Mechanical vs. Electrostatic Filter

**Mechanical Filter**
- Highly hydrophobic medium will not allow water to pass the membrane
- Optimal filtration performance due to highly efficient pleated glass fiber based filtration medium
- Higher resistance due to tightly woven filter medium
- Higher dead space due to the minimum required filtration area

**Electrostatic Filter**
- Good filtration performance but only in the systems without humidification caused by a humidifier or the chemical reaction in Soda Lime during Anesthesia
- Lower resistance due to loosely woven filtration medium

**Heat and Moisture Exchanger (HME)**
- Available with mechanical / electrostatic filtration medium or without bacterial filtration
- Alternative for active humidification
Overview Breathing System Filter & HME

**FILTER**
- Electrostatic
- Mechanical

CareStar®
- CareStar® 45 (MP01755)
- CareStar® 40A (MP01765)
- CareStar® 30 (MP01770)

SafeStar®
- SafeStar® 80 (MP01785)
- SafeStar® 60A (MP01795)
- SafeStar® 55 (MP01790)

**HME**
- Heat & Moisture Exchange

HumidStar®
- HumidStar® 55 (MP01730)
- HumidStar® 25 (MP01735)
- HumidStar® 10A (MP01740)
- HumidStar® 2 (MP01745)
- HumidStar® Trach Plus (MP05750)

**FILTER/HME**
- Electrostatic
- Mechanical

TwinStar®
- TwinStar® 90 (MP01800)
- TwinStar® 65A (MP01810)
- TwinStar® 55 (MP01805)
- TwinStar® 25 (MP01815)
- TwinStar® 10A (MP01825)
- TwinStar® 8 (MP01820)

TwinStar® HEPA (MP01801)

**NOTE:** The number indicates the dead space, DEHP & PVC free, “A” indicates Angled port, “HME” means Heat & Moisture Exchange filter, “Trach” means Tracheostomy

Shelf life: 3 years (TwinStar®, CareStar®), 5 years (SafeStar®, HumidStar®). Maximum Duration of use = 24hrs (Single Patient Use)
# Overview Expiratory Valves & compatible Expiratory Heated Filter

<table>
<thead>
<tr>
<th>Model</th>
<th>Expiratory Valve</th>
<th>Reusable/Disposable</th>
<th>EHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evita® Infinity V500</td>
<td>8416750</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
<tr>
<td>Evita® V300</td>
<td>8416750</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
<tr>
<td>Savina®</td>
<td>8413660</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
<tr>
<td>Savina® 300</td>
<td>8417050</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
<tr>
<td>Babylog® VN500</td>
<td>8415270</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
<tr>
<td>Babylog® 8000 Plus</td>
<td>8408950</td>
<td>Reusable</td>
<td>EHF</td>
</tr>
</tbody>
</table>

- **Reusable**
  - 8416750: Expiratory valve for Evita® Infinity V500, reusable
  - 8413660: Expiratory valve for Savina®, reusable
  - 8417050: Expiratory valve for Savina®, 300, reusable
  - 8415270: Expiratory valve for Babylog® VN 500, reusable
  - 8408950: Expiratory valve for Babylog® 8000 Plus, reusable

- **Disposable**
  - MP01060: Disposable RFID expiratory valve
  - MP01061: Expiratory valve (single use)

**Expiratory Heated Filter (EHF)**

- EHF = Expiratory Heated Filter
- Infinity ID Expiratory Filter (MP01780)
- Expiratory Filter (MP01781)

