 g
  - Increase after 3 h simulated use 1.6 g
- **Dimensions** (Diameter × L) 63 × 62 mm
- **Internal volume** 35 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused 1.83 [1.70 to 2.04] %
  - After 3 h simulated use 1.65 [1.61 to 1.74] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused 103 Pa
  - Increase after 3 h simulated use 32 Pa
- **Moisture output** at 0.5 L tidal vol. 31 g.m⁻³
- **Weight**
  - Unused 31 g
  - Increase after 3 h simulated use 2.1 g
- **Dimensions** (Diameter × L) 63 × 72 mm
- **Internal volume** 56 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end 15 f ☺ 22 m ☺
  - Machine end 15 m ☺ 22 f ☺
### ADULT HEPA FILTER 191070-000000

- **List price**: £5.19
- **Type**: adult pleated filter
- **Tidal volume range**: ≥ 150 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 0.016 [0.013 to 0.019] %
  - After 3 h use: 0.015 [0.014 to 0.015] %
- **Pressure drop** at 30 L.min⁻¹
  - Unused: 135 Pa
  - Increase after 3 h simulated use: 7 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 49 g
  - Increase after 3 h simulated use: 2.3 g
- **Dimensions** (Diameter × L)
  - 66 × 84 mm
- **Internal volume**: 73 mL
- **Connectors**
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

### PAEDIATRIC FILTER 191072-000000

- **List price**: £3.24
- **Type**: paediatric electrostatic filter
- **Tidal volume range**: 75 to 250 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 0.59 [0.38 to 0.86] %
  - After 3 h simulated use: 0.54 [0.28 to 0.69] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 110 Pa
  - Increase after 3 h simulated use: 1 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 22 g
  - Increase after 3 h simulated use: 1.5 g
- **Dimensions** (H × W × L)
  - 55 × 65 × 77 mm
- **Internal volume**: 39 mL
- **Connectors**
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺

### PAEDIATRIC HME FILTER 191084-000000

- **List price**: £3.47
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 75 to 250 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min⁻¹ (mean [range])
  - Unused: 0.91 [0.51 to 1.48] %
  - After 3 h simulated use: 0.96 [0.62 to 1.29] %
- **Pressure drop** at 15 L.min⁻¹
  - Unused: 116 Pa
  - Increase after 3 h simulated use: 6 Pa
- **Moisture output** at 0.25 L tidal vol.
  - 32 g.m⁻³
- **Weight**
  - Unused: 25 g
  - Increase after 3 h simulated use: 1.6 g
- **Dimensions** (H × W × L)
  - 55 × 65 × 78 mm
- **Internal volume**: 37 mL
- **Connectors**
  - Patient end: 15 f ☺ 22 m ☺
  - Machine end: 15 m ☺ 22 f ☺
MANUFACTURER’S COMMENTS
A draft copy of the report was sent to the manufacturer, who responded as follows:

The change from the old filter to the new filter is due to a change in manufacturing locations. This change will be performed as a running change in the marketplace, with no interruption to the availability of the filter.

TECHNICAL EVALUATION

**THERMOVENT HEPA (OLD) 100/585/000**

- **List price**: £1.50
- **Type**: adult pleated filter
- **Tidal volume range**: 150 to 1200 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration at 30 L.min⁻¹ (mean [range])**
  - Unused: 0.016 [0.015 to 0.016] %
  - After 3 h use: 0.017 [0.016 to 0.018] %
- **Pressure drop at 30 L.min⁻¹**
  - Unused: 157 Pa
  - Increase after 3 h simulated use: 13 Pa
- **Moisture output at 0.5 L tidal vol.**: 18 g.m⁻³
- **Weight**
  - Unused: 31 g
  - Increase after 3 h simulated use: 2.2 g
- **Dimensions (H × W × L)**: 38 × 59 × 84 mm
- **Internal volume**: 51 mL
- **Connectors**
  - Compliance with BS EN 1281-1
    - Patient end: 15 f ☺ 22 m ☺
    - Machine end: 15 m ☺ 22 f ☺

