

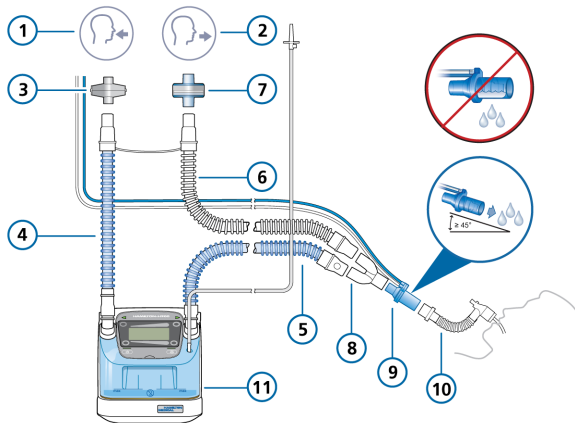
This application note does not replace the clinical judgment of a physician/medical professional nor the content of the ventilator Operator's Manual, which should always be available when using the ventilator. While the information contained herein is believed to be accurate, it does not represent an official recommendation from Hamilton Medical, nor may it substitute an opinion, assessment, or instructions provided by a trained healthcare professional.

This application note is intended as a useful reference for ventilation of **adult** and **pediatric** patients. It provides information related to breathing circuit positioning and maintenance of related components.

1 Breathing circuit diagram

The breathing circuit and components shown here are an example for clarification; the components are *not* all necessarily connected at the same time. Unheated circuits are also supported, but not shown. The diagram does not show positioning of additional optional devices, such as a CO2 sensor or nebulizer.

Figure 1. Breathing circuit diagram



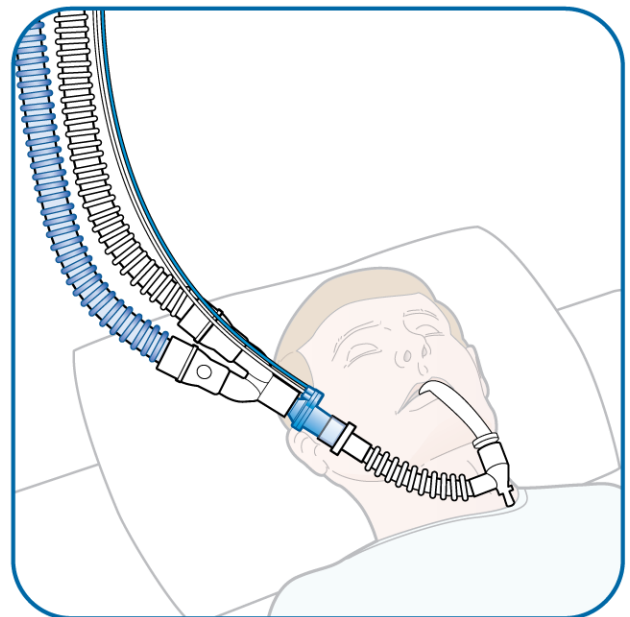
- | | |
|--------------------------------|----------------------|
| 1 To patient inspiratory port | 7 Expiratory filter |
| 2 From patient expiratory port | 8 Y-piece |
| 3 Inspiratory bacteria filter | 9 Flow sensor |
| 4 Ventilator inspiratory limb | 10 Patient interface |
| 5 Patient inspiratory limb | 11 Humidifier |
| 6 Expiratory limb | |

2 Breathing circuit positioning guidelines

In addition to the positioning information provided in the section *Setting up the patient breathing circuit*¹ of the ventilator Operator's Manual, note the following positioning guidelines:

- Position the ventilator, including the patient support arm, well back from the breathing circuit Y-piece.
- Position the flow sensor upright, with the patient end facing downward. Ideally, the flow sensor should be at a 45° or greater angle relative to the floor.
- Ensure there is no undue stress placed on any tubing or cables.

Figure 2. Breathing circuit positioning guidelines



2.1 Benefits of careful positioning

Positioning the breathing circuit components as described can help minimize the following:

- Drag on the patient interface
- Tension on the patient interface
- Accumulation of secretions and condensation in the breathing circuit, HME (if used), and/or CO2 sensor (if used)

¹ Chapter 3 (Chapter 4 of the HAMILTON-MR1 Operator's Manual).

3 Hamilton Medical flow sensor

The Hamilton Medical flow sensor is specially designed for, and approved for use with, Hamilton Medical ventilators.

It provides direct pressure and flow measurement proximal to the patient.

3.1 Benefits of using a proximal flow sensor

Positioning the flow sensor proximal to the patient (as shown in Figure 1) provides the following benefits:

- Allows accurate measurement of tidal volumes directly at the airway opening (AWO)
- Facilitates triggering for additional breaths
- Allows the ventilator to collect respiratory-mechanics-related measurements (static compliance and resistance) with the highest accuracy measured directly at the AWO
- Allows assessment of the direct volume increase during a recruitment maneuver
- With a proximal CO₂ sensor in use, provides a direct link between volume and CO₂ measurement at the AWO, thus giving more comprehensive volumetric capnography information

