About this resource

With collaborators & support from multiple institutions, including:

OC2 Open Critical Care | USAID FROM THE AMERICAN PEOPLE | STAR | UCSF Center for Health Equity in Surgery & Anesthesia

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How to Use This Document

This is a living document, created by created by nurses, physicians, respiratory therapists and other healthcare providers from multiple institutions and multiple countries via the OpenCriticalCare.org project.

The goal of this document is to provide tools that can be locally modified to help healthcare providers learning to provide respiratory care for hospitalized patients.

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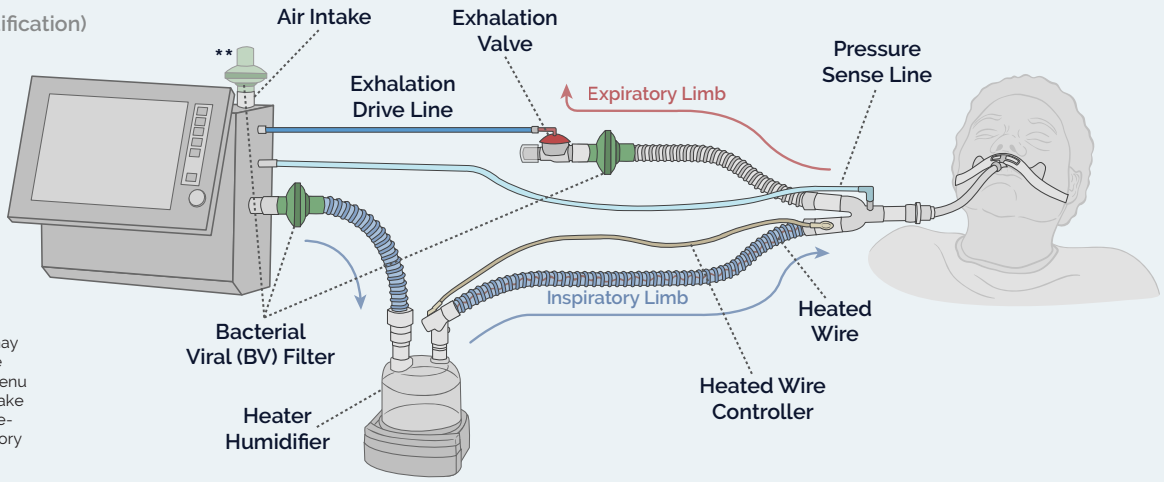
Ventilator Circuit Setup

Filter Placement & Humidification Types

"SINGLE LIMB" CIRCUITS*

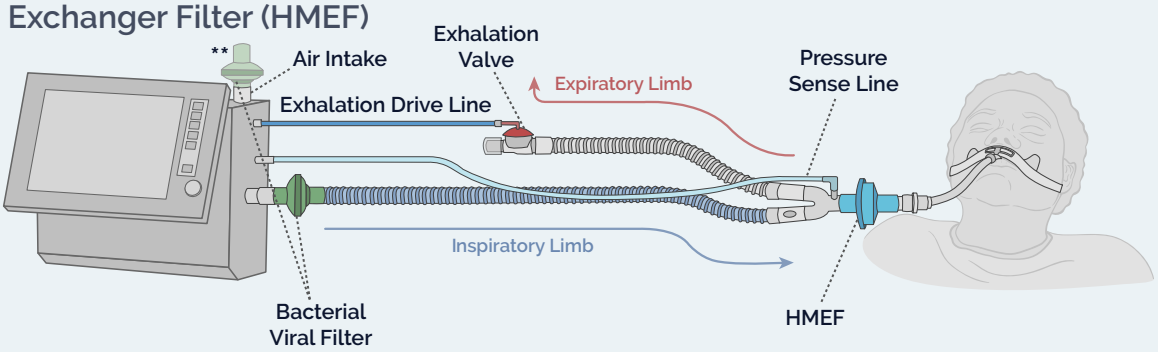
Heated Wire

(Active heat & humidification)



**Air Intake BV Filter may be recommended for some devices and may require menu settings changes. When intake BV filter is in use, BV filter between the vent and inspiratory limb may not be needed.