**THERMOVENT HEPA (NEW VERSION)**

- **List price**: £1.50
- **Type**: adult pleated filter
- **Tidal volume range**: 150 to 1200 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration at 30 L.min⁻¹ (mean [range])**
  - Unused: 0.014 [0.011 to 0.018] %
  - After 3 h use: 0.017 [0.013 to 0.025] %
- **Pressure drop at 30 L.min⁻¹**
  - Unused: 133 Pa
  - Increase after 3 h simulated use: 17 Pa
- **Moisture output**: Not measured
- **Weight**
  - Unused: 30 g
  - Increase after 3 h simulated use: 1.7 g
- **Dimensions (H × W × L)**: 38 × 59 × 84 mm
- **Internal volume**: 52 mL
- **Connectors**
  - Compliance with BS EN 1281-1
    - Patient end: 15 f ☺ 22 m ☺
    - Machine end: 15 m ☺ 22 f ☺
MANUFACTURER'S COMMENTS
A draft copy of the report was sent to the manufacturer, who responded as follows:

A family of multifunction filters available from one source. Each device is designed to provide the best possible combination of: High Filtration Efficiency, High Moisture output, Low compressible volume, Low resistance, & Lightweight.

TECHNICAL EVALUATION

- **Penetration** at 30 L.min⁻¹ (mean [range])
  - Unused: 7.49 [5.56 to 8.75] %
  - After 3 h simulated use: 9.83 [8.75 to 10.6] %

- **Pressure drop** at 30 L.min⁻¹
  - Unused: 51 Pa
  - Increase after 3 h simulated use: 8 Pa

- **Moisture output**
  - Not measured

- **Weight**
  - Unused: 18 g
  - Increase after 3 h simulated use: 1.5 g

- **Dimensions** (H × W × L)
  - 58 × 73 × 67 mm

- **Internal volume**
  - 36 mL

- **Connectors**
  - Compliance with BS EN 1281-1
    - Patient end: 15 f ☺ 22 m ☺
    - Machine end: 15 m ☺ 22 f ☺

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**5096**

- **List price**: £1.00
- **Type**: adult electrostatic filter
- **Tidal volume range**: ≥ 90 mL
- **Number of filters / box**: 50

**5096HEPA**

- **List price**: £1.44
- **Type**: adult electrostatic filter
- **Tidal volume range**: ≥ 90 mL
- **Number of filters / box**: 50
5708

- **List price**: £1.60
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 3.60 [2.61 to 4.72] %
  - After 3 h simulated use: 3.91 [3.34 to 4.72] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 94 Pa
  - Increase after 3 h simulated use: 3 Pa
- **Moisture output** at 0.5 L tidal vol.
  - 31 g.m\(^{-3}\)
- **Weight**
  - Unused: 22 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (H x W x L)
  - 58 x 73 x 82 mm
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f☺ 22 m☺
  - Machine end: 15 m☺ 22 f☺

5708HEPA

- **List price**: £2.50
- **Type**: adult electrostatic filter with HME
- **Tidal volume range**: 150 to 1500 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 30 L.min\(^{-1}\) (mean [range])
  - Unused: 4.12 [3.17 to 5.42] %
  - After 3 h simulated use: 4.03 [3.62 to 4.31] %
- **Pressure drop** at 30 L.min\(^{-1}\)
  - Unused: 89 Pa
  - Increase after 3 h simulated use: 1 Pa
- **Moisture output**
  - Not measured
- **Weight**
  - Unused: 22 g
  - Increase after 3 h simulated use: 2.0 g
- **Dimensions** (H x W x L)
  - 58 x 73 x 82 mm
- **Internal volume**: 55 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f☺ 22 m☺
  - Machine end: 15 m☺ 22 f☺

5711

- **List price**: £4.00
- **Type**: paediatric electrostatic filter with HME
- **Tidal volume range**: 60 to 600 mL
- **Number of filters / box**: 50

**TECHNICAL EVALUATION**

- **Penetration** at 15 L.min\(^{-1}\) (mean [range])
  - Unused: 6.69 [5.97 to 8.29] %
  - After 3 h simulated use: 6.02 [5.70 to 6.39] %
- **Pressure drop** at 15 L.min\(^{-1}\)
  - Unused: 69 Pa
  - Increase after 3 h simulated use: 7 Pa
- **Moisture output**
  - Not measured
- **Weight**
  - Unused: 18 g
  - Increase after 3 h simulated use: 1.5 g
- **Dimensions** (H x W x L)
  - 30 x 43 x 90 mm
- **Internal volume**: 24 mL
- **Connectors** compliance with BS EN 1281-1
  - Patient end: 15 f☺ 22 m☺
  - Machine end: 15 m☺ 22 f N/A
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