3.2 Clearing secretions, occlusions, and condensation

NOTICE

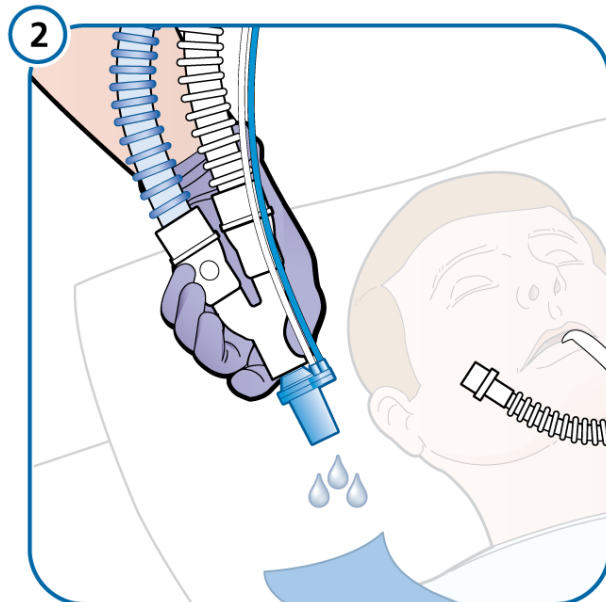
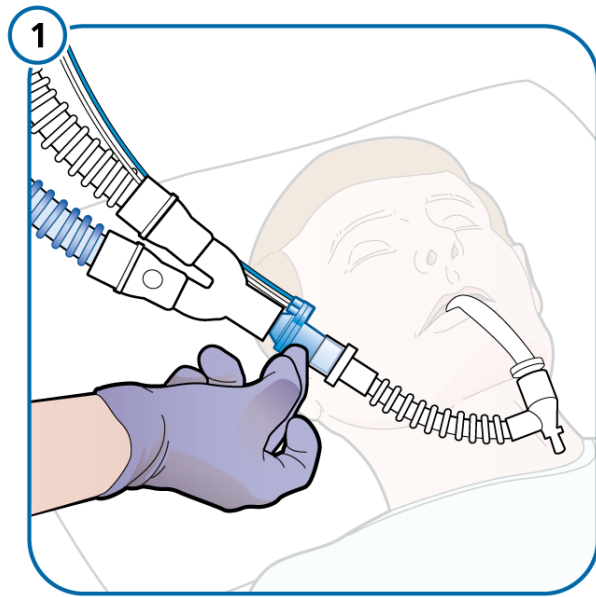
- During disconnection, closely monitor your patient and provide alternative ventilation if necessary.
- Be sure not to contaminate any invasive access points.

During ventilation, secretions, occlusions, and/or condensation can build up in the flow sensor and circuit components. Positioning the breathing circuit and flow sensor as shown can help minimize this accumulation.

To clear secretions/occlusions/condensation buildup

1. Flick/tap the flow sensor to dislodge any buildup.
2. To minimize the risk of any cross contamination:
 - a. Activate suctioning by pressing the **O₂ enrichment** key.
 - b. Disconnect the flow sensor, which activates a suctioning maneuver.
 - c. Clear the flow sensor onto a sterile compress (Figure 2).
 - d. Reconnect the flow sensor to the breathing circuit.

The ventilator automatically stops the suctioning maneuver and resumes ventilation.
3. If the flow sensor still has buildup, discard the flow sensor and replace it with a new one.
4. Calibrate the new flow sensor as described in the ventilator *Operator's Manual*.



4 Using a nebulizer and a filter

Best practices suggest using an expiratory filter, especially when nebulizing the patient.

Nebulization without an expiratory filter

Nebulizing without an expiratory filter can cause the following undesired effects:

- Buildup of crystallized medication on the expiratory valve set surfaces
- Unabsorbed exhaled medication can cause components to stick or perform erratically

Figure 3. Accumulation of exhaled medicine in the expiratory valve



Nebulization using an expiratory filter

Nebulizing with an expiratory filter allows the filter to capture excess medication much like the lint filter in your dryer.

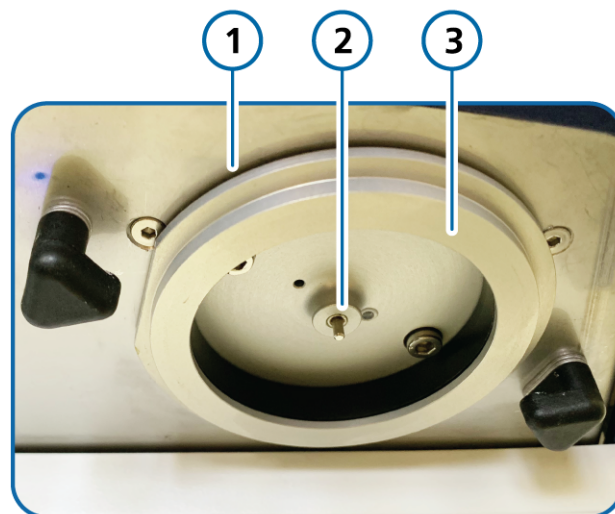
Changing the filter

- ▶ Change the filter every 4 to 8 hours depending on your nebulization intervals and/or according to your department policy and the manufacturer's specifications.

Note that the use of less viscous medications may require fewer filter replacements.

5 Ventilator expiratory port maintenance for HAMILTON-G5/S1

Figure 4. Expiratory port components



- | | |
|------------------------------|------------------|
| 1 Ventilator expiratory port | 3 Centering ring |
| 2 Valve plunger | |

Regularly cleaning the expiratory port components helps keep your ventilator operating optimally.

5.1 Cleaning the valve plunger and centering ring

The valve plunger helps maintain base flow and PEEP, and must be able to freely move up and down.

To clean the valve plunger and centering ring

1. Using an alcohol wipe (70% isopropyl alcohol) or alcohol-saturated cloth, gently grasp the valve plunger and carefully pull it down.

Do not use other cleaning agents, as some of them may leave a residue that can hinder performance.

2. Clean in a twisting motion.
3. Wipe inside the centering ring, as well as around the ring itself.

Figure 5. Cleaning the valve plunger and centering ring