Heat Moisture Exchanger Filter (HMEF)

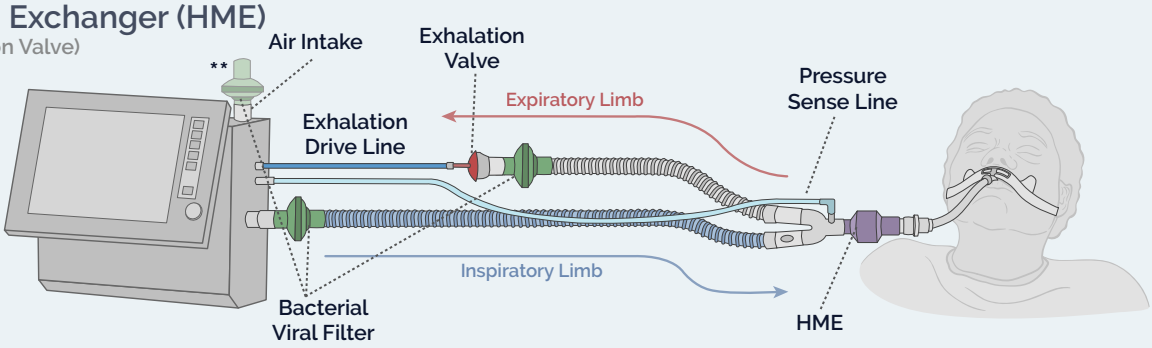


HMEFs must always be placed between the circuit wye and the endotracheal tube. They should not be used at the ventilator or exhalation valve.

Heat Moisture Exchanger (HME)

(BV filter by Exhalation Valve)

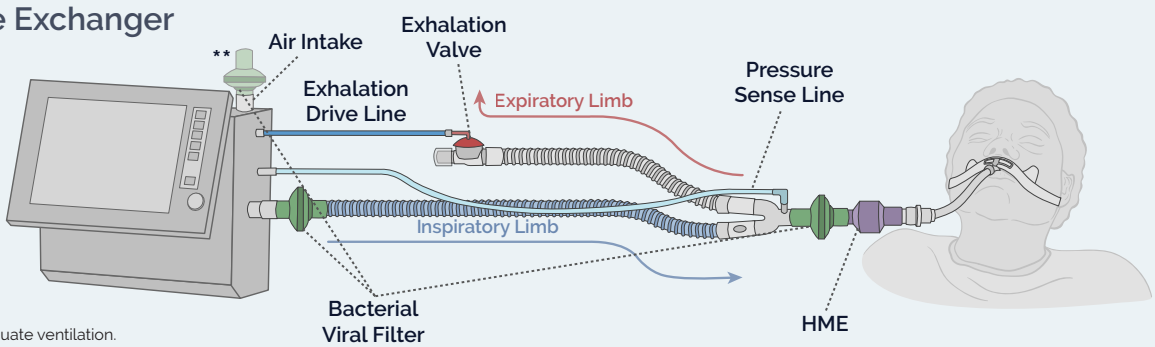
When using an HME, the expiratory BV filter should ideally be placed either at the exhalation valve (as shown) or at the takeoff of the expiratory limb from the Wye (not shown). This illustration shows a slightly different type of expiratory valve than the others on this page. This has no implication for the location of HMEs or filters.



Heat Moisture Exchanger

(BVF by HME)

When unable to place the expiratory BV filter in the expiratory limb due to hoses glued to the Wye or expiratory valve, it may be placed at the wye in series with the HME. **CAUTION**: this increases dead space & resistance. Review manufacturer's reported dead-space & resistance as tidal volume or pressure support level may require adjustment to ensure adequate ventilation.



* The term 'single limb' is a commonly used misnomer to describe the circuits shown here. These circuits do have a second (expiratory) limb, and thus may be considered functionally similar to 'dual limb circuits'

