Filter/HMEs: Supporting daily clinical routine

SAFESTAR®
CARESTAR®
HUMIDSTAR®
TWINSTAR®
COMBISTAR
Clinical Challenges

The utilization of heat and moisture exchangers (HMEs) and breathing system filters in the OR, the ICU as well as other settings is an approach to address concerns commonly associated with mechanical ventilation: proper humidification of inspired air and cross-infection.

Humidification
Humidification of the inspired gas in mechanical ventilation has been shown to contribute to the prevention of ventilator-associated pneumonia (VAP). Passive humidification as performed by heat and moisture exchangers additionally decreases condensation and moisture accumulation in the breathing system. Assessing the efficacy of HMEs in reducing bacterial growth and prevention of VAP, various randomized controlled studies observed slightly lower VAP rates, suggesting that the use of HMEs might decrease VAP rates. VAP is the most important nosocomial infection in intensive care units, accounting for 9 cases/1,000 ventilation days or about 30,000 cases annually in Germany alone. VAP leads to an attributable mortality rate of up to 71 %, increased average duration of mechanical ventilation, increased length of hospital stay, and higher treatment costs. The use of HMEs may decrease not only the incidence of VAP in patients eligible for these devices, but also the associated workload and cost. Late-onset VAP, occurring after five or more days of mechanical ventilation, is often due to multiresistant organisms such as Methicillin-Resistant Staphylococcus Aureus (MRSA) or Aerobic Gram-negative bacteria such as Pseudomonas aeruginosa, the latter originating 50 % from endogenous sources and 50 % from cross-contamination.

Cross Infection
As a preventive measure for infection prophylaxis and avoiding the risk of cross-infection in anesthesia, various expert committees recommend the use of a breathing system filter, to be attached to the Y-piece and replaced after every patient.

VAP leads to an attributable mortality rate of up to 71 %, increased average duration of mechanical ventilation, increased length of hospital stay, and higher treatment costs. The use of HMEs may decrease not only the incidence of VAP in patients eligible for these devices, but also the associated workload and cost. Late-onset VAP, occurring after five or more days of mechanical ventilation, is often due to multiresistant organisms such as Methicillin-Resistant Staphylococcus Aureus (MRSA) or Aerobic Gram-negative bacteria such as Pseudomonas aeruginosa, the latter originating 50 % from endogenous sources and 50 % from cross-contamination.
In several countries national medical associations have already put forth guidelines recommending the utilization of breathing system filters.

In its November 2002 publication “Infection Control in Anaesthesia” 15, the Association of Anaesthetists of Great Britain and Ireland recommends using a new breathing system filter for each patient. There is evidence that breathing circuits are often contaminated with transmissible microorganisms and blood. 19, 20 Furthermore, the possibility of cross-infection of Hepatitis C 20 and the occurrence of multiple-resistant tuberculosis pathogens have also been cited.

The Hygiene recommendations in anesthesia 16 by the French Working Group for Hygiene in Anesthesia advise using a breathing system filter on the Y-piece and replacing it after every patient to prevent the risk of possible cross-infection.

An update of these recommendations 17 in June 2002, authored by the Comité Technique National des Infections Nosocomiales, stresses the need to protect the anesthesia circuit with a filter. This requirement was derived from publications on cross-infections that actually occurred or were considered possible during anesthesia. 21, 22, 23, 24, 25, 26

Furthermore, the French Society of Anesthesia and Intensive Care recommends the use of a hydrophobic, mechanical filter for anesthesia which withstands at least a minimum water pressure of 49 mbar. 27

The Centers for Disease Control and Prevention in the United States recommend the use of a breathing system filter during anesthesia in patients with confirmed or suspected tuberculosis. 28, 29

The Ministry of Health and Long-Term Care of the Canadian province of Ontario has constituted the use of a hydrophobic, mechanical filter in all confirmed and suspected cases of SARS between the patient and the ventilator. 30

According to the Recommendations for Prevention of Nosocomial Pneumonias 30 published in Germany in 2000, by the Commission of Hospital Hygiene and Infection Prevention at the Robert Koch Institute, an anesthesia breathing circuit with breathing system filters shall be replaced once daily. If breathing system filters are not used, the anesthesia hoses must be replaced or disinfected for each new patient. Breathing system filters should be inserted between the tracheal tube and the Y-piece.
Dräger Filters/HMEs - for all Clinical Applications and Needs

SafeStar® Family

CareStar® Family

HumidStar® Family

TwinStar® Family

CombiStar Family
The Dräger Solution

The HMEs and breathing system filters of Dräger's extensive portfolio offer the following features:

- for different tidal volumes and/or different deadspace needs all products are available in different sizes
- equipped with a Luer-Lock connector for gas sampling
- sampling port in convenient 45° angle
- with a tethered luer cap in order to prevent any loose parts from falling into the breathing system*
- transparent housing of the products allows for visual inspection at any time while in use
- fast and easily identified due to their color coding and clear labeling
- standardized connectors provide proper and easy connection with other components of the ventilation circuit
Five families – one goal: Supporting daily clinical routine

In order to support the clinician to properly address his specific clinical challenges, Dräger offers an extensive portfolio of high-performing HMEs and breathing system filters.

