

Ventilation recommendations - Managing intensive care ventilator breathing circuits

Authors: Jean-Damien Ricard, Philippe Montravers, Olivier Langeron

Review: Manuelle Panczer, Sandra Fournier, Arnaud Galbois

General principles:

- These recommendations apply to all patients suspected of having Covid-19 or who have tested positive for it.
- They have been designed to apply to the whole of the pool of intensive care ventilators used, however the case may arise where some ventilators do not contain certain features required for this application.
- These recommendations take into account parameters which would not necessarily have otherwise been taken into account given the current situation.
- Any action which leads to the air/watertightness of the circuit being violated (changing the circuit out, swapping out filters, swapping out the closed suction system) entails a risk of desaturation (due to loss of aeration from the loss of pressure) and therefore exposure to the virus. Any such action should therefore be avoided inasmuch as possible and - where required - only performed after an expiratory pause.
- The same precautions with respect to PPE, mask and goggle use should be taken whenever performing these actions.
- Schematically speaking there are two types of filters:
 - “Machine” filters used to filter expiratory gas and protect the ventilator and caregivers.
 - “Patient” filters used for intensive care which warm and humidify gases inhaled, protecting the patient’s airway. The use of these filters also help limit circuit contamination.
 - Note however that filters from these two categories cannot be used interchangeably!

	Recommendations	Notes
Selecting a breathing circuit	Single-use circuits	
Frequency with which circuits are changed out	No systematic changing out	Only change in the event of: <ul style="list-style-type: none">• Visible stains or contamination

		<ul style="list-style-type: none"> • Checks for persistent leaks in the ventilator and all other air/watertightness checks for the system have been performed <p>Changes in this respect present a high risk of:</p> <ul style="list-style-type: none"> • Health professionals being exposed to the virus • Desaturation (loss of aeration) in patients
Treating inhaled gases	Filters for use in patients on intensive care (heat and moisture exchange filters, HMEFs) placed at the Y-piece.	<ul style="list-style-type: none"> • Use of heated humidifiers entails too great a risk of being exposed to the virus, so is therefore not recommended. • The internal volume of these filters may increase instrumental dead space and cause an increase in PaCO₂ for patients at varying rates. Their capacity to limit the contamination of circuits in this respect however overrides any other considerations.
Frequency with which patients' filters are changed out	Once weekly	<ul style="list-style-type: none"> • Change filters out more frequently if the surface of the filter is contaminated with secretions. • Swapping the filter out entails a high risk of the patient being exposed to the virus as well as desaturation (loss of aeration).
Tracheal aspirates	Solely for closed aspiration systems	<ul style="list-style-type: none"> • The point here is maintaining circuit air/watertightness, thereby limiting the risk of exposure to the virus and loss of aeration.
Frequency with which closed systems are changed out	No systematic changes.	<p>Only change in the event of:</p> <ul style="list-style-type: none"> • The aspiration catheter becomes obstructed by secretions. • Persistent leaks occur despite the circuit being checked and no other problems are noted.

<p>Protecting the ventilator</p>	<p>Place an electrostatic filter for machine use at the end of the circuit's expiratory connection, right before the expiratory unit.</p>	<p>- Note: make sure this is a “machine” filter (as described above) and not an HME filter (otherwise there is a major risk of the filter becoming obstructed leading to resistance to expiration and an increase in intrathoracic pressure with haemodynamic consequences, such as cardiac arrest).</p> <p>- Some manufacturers likewise recommend placing a “machine” filter on the inspiratory connection point for the circuit, at the gas outflow point. The authors however do not believe this procedure should be recommended due to the following reasons:</p> <p style="padding-left: 40px;">(i) Placing a filter here could theoretically affect the ventilator's trigger capacity.</p> <p style="padding-left: 40px;">(ii) Its usefulness in terms of preventing risk of viral exposure has not been proven</p> <p>and the widescale application of this recommendation would limit filter availability.</p>
<p>Frequency with which the “machine” filter is replaced</p>	<p>No systematic replacement required. It will depend on each patient at the very least.</p>	<p>Replacing the filter during ventilation is an action:</p> <ul style="list-style-type: none"> • entailing a high risk of exposure to the virus, so therefore should be limited as much as possible. • involving a high risk of loss of aeration (loss of pressure whilst the action is being performed). <p>Replacements should therefore be limited to situations where the filter has become contaminated or</p> <p>whenever humidity appears (due to the reduced efficacy).</p>