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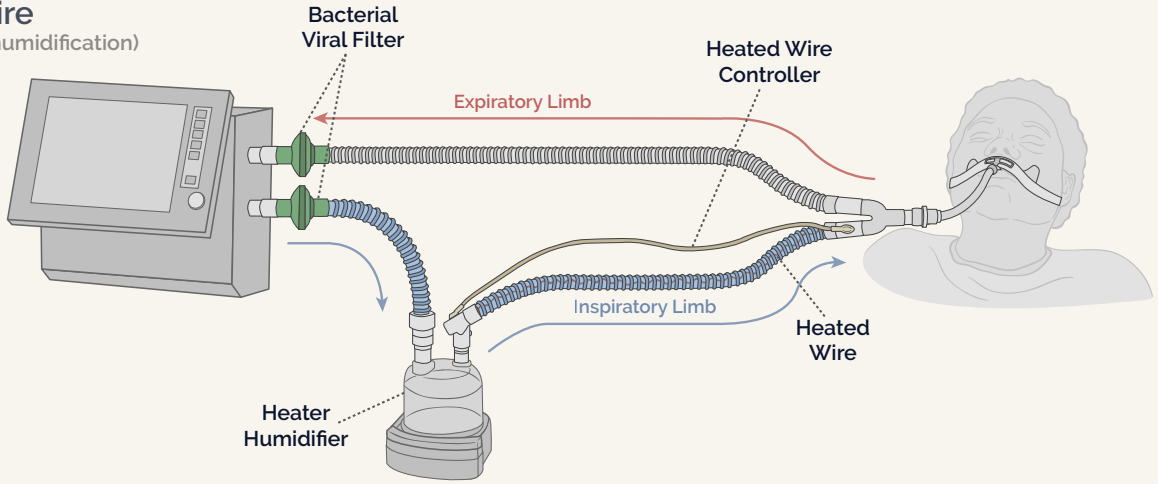
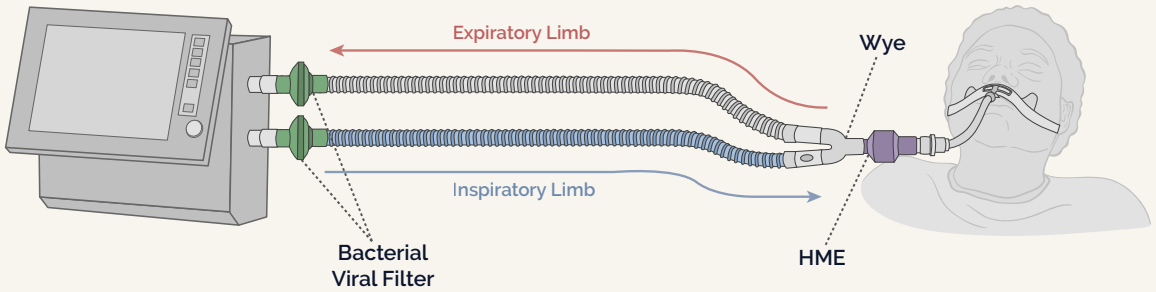
DUAL LIMB CIRCUITS

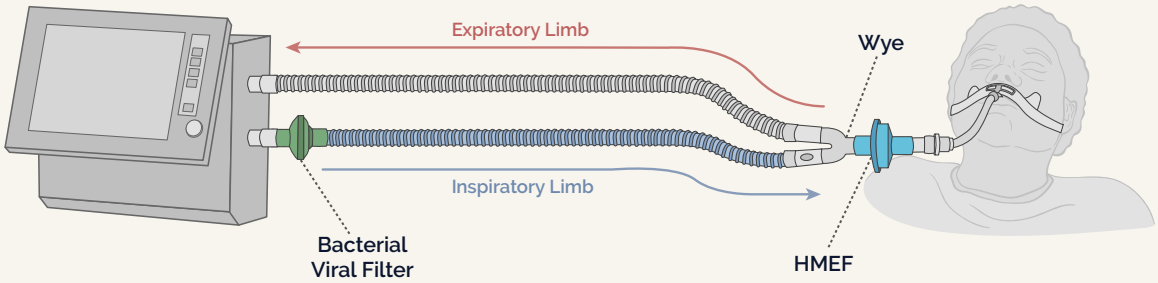
Heated Wire
(Active heat & humidification)



Heat Moisture Exchanger (HME)

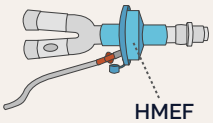


Heat Moisture Exchange Filter (HMEF)

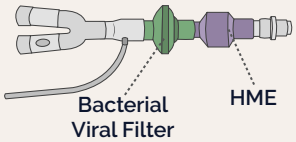


END TIDAL CO2 PLACEMENT

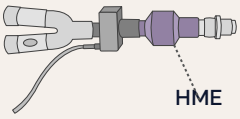
Sidestream CO2
Sampling HMEF with integrated sampling port



Sidestream CO2
Sampling HME and Bacterial Viral Filter



Mainstream CO2
Monitoring HME



Deadspace and resistance are increased by the addition of any filters or other adapters, including end tidal CO2. Read manufactuers' specifications to quantify potential impact on ventilator strategy.

