Streamlining Pulmonary Rehabilitation in Total Laryngectomy Care

With
InHealth Technologies®

Blom-Singer® Heat and Moisture Exchange Systems (HMEs), Attachments, and Accessories

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Introduction

Total laryngectomy is a life-changing surgery; it permanently alters breathing, communication, swallowing, and can also impact overall quality of life.[4,26,34] Despite over a century and a half of total laryngectomy surgery being performed, survivors, medical professionals, and industry leaders continue to explore optimal care strategies for laryngectomees. As technology and practice patterns continue to evolve, so do the tools and devices used daily by this patient community.

This white paper discusses several key topics. It examines the anatomical and physiological changes following total laryngectomy, reviews the latest data in Heat and Moisture Exchange systems (HMEs), and demonstrates how InHealth Technologies® is innovating to meet and surpass the health and lifestyle needs of patients.

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Total Laryngectomy – Pulmonary Changes and Physiological Impact

Anatomy

The larynx is a structure with many different components and respiratory, phonatory, and protective functions. It is made up of cartilage and mucous membranes that are controlled by muscles and ligaments to move and stabilize the structure. The larynx serves as a vital gateway to the lungs. At rest, the larynx directs air into the lungs during inspiration. When swallowing, the larynx diverts food, liquid, and saliva away from the airway and towards the esophagus. The larynx also houses the vocal folds which close to protect our airway when swallowing and vibrate to create voice.

Total laryngectomy surgery entails complete removal of the larynx and its structures. After removal, the trachea is permanently sutured to the neck, forming a *tracheostoma* or *stoma*, through which the patient now exclusively breathes. Since the upper and lower airways are irreversibly separated during surgery, patients can no longer breathe through the mouth and nose. After a total laryngectomy, patients are considered total neck breathers. This means all emergency rescue breaths and supplemental oxygen must be provided directly to the stoma. The permanent separation of the upper and lower airways leads to significant changes in the physiological aspects of breathing. Specifically, *airflow resistance, filtration, temperature, and humidity*—each crucial for optimal pulmonary function—are affected. The removal of natural respiratory conditioning mechanisms can result in various chronic pulmonary issues including persistent coughing, excess mucus production, and the need for repeated expectoration to clear the airway.[32] Each of these physiologic parameters will be reviewed, as one of the most important prognostic factors in the survival of laryngectomized patients is lung function.[5]

Pre-Total Laryngectomy

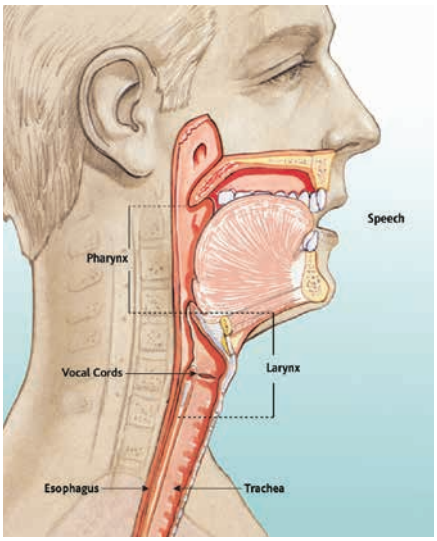


Figure 1. Pre-surgical anatomy

Post-Total Laryngectomy

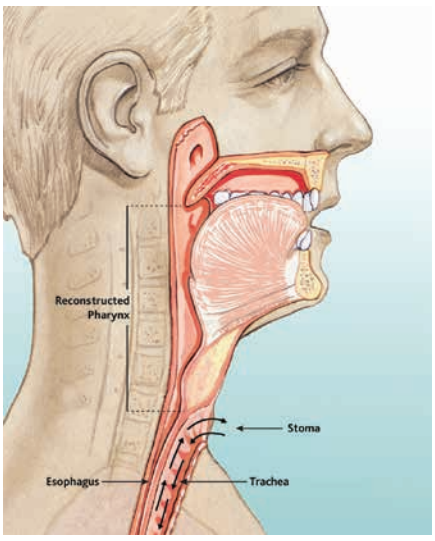


Figure 2. Post-surgical anatomy

Airflow Resistance

Airflow resistance is an essential parameter of lung function and results from the frictional forces of the airway, which oppose airflow.[12] Airway resistance in the trachea is responsible for turbulent airflow. In contrast, resistance in the bronchi and bronchioles allows for more laminar airflow, in which air smoothly flows to the distal segments of the lungs.[12] Prior to surgery, this resistance helps modify the upper airway in response to different respiratory demands. For instance, it widens the respiratory tract during physical activity to allow for more air intake.[31] Following surgery, the resistance that is crucial for maintaining adequate arterial oxygenation and appropriate pressure gradients in the lungs is lost.[22] It has been suggested that the lack of airflow resistance post-surgery results in reduced ventilation in the distal sections of the lung.[5] This may lead to an overall deterioration of lung function. Furthermore, multiple studies have suggested that this drop in resistance shifts the pressure equalization point to the less elastic peripheral lung segments, increasing the risk of alveolar collapse and decreased lung volume.[22]

Filtration

Prior to total laryngectomy, the nose and upper airway structures act as filters, trapping particles like allergens, pollen, and dust, as well as airborne pathogens.[33] After total laryngectomy, this filtration system is compromised since the upper and lower airways are permanently separated, and the patient no longer has filtration from the upper airway. The direct exposure of the lower airway to unfiltered air increases the risk of inflammation and infections in the lungs and airway.[10,11,40] The stoma also becomes a site for potential infections due to frequent hand contact during communication or routine stoma care.[8,18]

Temperature

Prior to surgery, the nose plays the primary role in warming inhaled air to approximately 88-93 °F (31-34 °C) by exposing it to the rich blood supply in the nasal passages.[5,34] After surgery, with the upper airway disconnected from the lower airway, the body is not able to sufficiently warm the air before it reaches the trachea and lungs. Therefore, the air contacting the trachea and lungs remains at approximately the ambient environmental temperature. The cooler ambient air prompts the body to produce more mucus as a protective measure for the tissues lining the airway and lungs.[10,11] This protective response also results in frequent daily coughing, negatively impacting a patient's quality of life.[3] Additionally, cooler air can heighten the risk of respiratory infections due to a reduction in tracheal mucosal temperature, which slows down cellular metabolism, impairs the immune system's protein and enzyme production, and decreases the motility of cilia essential for clearing mucus and debris from the lungs.[11,38]