**Note:** The Expiratory Heated Filter have a Maximum Duration of Use of 7 days.

For more details see IFU or PI

Not all articles are available worldwide.
## Filtration Efficiency

<table>
<thead>
<tr>
<th>Filter Model</th>
<th>Bacterial retention*</th>
<th>Viral retention**</th>
<th>NaCl retention***</th>
</tr>
</thead>
<tbody>
<tr>
<td>CareStar® 45 (MP01755)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>≥ 98.5%</td>
</tr>
<tr>
<td>CareStar® 40A (MP01765)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>≥ 98.1%</td>
</tr>
<tr>
<td>CareStar® 30 (MP01770)</td>
<td>≥ 99.99%</td>
<td>≥ 99.99%</td>
<td>≥ 95.3%</td>
</tr>
<tr>
<td>SafeStar® 80 (MP01785)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>≥ 99.99%</td>
</tr>
<tr>
<td>SafeStar® 55 (MP01790)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>≥ 99.97%</td>
</tr>
<tr>
<td>SafeStar® 60A (MP01795)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>≥ 99.98%</td>
</tr>
<tr>
<td>TwinStar® 90 (MP01800)</td>
<td>≥ 99.999%</td>
<td>≥ 99.999%</td>
<td>≥ 97.8%</td>
</tr>
<tr>
<td>TwinStar® HEPA**** (MP01801)</td>
<td>≥ 99.999%</td>
<td>≥ 99.9999%</td>
<td>≥ 99.8%</td>
</tr>
<tr>
<td>TwinStar® 55 (MP01805)</td>
<td>≥ 99.999%</td>
<td>≥ 99.99%</td>
<td>≥ 96.1%</td>
</tr>
<tr>
<td>TwinStar® 65A (MP01810)</td>
<td>≥ 99.999%</td>
<td>≥ 99.99%</td>
<td>≥ 97.3%</td>
</tr>
<tr>
<td>TwinStar® 25 (MP01815)</td>
<td>≥ 99.999%</td>
<td>≥ 99.99%</td>
<td>≥ 98.0%</td>
</tr>
<tr>
<td>TwinStar® 8 (MP01820)</td>
<td>≥ 99.9%</td>
<td>≥ 99.9%</td>
<td>≥ 79.1%</td>
</tr>
<tr>
<td>TwinStar® 10A (MP01825)</td>
<td>≥ 99.9%</td>
<td>≥ 99.9%</td>
<td>≥ 79.1%</td>
</tr>
<tr>
<td>Infinity ID Expiratory Filter**** (MP01780)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>-</td>
</tr>
<tr>
<td>Expiratory Filter**** (MP01781)</td>
<td>≥ 99.9999%</td>
<td>≥ 99.9999%</td>
<td>-</td>
</tr>
</tbody>
</table>

* BFE

** VFE

*** NaCl

**** HEPA

* According to Nelson Laboratories, Inc. Salt Lake City, USA. The mean particle size (MPS) of the challenge aerosol must be maintained at 3.0 ± 0.3 µm. The average percent bacterial filtration efficiency (%BFE) for the reference material must be within the upper and lower control limits established for the BFE test.

** According to Nelson Laboratories, Inc. Salt Lake City, USA. The mean particle size (MPS) of the challenge aerosol must be maintained at 3.0 ± 0.3 µm. The average percent virus filtration efficiency (%VFE) for the reference material must be within the upper and lower control limits established for the VFE test.

*** According to Nelson Laboratories, Inc. Salt Lake City, USA. The filter tester produces a particle size distribution with a count median diameter of 0.075 ± 0.02 µm and a standard geometric deviation not exceeding 1.86 µm as determined with a scanning mobility particle sizer (SMPS).

**** HEPA

HEPA filter class H13 according to DIN EN 1822-1:1998 / DIN EN 1822-1:2011. Our SafeStar® filter are designed with the same filtration medium as our TwinStar® HEPA.
FAQ regarding SARS COV-2

What specification is the minimum required in a breathing circuit filter (HMEF or Filter only) to prevent passage of the SARS COV-2 virus?

It always depends on the application. Generally, mechanical filters (like SafeStar® or TwinStar® HEPA) are always safer because they are less sensitive against humidity and they do have a really good filtration efficiency in their Most Penetrating Particle Size (MPPS). MPPS means: The filtration efficiency acts like parable at its minimum most particles pass through.