**SafeStar Family**
The new SafeStar® mechanical HEPA breathing system filters from Dräger meet high standards for infection prophylaxis in ventilation. The active medium of these mechanical filters is a hydrophobic filter membrane of coated glass fibers developed specifically for this purpose. Due to the hydrophobicity SafeStar cannot be passed by potentially contaminated fluids (e.g. blood, sputum, condensate) under normal pressure conditions of mechanical ventilation. Therefore, SafeStar can inhibit the passage of fluidborne microorganisms. Furthermore, SafeStar’s mechanical medium with very high bacterial and viral filtration efficiency rates reduces the passage of airborne microorganisms to a considerable extent. This significantly helps to reduce the risk of possible cross-infection.

Due to its high-performing electrostatic filtration medium, CareStar supports protection of the patient from potentially present microorganisms in the inspired air as well as safe-guarding the ventilator and the ventilator breathing system from airborne microorganisms that the patient exhales. This also helps to reduce the risk of possible cross-infection.

**HumidStar Family**
The HME medium of HumidStar® heat and moisture exchangers from Dräger consists of a new microporous polymer foam that was specially developed for this application and returns a high degree of heat and moisture. In addition to the HumidStars for mechanical ventilation Dräger offers the HumidStar Trach for tracheostomized patients which features an oxygen port and a safety valve.

**TwinStar Family**
The TwinStar® breathing system filters/HMEs from Dräger combine all the advantages of the CareStar and the HumidStar or the SafeStar and the HumidStar. They efficiently humidify and heat the inspired air of the ventilator dependent patient. Additionally, with their high bacterial and viral.
filtration efficiency rates they exceptionally sustain infection-prevention since TwinStar supports protection of the patient from potentially present microorganisms in the inspired air as well as safe-guarding the ventilator breathing system from airborne micro-organisms that the patient exhales. A highlight is the TwinStar HEPA which contains a hydrophobic filter membrane of coated glass fiber. This membrane cannot be passed by potentially contaminated fluids (e.g. blood, sputum, condensate) under normal pressure conditions of mechanical ventilation.

**CombiStar Family**
CombiStar is an optimal combination of filter and catheter mounts. Thanks to their pre-assembled components, patients can be quickly cared for. Additional packaging waste is also reduced.

* for further information please refer to: Department of Health, 2004, Protecting the breathing circuit in anaesthesia, Report to the Chief Medical Officer of an Expert Group on blocked anaesthetic tubing, Department of Health Publications: London, UK

Dräger consumables are tested and manufactured to meet the highest standards in medical technology and their functionality is convincing.
### FILTERS AND HMES

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1. According to Nelson Laboratories, Inc., Salt Lake City, USA
2. According to EN 1822-1:2009
## FILTERS AND HMES

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¹ According to Nelson Laboratories, Inc., Salt Lake City, USA
² According to EN 1822-1:2009
³ According to EN ISO 9360-1 (2009)
# FILTER AND HMEs