Humidity

Similarly, surgery affects the humidity levels of inhaled air. Prior to surgery, air reaches nearly 99% relative humidity as it passes through upper airway structures.[13,38] Following surgery, the air entering through the stoma and reaching the lower airway has only about 45% relative humidity, resulting in a significant decrease in daily water retention (>500 mL loss/day) when breathing through the stoma compared to pre-surgical nasal breathing.[22,40,30] The reduced humidification leads to drier conditions for the mucociliary tissues, causing a decrease in ciliary function and decreased ability to effectively clear secretions.[33] This lack of humidity ultimately results in drier secretions, increased risk for mucus plugs, and increased cough frequency in an attempt to mobilize secretions.[6,7]

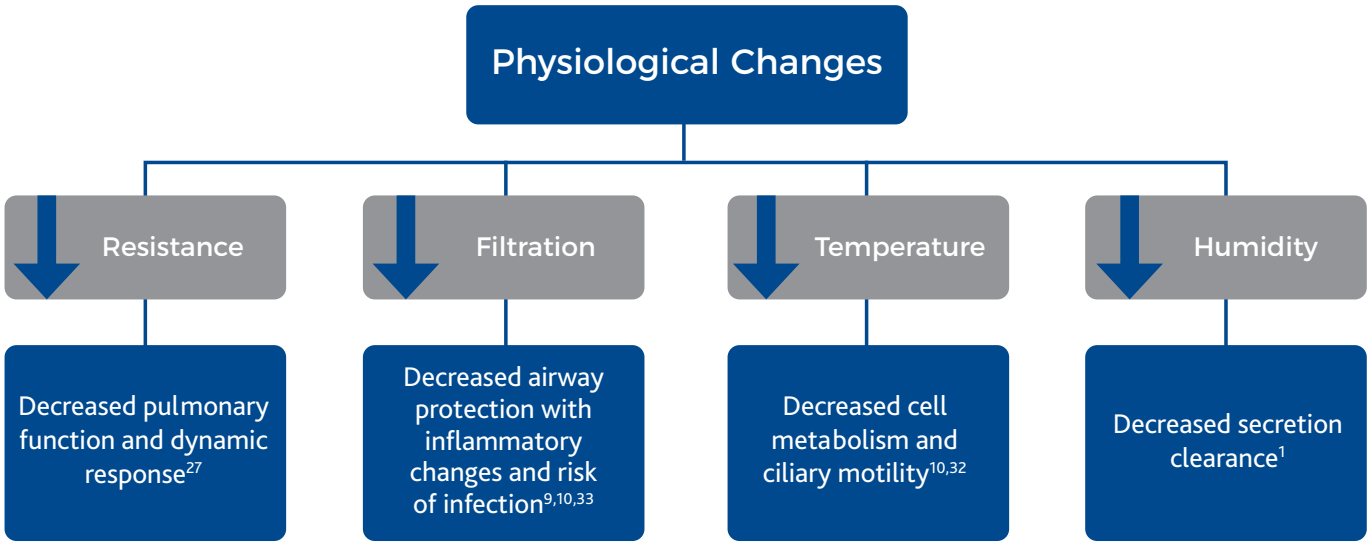


Figure 3. Pulmonary physiological changes that occur post-total laryngectomy

Key Takeaways

- Total laryngectomy results in permanent disconnection between upper and lower airway tracts
- Disconnecting the upper and lower airway tracts alters the body's ability to condition air *(resistance, filtration, temperature, and humidity)*
- Unconditioned air can result in diminished pulmonary function and elevated risk of infection

Heat and Moisture Exchange System (HME)

With these permanent changes to tracheal climate, filtration, resistance, and ability to protect the airway from foreign objects/pollutants, the body cannot compensate for this loss of function on its own. To compensate for these physiological changes, a Heat and Moisture Exchange System (HME) is introduced. HMEs increase humidity, facilitate an increase in air temperature, improve airway protection, and reestablish a degree of breathing resistance.[23]

The HME cartridge is a single-use, passive humidifying device composed of a protective plastic housing shell and an open-cell polyurethane foam treated with a hygroscopic compound that enhances water retention.[6,23] HMEs are designed to be worn 24/7 to optimize pulmonary outcomes and are affixed over the stoma via attachments, such as laryngectomy tubes or baseplates. Prior to reviewing attachments, we will first explore the benefits of HMEs.

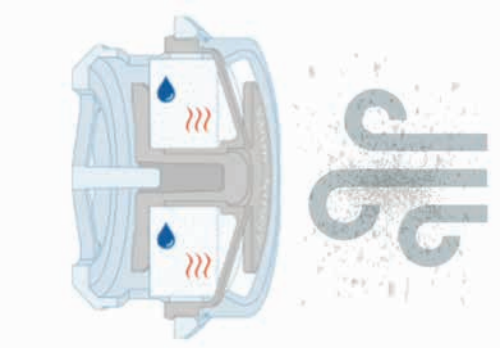


Figure 4. HME internal structure aids in filtering air, warming air, and protecting against environmental pollutants/particles

Airflow Resistance

As previously reviewed, airflow resistance is crucial for optimal pulmonary performance.[24] A degree of restored airflow resistance allows lung pressure to build during exhalation. This pressure keeps the lungs expanded, avoiding collapse of alveoli, which are tiny air sacs in the lungs where gas exchange occurs.[37] Studies indicate that initially, patients using HMEs may experience a sensation of increased resistance when breathing. This is often a barrier to patients initiating HME use immediately after a total laryngectomy surgery.[23] However, after an additional four weeks of continuous HME use, patients reported near baseline breathing comfort. After twelve weeks, over 96% of patients reported breathing felt as easy, if not easier, as breathing directly through an open stoma.[23]

Filtration and Stoma Protection

HMEs play a vital role in compensating for the lost natural filtration capacity of the nose and upper airway. While HMEs cannot completely block microorganisms due to their pore size—which is optimized for breathability—they do filter a degree of larger particles from incoming air.[22] This filtration is vital as it reduces the risk of harmful particles entering the lower respiratory tract and thereby reducing the likelihood of infections. Additionally, HMEs can serve as physical barriers to foreign objects.[22]

Tracheal Climate (Temperature and Humidity)