- MPPS of electrostatic filtration medium ~ 0.04-0.08 µm (the filtration efficiency could be ≤ 99%)
- MPPS of mechanical filtration medium ~ 0.2 µm (the filtration efficiency should still be ≥ 99%)

On the other hand, the tightly woven glass fiber based filtration medium requires a minimum filtration area for optimal filtration efficiency. This leads to relatively higher resistance as well as higher dead space which is not recommended for pediatric or neonatal patients at the Y-piece.

Are the differences (≥99.9% or ≥99.99% or ≥99.999%) important when trying to protect patients from the SARS COV-2 virus?

Since no filter can promise 100% efficiency, there remains always a small risk of cross contamination. For even better protection, there is sometimes the opportunity to place a second mechanical filter at the expiratory valve.

Exceptions:
- Mechanical filters are only allowed at the expiratory valve (never place it at the Y-piece), if the patient is a neonate or child. This is due to the dead space of the product. Smaller mechanical filters are so far not possible to produce because the area of the filtration medium is decisive for the filtration efficiency.
- No filter is allowed at the Y-piece during active humidification in the ICU because the resistance would increase and the patient would not receive enough humidity.
- More information regarding the set-up and warnings could be found in the corresponding Instruction for Use.
Overview Application Areas

OVERVIEW

ANESTHESIA
- FRESHGAS FLOW
- MINIMAL / LOW FLOW

RESPIRATORY
- INTENSIVE CARE UNIT (ICU)
  - ACTIVE HUMIDIFICATION
  - PASSIVE HUMIDIFICATION
- EMERGENCY / TRANSPORT
  - < 3 HOURS
  - > 3 HOURS
Application in Anesthesia

ANESTHESIA

FRESHGAS FLOW

- Adult
  - Y-Piece: TwinStar HEPA
  - Expiratory Valve: Optional: SafeStar 55 / 80

- Pediatric
  - Y-Piece: TwinStar 25 / 10A / 8
  - Expiratory Valve: SafeStar 55

- Neonatal
  - Y-Piece: HumidStar 2
  - Expiratory Valve: SafeStar 55

MINIMAL / LOW FLOW

- Adult
  - Y-Piece: SafeStar 55
  - Expiratory Valve: Optional: TwinStar 25 / 10A / 8

- Pediatric
  - Y-Piece: Optional: TwinStar 25 / 10A / 8
  - Expiratory Valve: SafeStar 55

- Neonatal
  - Y-Piece: Optional: HumidStar 2
  - Expiratory Valve: SafeStar 55
Application in the Intensive Care Unit

**ACTIVE HUMIDIFICATION**
- **Adult**
  - Y-Piece: None
  - Expiratory Valve: SafeStar 55 / 80 or Expiratory Heated Filter

- **Pediatric**
  - Y-Piece: None
  - Expiratory Valve: SafeStar 55 or Expiratory Heated Filter

- **Neonatal**
  - Y-Piece: None
  - Expiratory Valve: SafeStar 55 or Expiratory Heated Filter with adapter

**PASSIVE HUMIDIFICATION**
- **Adult**
  - Y-Piece: TwinStar 55 / HEPA
  - Expiratory Valve: SafeStar 55 / 80 or Expiratory Heated Filter

- **Pediatric**
  - Y-Piece: TwinStar 25 / 10A / 8
  - Expiratory Valve: SafeStar 55 or Expiratory Heated Filter
Application in Emergency Care

EMERGENCY/TRANSPORT

< 3 HOURS

Adult
  CareStar 30 / 40A / 45

Pediatric
  CareStar 30

> 3 HOURS

Adult
  TwinStar 55 / HEPA

Pediatric
  TwinStar 25 / 10A / 8

Y-Piece
Many thanks

Meike Lessau | Product Manager
Drägerwerk AG & Co. KGaA
Moislinger Allee 53-55
23558 Lübeck, Germany

Tel. +49 451 882 1544
Mail meike.lessau@draeger.com
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