## Product Overview Filters / HMEs

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<td>MP04230 (MP01805 + MP01855)</td>
<td>MP04240 (MP01805 + MP01850)</td>
<td>MP04232 (MP01801 + MP01855)</td>
<td>MP04242 (MP01801 + MP01850)</td>
<td>MP04234 (MP01770 + MP01855)</td>
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<td>MP04236 (MP01790 + MP01855)</td>
<td>MP04246 (MP01790 + MP01850)</td>
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<tr>
<td>Recommended tidal volume (ml)</td>
<td>300 – 1,500</td>
<td>300 – 1,500</td>
<td>300 – 1,500</td>
<td>300 – 1,500</td>
<td>300 – 1,500</td>
<td>300 – 1,500</td>
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<tr>
<td>Moisture output (mg H₂O/l air)</td>
<td>36.8</td>
<td>36.8</td>
<td>34.2</td>
<td>34.2</td>
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<tr>
<td>Resistance (mbar)</td>
<td>1.3 at 30 l/min</td>
<td>2.6 at 60 l/min</td>
<td>2.0 at 30 l/min</td>
<td>1.0 at 30 l/min</td>
<td>1.3 at 30 l/min</td>
<td>1.7 at 30 l/min</td>
<td>2.0 at 30 l/min</td>
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<td>Length (mm)</td>
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<td>176 – 236</td>
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<td>183 – 243</td>
<td>215</td>
<td>165 – 225</td>
<td>233</td>
<td>183 – 243</td>
</tr>
<tr>
<td>Filter diameter (mm)</td>
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<td>68.5</td>
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<tr>
<td>Weight (g)</td>
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<td>59</td>
<td>61</td>
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<tr>
<td>Sampling port</td>
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<td>Luer Lock</td>
<td>Luer Lock</td>
<td>Luer Lock</td>
<td>Luer Lock</td>
<td>Luer Lock</td>
<td>Luer Lock</td>
<td>Luer Lock</td>
</tr>
<tr>
<td>Cap of sampling port</td>
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<td>tethered</td>
<td>tethered</td>
<td>tethered</td>
<td>tethered</td>
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<td>tethered</td>
</tr>
<tr>
<td>Connector patient side</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
</tr>
<tr>
<td>Connector machine side</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
<td>22M/15F</td>
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<tr>
<td>Shelf life</td>
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<td>2 years</td>
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<tr>
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<td>Blue</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
</tbody>
</table>

¹ According to Nelson Laboratories, Inc., Salt Lake City, USA
² According to EN 1822-1:2009
³ According to EN ISO 9360-1 (2009)
**Bibliography**

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3. Dreyfuss D et al., 1995, Mechanical ventilation with heated humidifiers or heat and moisture exchangers: effects on patient colonization and incidence of nosocomial pneumonia, Am J Respir Crit Care Med, 151:986
4. Branson RD et al., 1996, Comparison of three humidification techniques during mechanical ventilation: patient selection, cost and infection considerations, Respir Care, 41:809
7. Memish ZA et al., 2001, A randomized clinical trial to compare the effects of a heat and moisture exchanger with a heated humidifying system on the occurrence rate of ventilator-associated pneumonia, Am J Infect Control, 29:301
8. Gastmeier P et al., 2003, Five years working with the German nosocomial infection surveillance system (Krankenhaus Infektions Surveillance System), Am J Infect Control, 31:316
29. Jensen PA et al., 2005, Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings, MMWR 54(RR17):1-141

**FILTER AND HMES**

**Product name** CombiStar
**Part no.** MP01671
**Material** PE, SEBS
**Length (mm)** 275
**Filter diameter (mm)** 68.5
**Product** PVC free
**Weight (g)** 53
**Sampling port** Luer Lock
**Cap of sampling port** tethered
**Connector patient side** 22M/15F
**Connector machine side** 22M/15F
**Shelf life** 2 years
**Colour code** Blue
**Units/package (pcs.)** 25
**Deadspase (ml)** 89
**Recommended patient tidal volume (ml)** 300 – 1,500
**Bacterial retention (%)** 99.999
**Viral retention (%)** 99.99
**Filtration method** electrostatic
**Moisture loss (mg H₂O/l air)** 7.2 (@ Vt 500 ml)
**Moisture output (mg H₂O/l air)** 36.8
**Resistance (mbar)** 1.7 at 30 l/min, 5.1 at 60 l/min
**Maximum duration of use** 24 hours

**Connector side**
- **Part no.** MP01671
- **Material** PE, SEBS
- **Length (mm)** 275
- **Filter diameter (mm)** 68.5
- **Product** PVC free
- **Weight (g)** 53
- **Sampling port** Luer Lock
- **Cap of sampling port** tethered
- **Connector patient side** 22M/15F
- **Connector machine side** 22M/15F
- **Shelf life** 2 years
- **Colour code** Blue
- **Units/package (pcs.)** 25

**Recommended tidal volume**
- Adult: 300 – 1,500 ml

**Recommended patient**
- 22M/15F
- Tethered

**Viral retention**
- 99.99%

**Filtration method**
- Electrostatic

**Moisture output**
- 36.8 mg H₂O/l air

**Resistance**
- 1.7 mbar at 30 l/min, 5.1 mbar at 60 l/min

**Maximum duration of use**
- 24 hours

**Material**
- PE, SEBS

**Part no.** MP01671 (MP01805 + MP01845)

**Bibliography**

- Martin C et al., 1990, Heat and moisture exchangers and vaporizing humidifiers in the intensive care unit, Chest, 97:144
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