The presence of HMEs can boost the relative humidity of the air inhaled through the stoma by 20%.[17] This increase significantly impacts the moisture content reaching the tracheal lining, which enhances mucociliary clearance and leads to more productive and less frequent coughing.[17,20,23] The alleviation of respiratory symptoms also results in improved sleep quality.[3] Assuming environmental air is 72°F, when HMEs are used, the temperature of inhaled air increases by about 2°F (1°C), bringing it to approximately 74°F (23°C).[13,17] This warmer air results from the HME's foam and hygroscopic component, calcium chloride (CaCl2), effectively capturing and retaining moisture from exhaled air. This closed-loop system not only warms, but also re-moistens the air on the next inhalation, which has beneficial effects on tracheal mucosa.[13]

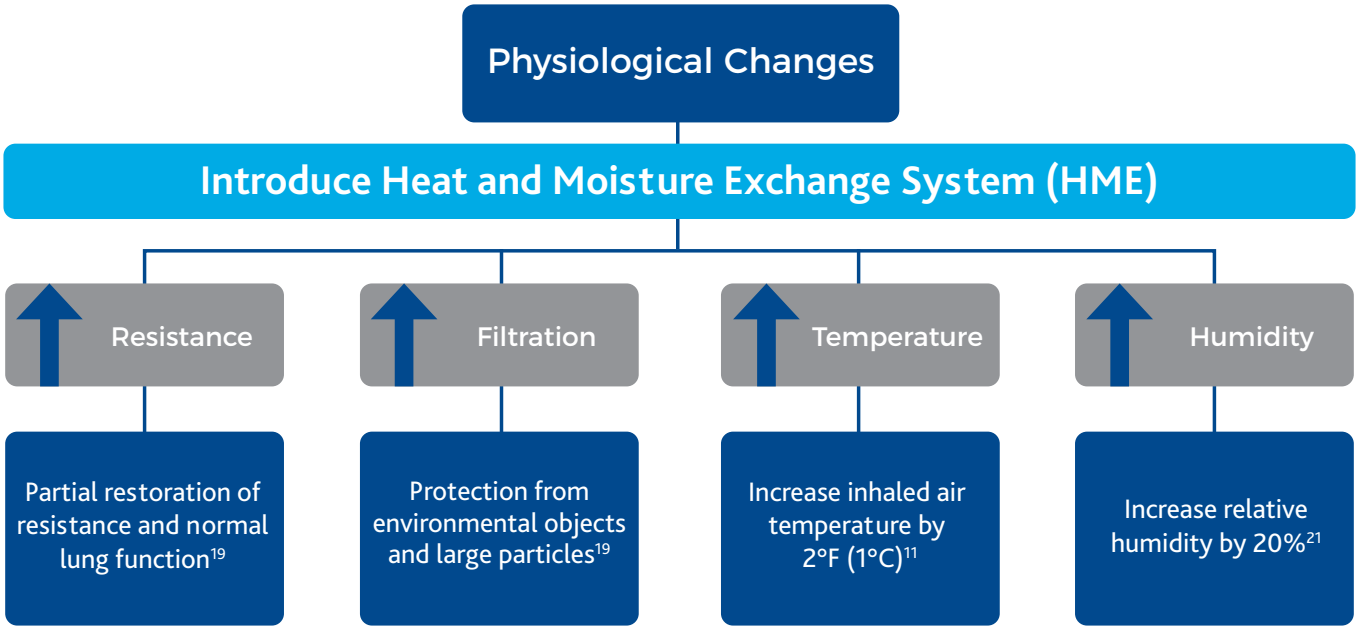


Figure 5. Impact of HMEs on pulmonary physiology

Early HME Adoption and Adherence

Ideally, HME use should begin immediately post-operatively while the patient is admitted to the hospital. With so many physiological benefits to tracheal climate, breathing resistance, and airway protection, the earlier HMEs are introduced and utilized daily, the better. Early introduction is crucial for habituation to breathing through a stoma and using HMEs.[6] It may also help prevent a common post-operative complication: mucus plugs, which affect nearly 50% of patients.[6] This serious but preventable complication occurs when the newly established airway is exposed to cool, dry air, triggering the body's defense mechanism of excessive mucus production.[25] Over time, secretions can accumulate, becoming dry, hardened, and increasingly difficult to clear from the airway.

A 2020 study evaluated patient outcomes before and after implementation of a patient safety initiative utilizing HMEs post-total laryngectomy.[6] The study compared outcomes between patients who utilized external tracheal humidification (ETH) and those who utilized HMEs. The study found that the rate of mucus plugging was significantly lower in the HME group than the ETH group. Furthermore, nursing adherence to daily HME cassette replacement was recorded at 91.5%. Use of an HME system partially restores the optimal tracheal environment to better preserve ciliary function. The HME has a protective effect on tracheal epithelium and ciliary cells, therefore reducing coughing and forced expectoration compared to breathing through an open stoma or with ETH. With HME use, the body can more easily mobilize and clear secretions out of the tracheobronchial tract, ultimately reducing the incidence of mucus plugging.[6]

Since HMEs are such a crucial part of post-operative care, they are featured in every configuration of the Blom-Singer® Post-Operative Care Kits, along with laryngectomy tubes, tube holders, a shower guard, adhesive housings, mirror, and LED flashlight. There is also an option that includes an electrolarynx and intra-oral adapter (*see Appendix for available configurations*). While a patient is admitted to the hospital, this kit is utilized for ongoing post-operative care, patient/caregiver teaching, and provides nursing staff with quick access to products, allowing for high adherence to daily HME cassette replacement.[6] In addition to reducing the risk of mucus plugs, HMEs have also been found to lead to quicker in-hospital mobilization.[7] These kits facilitate early HME adoption and provide supplies needed to ease the transition from hospital to home.

Two primary barriers to continued HME use (per patient report) are breathing resistance and difficulty with baseplate adhesion[4,29]. Innovations in HME and baseplate designs that address these challenges are outlined in the InHealth Technologies® HME Product Line section. Early and consistent use of HMEs following surgery not only aids in physiological recovery, but also significantly improves the patient's quality of life.[26] HME use can alleviate common post-surgical symptoms such as involuntary coughing, excessive mucus production, and the need for frequent airway clearance.[22,41] Over time, these benefits can help patients approach their pre-operative levels of respiratory function and comfort.[7]

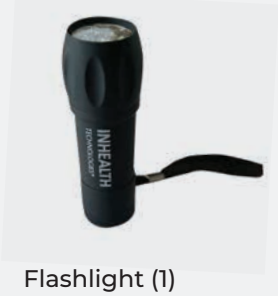
All kits include:

Marpac Tracheostomy Tube Holder/ Collar™ (7)

Blom-Singer® StomaSoft® Laryngectomy Tube (2)

Blom-Singer® HydroFit® Oval Adhesive Housing (6)