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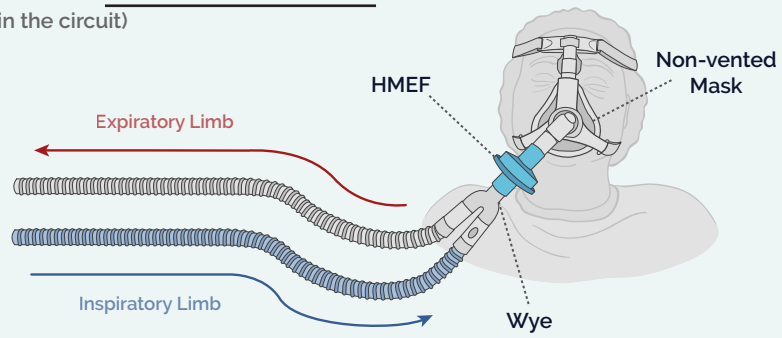
CPAP/NIPPV Circuit Setup

Mask types and filter placement

Dual Limb Circuit + Non-Vented Mask

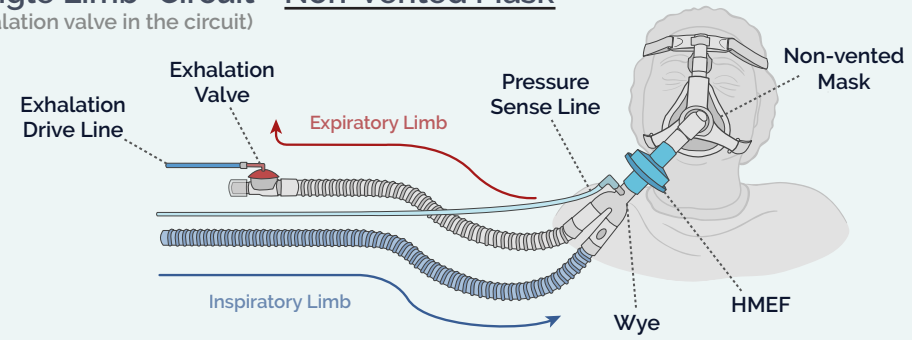
(Exhalation valve in the circuit)



- Because this setup has an **expiratory valve** at or in the ventilator (not shown), a **non-vented mask** must be used for CPAP/NIPPV
- See Figure "Ventilator Circuit Setup" for alternative humidification & filter setups. An HMEF is shown here but may not be the optimal setup depending on local resources.
- The addition of filters between the circuit Wye and the patient introduce dead space.

"Single Limb" Circuit + Non-Vented Mask

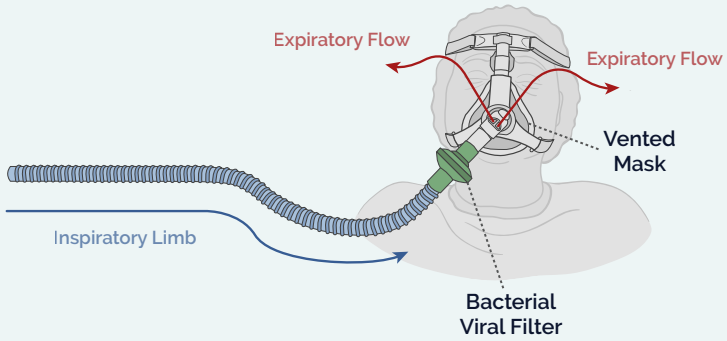
(Exhalation valve in the circuit)



- The term 'single limb' circuit is a commonly used misnomer when referring to the type of circuit shown here. The setup shown has a short expiratory limb and expiratory valve and functions similarly to a dual limb circuit.
- Because this setup has an **expiratory valve**, a **non-vented mask** must be used for CPAP/NIPPV
- See Figure "Ventilator Circuit Setup" for alternative humidification & filter setups.