Blom-Singer® Day&Night® HME (30)



Flashlight (1)

Mirror (1)

Blom-Singer® Shower Guard (1)

Available in certain configurations

See Appendix for details

Electrolarynx and intra-oral adapter (1)

Figure 6. Example Blom-Singer® Post-Operative Care Kit

InHealth Technologies® Pulmonary Rehabilitation Solutions

The InHealth Technologies® Total Solutions approach is designed to simplify laryngectomy care. From the Blom-Singer® Day&Night® HME designed for 24-hour use, to the first ever pre-assembled, disposable, adjustable hands-free HME—the Blom-Singer® SpeakFree® HME with Hands-Free Valve—and attachments designed for every stoma need (Blom-Singer® AccuFit®, Blom-Singer® HydroFit®, Blom-Singer® TruFit®, Blom-Singer® StomaSoft® Laryngectomy Tube, and Blom-Singer® Laryngectomy Button), InHealth Technologies® has streamlined the design and function of its products to fit the everyday needs of total laryngectomy patients.

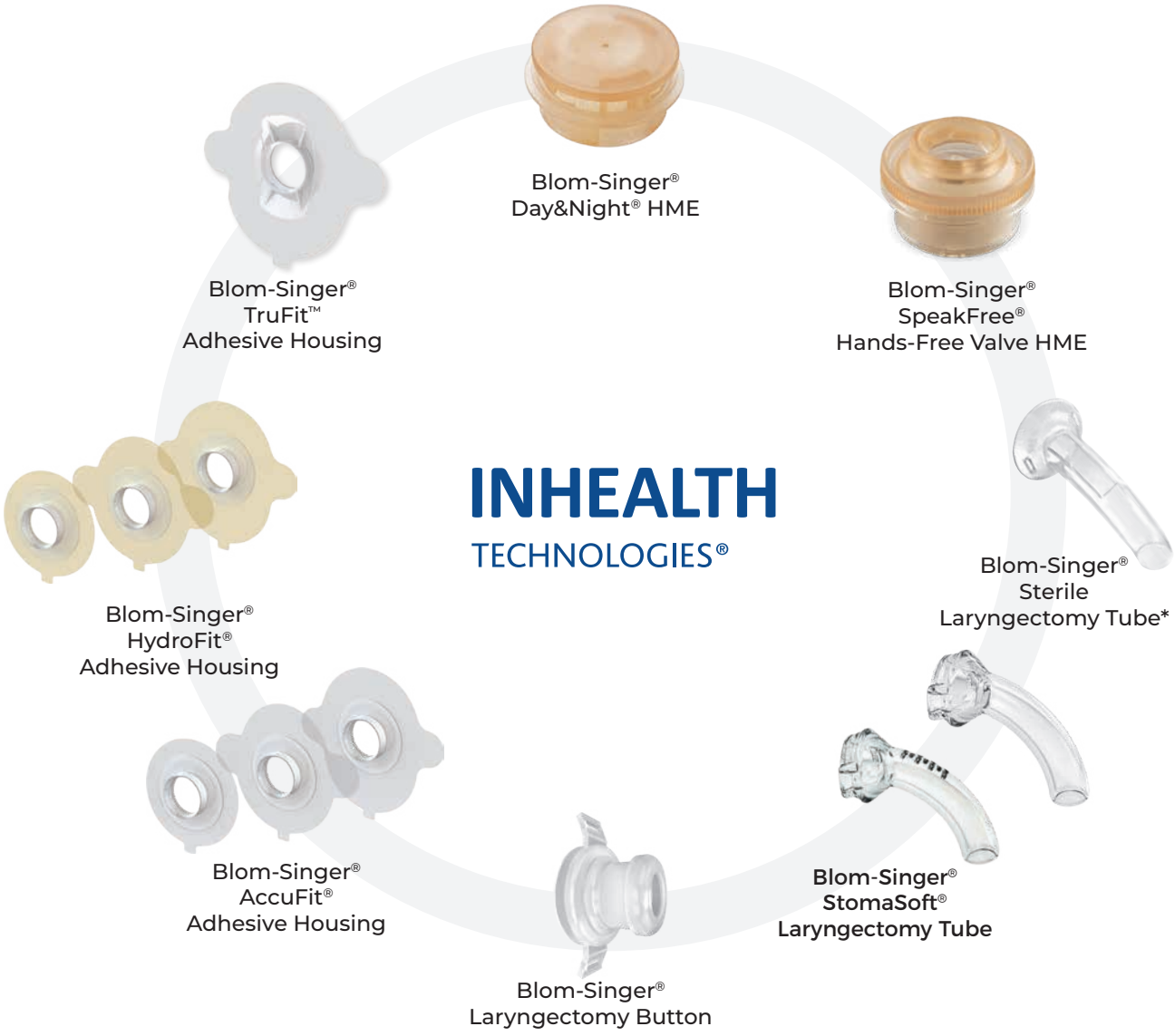


Figure 7. InHealth Technologies® HME/HME attachments[14]
**Blom-Singer® Sterile Laryngectomy Tube does not house HMEs*

Blom-Singer® Day&Night® HME

The Blom-Singer® Day&Night® HME is engineered for continuous use to ensure optimal pulmonary health around the clock. Designed for discreet daily use, it features a nonreflective, translucent finish and is compatible with all InHealth Technologies® attachments via the well-established 22mm hub. This device can be manually occluded for tracheoesophageal speech and features a unique locking safety feature to prevent accidental occlusion of the HME. Locking the HME in the open position is useful during initial post-operative HME training, periods of sleep, activities that could inadvertently occlude the HME (e.g., riding a motorcycle, exercising, skydiving) or for patients not utilizing a voice prosthesis as their means of communication.

Figure 8. Internal structure of Day&Night® HME

Figure 9. Locking safety feature of Day&Night® HME

The Day&Night® HME is available in two foam variants depending on breathability needs:

- **ClassicFlow® HME:** Optimized for moisture retention and resistance, suitable for everyday wear and light activity
- **EasyFlow® HME:** Offers increased breathability due to its more porous foam, while still providing moisture retention and resistance.

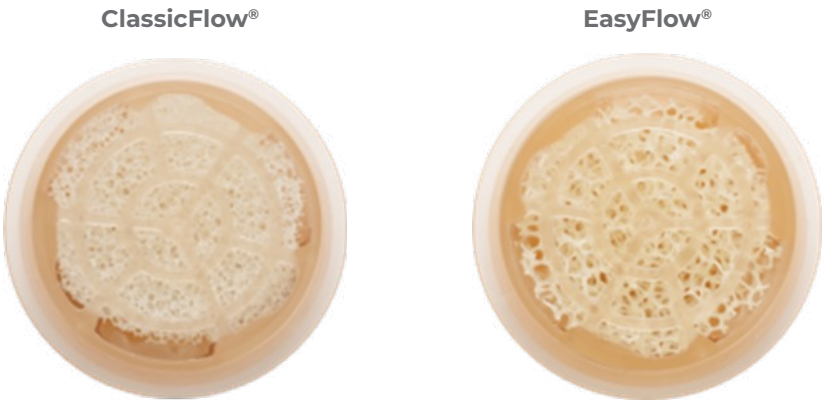


Figure 10. Foam porosity of Blom-Singer® Day&Night® HMEs

Blom-Singer® SpeakFree® HME Hands-Free Valve

The Blom-Singer® SpeakFree® HME Hands-Free Valve is an innovative solution that enables hands-free communication for patients with a tracheoesophageal prosthesis. The SpeakFree® HME is pre-assembled and is designed to adjust to the patient's speaking effort and activity level. Patients can seamlessly transition from talking hands-free with a loved one at home to calling out their score on the pickleball court. In one device, the SpeakFree® HME can accommodate a full spectrum of speaking pressures, rather than requiring multiple non-adjustable competitor hands-free devices. This allows for easy adjustment throughout the day and offers patients the freedom to choose between hands-free speech or manual occlusion.

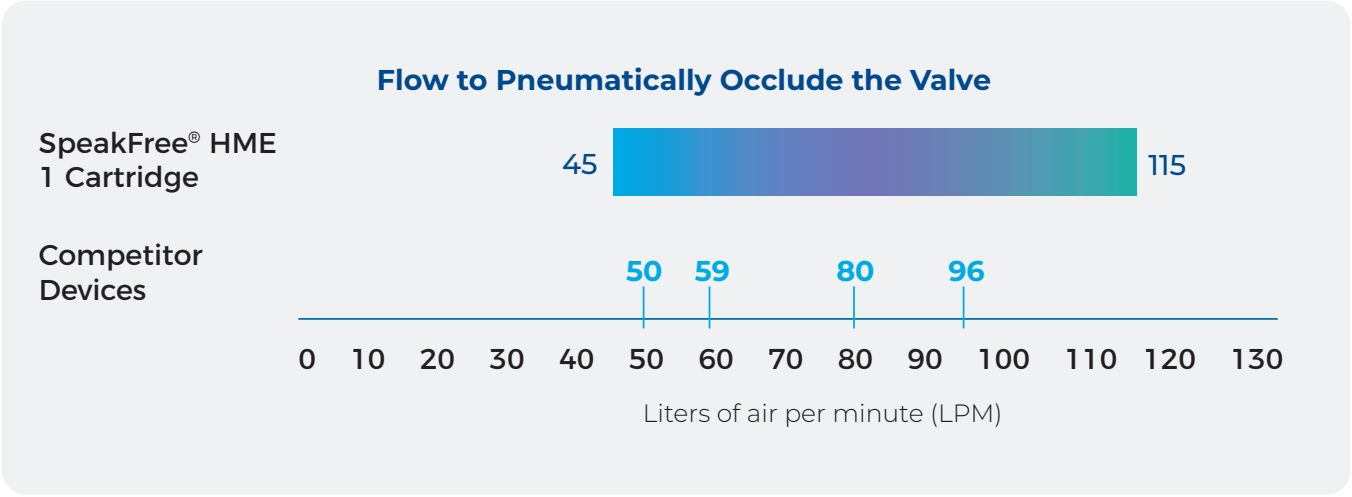


Figure 11. One SpeakFree® HME cartridge can be adjusted to do the work of multiple hands-free competitor devices

Figure 12. Internal structure and assembled components of the SpeakFree® HME

When the SpeakFree® HME is in its most open position, the helical valve is prevented from contacting the adjustable top, therefore allowing for unrestricted airflow during times of increased physical activity, though tracheoesophageal speech can still be achieved by manually occluding the valve. The SpeakFree® HME also offers an optional crossbar for additional safety to prevent unintended occlusion (e.g. scarf) of the valve. Like Day&Night® HME, the SpeakFree® HME is available in both ClassicFlow® and EasyFlow® depending on daily activity needs or preferences.

Blom-Singer® SpeakFree® HME Hands-Free Valve *IN ACTION*

The Blom-Singer® SpeakFree® HME Hands-Free Valve stands out for its revolutionary design that allows for seamless hands-free communication, ideal for dynamic and active lifestyles. In a 2024 comparative study conducted in Italy, the SpeakFree® EasyFlow® HME was evaluated against competitor devices during physical exertion using the Six-Minute Walking Test.[25] This test measures how far individuals can walk within a six-minute time constraint. During the test, objective measures such as heart rate, oxygen saturation, and distance traveled were recorded.[25]

The SpeakFree® EasyFlow® HME demonstrated superior performance in oxygen saturation and overall distance traveled and high performance in heart rate, making it the preferred choice for wear during physical activity. Additionally, it was the only device tested that also allowed for hands-free speech, further proving its effectiveness and innovation for real-world scenarios.[26] These findings underscore the SpeakFree® EasyFlow® HME's ability to meet and exceed the demands of physically active patients, providing a balance of filtration, breathability, and communication.

Quality of Life and Respiratory Performance in the Laryngectomized Patient: Role of the HME Filters during Physical Activity

Massimo Mesolella, Salvatore Allosso, Mauro Mormile, Giuseppe Quaremba, Veronica Errante, Roberto D'Aniello, Giovanni Motta, Vincenzo Catalano, Gaetano Motta, Grazia Salerno

"Considering the average of the **saturation parameter**, … the Blom-Singer SpeakFree HME filter was **the best performing**…" *(p. 4)*

"…considering the average **meters traveled**…we observe that the Blom-Singer SpeakFree HME filter was **the best performing**…" *(p. 8)*

"The Blom-Singer SpeakFree HME filter…[is] certainly **much more suitable for more intense physical activity** than traditional filters" *(p. 15)*