True Single Limb Circuit + Vented Mask

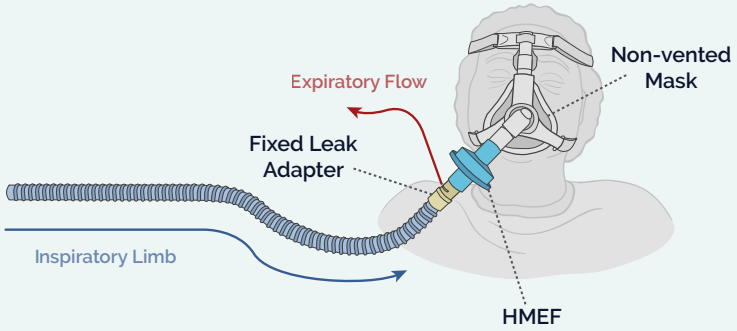
(No exhalation valve)



- The 'true' single limb circuit is commonly found in home CPAP/NIPPV machines and has **no expiatory valve.**
- Exhaled breath must leave through intentional leak ports - in this setup a **vented mask** is used
- The BV filter in this scenario protects the patient from a potentially contaminated device/circuit but does not protect personnel from potentially infectious aerosolized particles in the exhaled gas.

True Single Limb Circuit + Leak Adapter + Non-Vented Mask

(No exhalation valve)



- This 'true' single limb circuit is commonly found in home CPAP/NIPPV machines and has **no expiatory valve.**
- Exhaled breath must leave through intentional leak ports - in this setup, a non-vented mask is used and the leak occurs via a specialized **fixed leak adapter** in the circuit.
- Either a bacterial viral filter (if active heated humidification is being used) or HMEF (if no active heated humidification) should be placed between the leak adapter & the patient.

CPAP - continuous positive airway pressure
NIPPV - non-invasive positive pressure ventilation (e.g. bilevel positive airway pressure)

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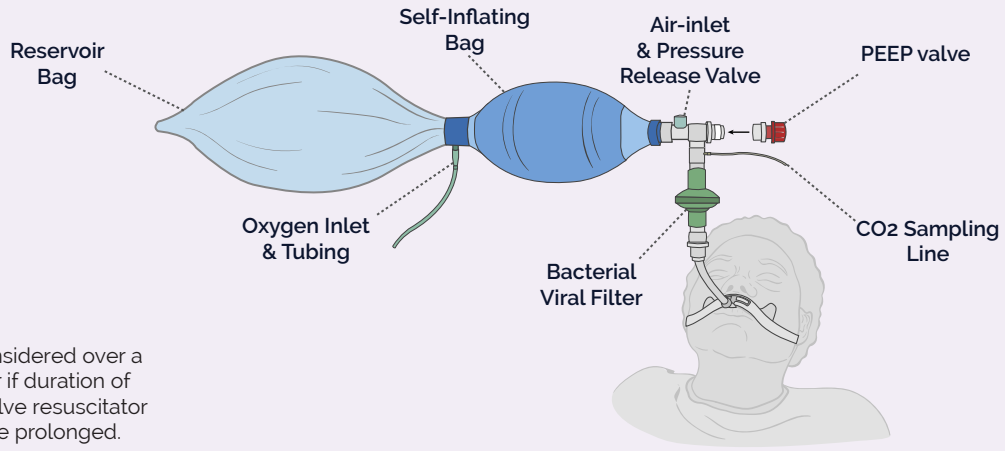
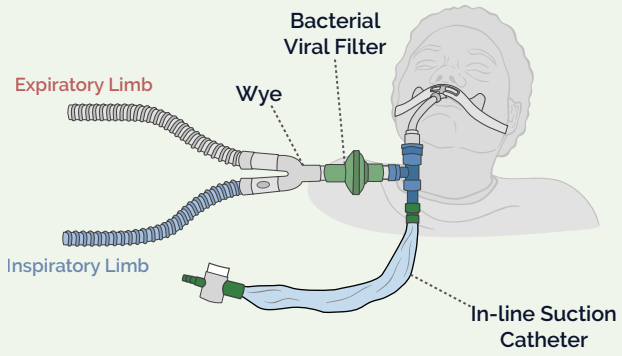
Bag valve resuscitator setup



HMEF may be considered over a bacterial viral filter if duration of use on the bag valve resuscitator is anticipated to be prolonged.

In-line suction catheter setup

This illustration shows the location of the in-line suction catheter in relation to the patient circuit. There are other potential configurations not shown here, but in all, the in-line suction catheter is placed on the endotracheal tube.



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