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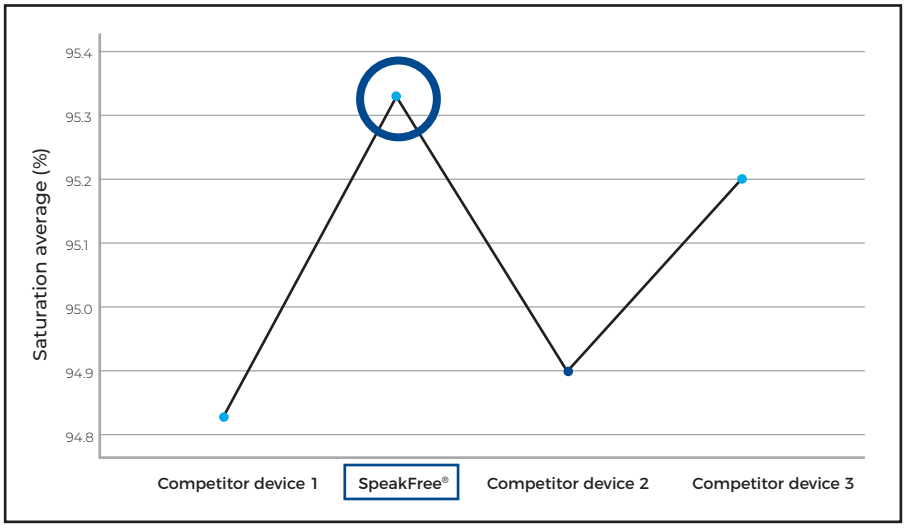

Figure 13. Average oxygen saturation for each HME[26]

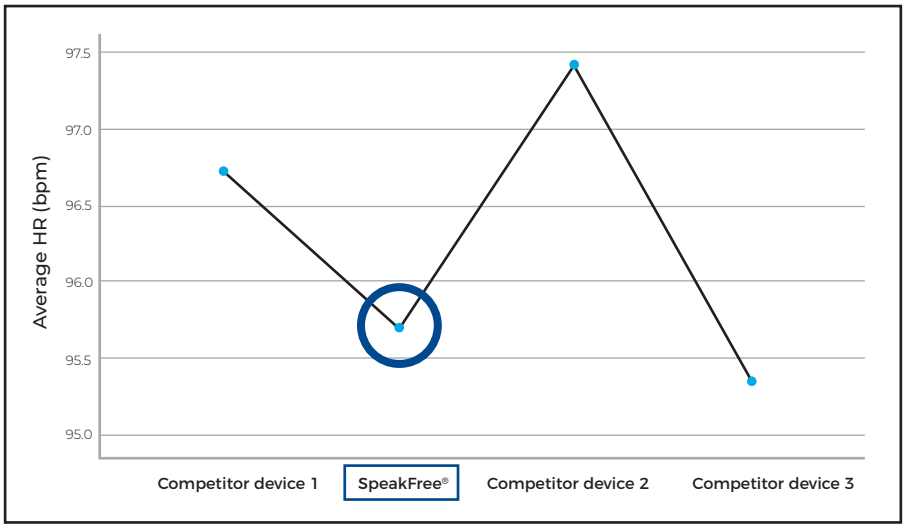

Figure 14. Average heart rate recorded for each HME[26]

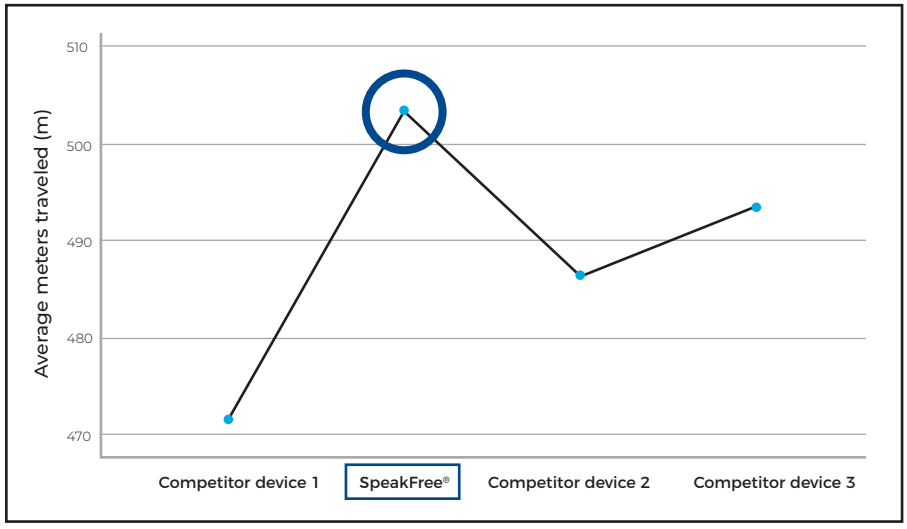

Figure 15. Average meters traveled recorded for each HME[26]

Patient Experience with the SpeakFree® HME

"Ever since I started using the new SpeakFree HME, I feel more confident doing the things I love the most (riding bikes with wife and going out to dinner)."

-Joseph

"SpeakFree has given me my life back. I can comfortably work and talk to my customers at the same time. I love how simple it is to use. I set the dial to my activity level and get on with my day."

-Joanne

"Since using SpeakFree HME, I have the confidence to go out and enjoy life again. I can ride my motorcycle again without worrying about changing my HMEs to fit my activity."

-Marcy

Key InHealth Technologies® HME Takeaways

- **SpeakFree® HME** is the first pre-assembled, disposable, adjustable hands-free valve
  - Allows patients the flexibility to be hands-free and adjust to meet activity level
- **Day&Night® HME** is designed for 24/7 wear
- **SpeakFree® and Day&Night® HMEs** are available in ClassicFlow® and EasyFlow® to meet daily activity needs

InHealth Technologies® HME Attachments

SpeakFree® and Day&Night® HMEs are excellent options for daily pulmonary and communication needs. To enjoy the many benefits of these HME devices, effective and personalized stomal attachments are needed. There are multiple challenges patients tend to encounter with HME attachments including irritated skin from adhesives, poor fit of adhesives, adhesives coming loose or leaking air, and even tracheal irritation.[23] InHealth Technologies® has developed a range of HME attachments designed to improve daily usability and patient comfort. Each attachment is designed to work seamlessly with all InHealth products, featuring the well-established 22mm hub.

Figure 16. InHealth Technologies® HME attachments

Blom-Singer® StomaSoft® Laryngectomy Tube

The Blom-Singer® StomaSoft® laryngectomy tube is an HME-compatible tube designed to maintain the shape and patency of a tracheostoma. A 2024 Stanford University study analyzed the benefits of utilizing soft silicone laryngectomy tubes in the immediate post-operative period to maintain stomal patency and house HMEs.[16] As noted previously, early introduction and utilization of HMEs have proven to be advantageous for patient outcomes.[6,16] The study concluded that soft laryngectomy tubes, such as the StomaSoft®, are particularly well-suited for the post-operative period due to their soft, flexible design, which is ideal for a newly established airway.[16] In addition to their use in the immediate post-operative period, the StomaSoft® laryngectomy tube is excellent for daily or overnight wear, particularly in cases where stomal stenosis is an issue. The side tabs of the tube are reinforced for enhanced durability. The StomaSoft® is available fenestrated and non-fenestrated, in multiple diameters, and two lengths (36mm and 55mm) depending on specific patient needs (*see Appendix*).

Figure 17. StomaSoft® Laryngectomy Tube (fenestrated and non-fenestrated)

Blom-Singer® Laryngectomy Button

The Blom-Singer® Laryngectomy Button is a self-retaining, medical-grade silicone device designed to support vocal and pulmonary rehabilitation post-laryngectomy. It is designed to maintain a patent tracheostoma and prevent stomal stenosis, which occurs in up to 44% of patients following a total laryngectomy.[39] Patients may transition from a Blom-Singer® StomaSoft® laryngectomy tube to a Blom-Singer® laryngectomy button after post-operative healing. This device is ideal for patients with a well-defined stomal rim and has side tabs for attachment points as needed. The button is compatible with Blom-Singer® SpeakFree® and Day&Night® HMEs to support pulmonary health.

Figure 18. Blom-Singer® Laryngectomy Button

Blom-Singer® AccuFit® Adhesive Housing

The AccuFit® Adhesive Housing offers a secure fit while maintaining flexibility. It comes in three shapes—Round, Oval, and Oval Extra—to accommodate different stomal topographies. Because stoma anatomy and position can present obstacles to successful tracheoesophageal speech (e.g., achieving an adequate stomal seal or preventing air leakage during speech attempts), selecting an appropriately sized and shaped baseplate can help optimize communication outcomes.[20]

Figure 19. AccuFit® Adhesive shapes: Round, Oval, and Oval Extra

Blom-Singer® HydroFit® Adhesive Housing

Designed for those with sensitive skin, the HydroFit® Adhesive Housing features a hydrocolloid, gel-like adhesive for enhanced comfort and moisture absorbency. The unique soothing dermatological components of HydroFit® are intended for irritated or generally sensitive skin tissue and help protect against skin breakdown from repeated baseplate changes[15]. Hydrocolloid materials have been found to promote healing as well as reduce pain and risk of infection[35], making HydroFit® an excellent option for the post-operative period if baseplate placement is appropriate. This adhesive housing is also available in Round, Oval, and Oval Extra shapes.

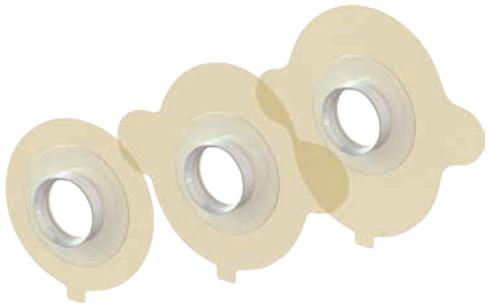

Figure 20. HydroFit® Adhesive shapes: Round, Oval, and Oval Extra

Blom-Singer® TruFit™ Adhesive Housing

The Blom-Singer® TruFit™ Adhesive Housing is designed for deep-set stomas and for those needing additional baseplate support for hands-free speech with the Blom-Singer® SpeakFree® HME. The TruFit® features a concave thermoplastic polyurethane (TPU) housing and the same reliable adhesion as AccuFit®. The TruFit™ is available in Oval Extra shape.

Figure 21. TruFit™ Adhesive Housing: Oval Extra

Key InHealth Technologies® HME Attachment Takeaways

- **StomaSoft®** is made from soft, flexible silicone and is ideal for immediate post-operative use or long-term use to maintain stomal patency
- **Laryngectomy Button** is engineered to maintain a patent tracheostoma and is compatible with Blom-Singer® SpeakFree® and Day&Night® HMEs
- **AccuFit®** is designed to be the strongest adhesive option while still maintaining flexibility
- **HydroFit®** is ideal for sensitive skin needs
- **TruFit™** is engineered for deeper tracheostomas as well as increased support, ideal for hands-free speech with the Blom-Singer® SpeakFree® HME
- There are many variations in stoma shape, size, and peristomal landscape; therefore, it is crucial to select the optimal attachment to meet patient needs

InHealth Technologies® Accessories

In addition to a comprehensive line of HMEs, adhesive baseplates, and HME attachments, InHealth Technologies® also offers multiple accessories, all compatible with InHealth's line of products.

Manometer with Manometer Adapter

The manometer is a troubleshooting and biofeedback tool used to determine the intratracheal pressure generated during tracheoesophageal speech. A 'target range' is marked on the gauge to allow clinicians and patients to visualize the optimal pressure during voicing. This visual biofeedback tool can help the patient decrease intratracheal pressure to improve tracheoesophageal speech and optimize baseplate seal.

Figure 22. Manometer with Manometer Adapter

Blom-Singer® Shower Guard

The Blom-Singer® Shower Guard is designed to protect the stoma when showering by preventing water from entering the airway. The device is washable, durable, and compatible with all InHealth adhesive baseplates and attachments.

Figure 23. Blom-Singer® Shower Guard

Future Directions for InHealth Technologies®

InHealth Technologies® is committed to advancing the care of individuals who have undergone a total laryngectomy. InHealth remains focused on exploring new questions and challenges in HME utilization and tracheoesophageal voice restoration. While research has addressed many HME questions, there is still progress to be made and questions to be asked. As patient needs evolve, InHealth Technologies® is dedicated to developing solutions that streamline care management and maximize patient quality of life.

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Appendix

Keywords

- **Tracheostoma/stoma –** formed during surgery by attaching the trachea to the neck, this is the anatomical opening that total laryngectomees exclusively breathe in and out of ("total neck breather").

- **Airflow resistance –** an essential parameter of lung function to modify the airway in response to different respiratory demands. This resistance is lost after a total laryngectomy, though is partially restored with use of HMEs.

- **Filtration –** prior to surgery, the nose and upper airway structures trap harmful particles (e.g. allergens, pollen, dust, airborne pathogens). After total laryngectomy, the filtration system is compromised increasing the risk for inflammation and infection. Filtration is partially restored with use of HMEs.

- **Temperature –** prior to surgery, the nose warms inhaled air by exposing it to rich blood supply in the nasal passages. After surgery, there is a significant drop in temperature reaching the lungs since the upper airway is no longer connected. Warming of air is partially restored with use of HMEs.

- **Humidity –** prior to surgery, inhaled air gains moisture by passing through upper airway structures. After surgery, there is a significant decrease in the amount of moisture present in inhaled air reaching the lungs. Humidity is partially restored with use of HMEs.

- **Heat and Moisture Exchange System (HME) –** single-use, passive humidifying device composed of protective plastic housing shell and an open-cell polyurethane foam treated with calcium chloride to enhance water retention. These devices facilitate an increase in air temperature, improve airway protection, increase humidity, and reestablish a degree of breathing resistance.

- **Calcium chloride –** a hygroscopic compound embedded in the foam of HMEs that effectively captures and retains moisture from exhaled air. This allows the air to be warmed and re-moistened during the next inhalation.

- **Laryngectomy tube –** an intraluminal device made of silicone. It is designed to maintain the shape and patency of a tracheostoma as well as house HMEs.

- **Baseplate –** adhesive attachments affixed over the stoma to house HMEs.

- **Laryngectomy button –** a self-retaining, medical-grade silicone device designed to support vocal and pulmonary rehabilitation, maintain a patent tracheostoma, and prevent stoma stenosis post-laryngectomy.

- **Manometer –** a troubleshooting and biofeedback tool that is utilized to determine the intratracheal pressure generated during tracheoesophageal speech.

Product Information

Blom-Singer® Post-Operative Care Kits

Ref	Description
PK 2100	Post-Operative Care Kit 9/55 Tube – ClassicFlow® HME
PK 2101	Post-Operative Care Kit 10/55 Tube – ClassicFlow® HME
PK 2102	Post-Operative Care Kit 9/55 Tube – EasyFlow® HME
PK 2103	Post-Operative Care Kit 10/55 Tube – EasyFlow® HME
PK 2104	Post-Operative Care Kit 10/55 Tube – ClassicFlow® HME – Electrolarynx
PK 2106	Post-Operative Care Kit 12/55 Tube – ClassicFlow® HME
PK 2107	Post-Operative Care Kit 12/55 Tube – EasyFlow® HME

Blom-Singer® Heat and Moisture Exchange Systems (HMEs)

Ref	Description
BE 1091	Day&Night® ClassicFlow® HME Cartridges, pack of 30
BE 1092	Day&Night® EasyFlow®HME Cartridges, pack of 30
BE 1090EF	SpeakFree® Hands-Free HME Valve with EasyFlow®, pack of 30
BE 1090EZ	SpeakFree® Hands-Free HME Valve with ClassicFlow®, pack of 30

Blom-Singer® Pulmonary Rehabilitation Solutions

Ref	Description
BE 6389	8/36mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6399	8/55mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6400	9/36mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6401	9/55mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6402	10/36mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6403	10/55mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6404	12/36mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6405	12/55mm Laryngectomy Tube – Non-Fenestrated Sterile
BE 6698	8/36mm StomaSoft® Laryngectomy Tube, Non-Sterile
BE 6698F	8/36mm StomaSoft® Laryngectomy Tube, Fenestrated, Non-Sterile
BE 6699	8/55mm StomaSoft® Laryngectomy Tube, Non-Sterile
BE 6699F	8/55mm StomaSoft® Laryngectomy Tube, Fenestrated, Non-Sterile
BE 6700	9/36mm StomaSoft® Laryngectomy Tube, Non-Sterile
BE 6700F	9/36mm StomaSoft® Laryngectomy Tube, Fenestrated, Non-Sterile
BE 6701	9/55mm StomaSoft® Laryngectomy Tube, Non-Sterile
BE 6701F	9/55mm StomaSoft® Laryngectomy Tube, Fenestrated, Non-Sterile
BE 6702	10/36mm StomaSoft® Laryngectomy Tube, Non-Sterile
BE 6702F	10/36mm StomaSoft® Laryngectomy Tube, Fenestrated, Non-Sterile
BE 6703	10/55mm StomaSoft® Laryngectomy Tube, Non-Sterile
E3131208	12/8mm Blom-Singer® Laryngectomy Button
E3131408	14/8mm Blom-Singer® Laryngectomy Button
E3131608	16/8mm Blom-Singer® Laryngectomy Button
E3131808	18/8mm Blom-Singer® Laryngectomy Button
BE 6082	AccuFit® Adhesive Housing, Round, 30 ea
BE 6083	AccuFit® Adhesive Housing, Oval, 30 ea
BE 6084	AccuFit® Adhesive Housing, Oval Extra, 30 ea
BE 6085	HydroFit® Adhesive Housing, Round, 30 ea
BE 6086	HydroFit® Adhesive Housing, Oval, 30 ea
BE 6087	HydroFit® Adhesive Housing Oval Extra, 30 ea
BE 6088	TruFit™ Adhesive Housing Oval Extra, 30 ea

Accessories

Ref	Description
BE 6040	Blom-Singer® Insufflation Test Set, 6 ea
BE 8000	Manometer Kit
BE 8020	Replacement Manometer Adapter Pack, 5 ea
BE 6048	Blom-Singer® Shower Guard, includes Housing & Tape Discs

HME Styles and Features Chart

STYLES				
FEATURES	Blom-Singer® Day&Night® **ClassicFlow®** HME	Blom-Singer® Day&Night® **EasyFlow®** HME	Blom-Singer® SpeakFree® HME Hands-Free Valve with **ClassicFlow®** HME	Blom-Singer® SpeakFree® HME Hands-Free Valve with **EasyFlow®** HME
Wear Time	**24 HR USE**	**24 HR USE**	**DAYTIME**	**DAYTIME**
Single-Use Device	✓	✓	✓	✓
Easy Manual Occlusion for Voicing	✓	✓	✓	✓
Adjustable Hands-Free Speech Valve			✓	✓
Breathability	≈ ≈	≈ ≈ ≈	≈	≈
Hygroscopic Filter	✓	✓	✓	✓
22mm Hub (compatible with all InHealth products)	✓	✓	✓	✓
Optional Safety Feature	**TWIST TO LOCK**	**TWIST TO LOCK**	**CROSSBAR**	**CROSSBAR**
Not Made with Natural Rubber Latex	✓	✓	✓	✓
Nonreflective Surface Texture	✓	✓	✓	✓
Reference Number	BE 1091 **30 pk**	BE 1092 **30 pk**	BE 1090EZ **30 pk**	BE 1090EF **30 pk**

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