Sensormedics 3100B with modified circuit and heated expiratory VADI® filter

For use with patients on airborne or enhanced droplet respiratory precautions

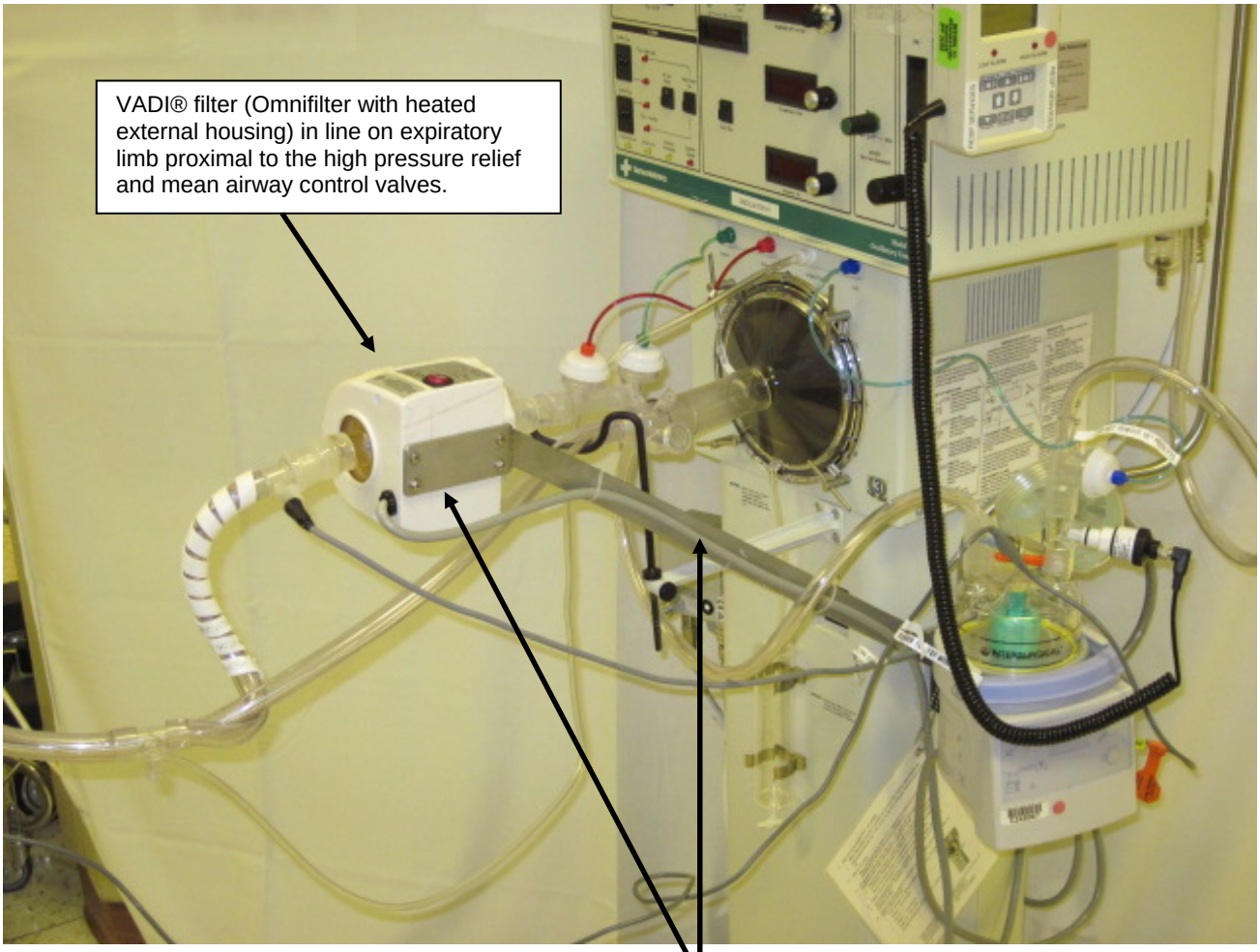

Figure 1

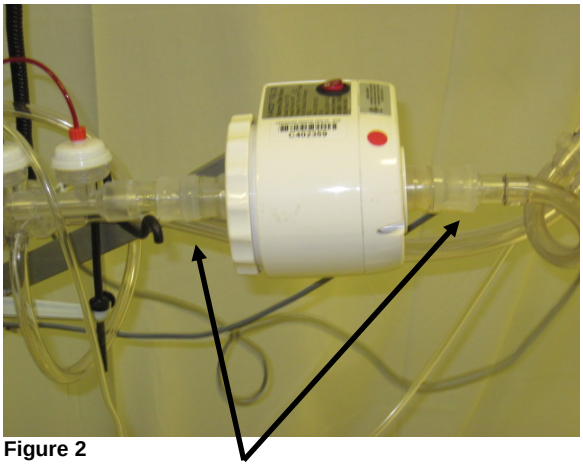

Figure 2

Silastic connectors pre and post filter ensure tight connections **(fig 2)**

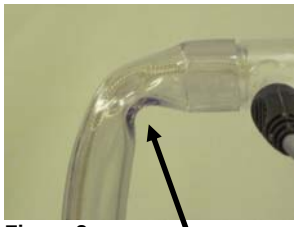

Figure 3

Figure 4

Tubing kinks proximal to expiratory **(fig 3)** prevented with hard plastic coil wrap **(fig 4)**.

High Frequency Oscillation is safe and effective in improving oxygen in patients with acute respiratory distress syndrome (ARDS)[1,2]. Severe pneumonia caused by nH1N1, H5N1, or SARS may require high frequency oscillation. The rapid movement of the piston within the SensorMedics 3100B High Frequency Oscillatory Ventilator may cause aerosolization of expired droplet particles, increasing the risk of infectious disease exposure for critical care clinicians through airborne transmission. Circuits with included inspiratory/expiratory filters for the 3100B are available from the manufacturer (CareFusion) but these filters are not heated, resulting in condensation and an increase in resistance to flow. This necessitates frequent changing of the filters during oscillatory ventilation, causing loss of recruitment with the opening of the circuit and a further exposure risk to staff with each disconnection. Use of a high frequency oscillator is often not recommended for use in patients on airborne or enhanced droplet precautions for these reasons.

We modified the circuit of a Sensormedics 3100B High Frequency Oscillator (flexible patient circuit with dual heated wire, FP850) to include a Tyco Omnifilter Bacterial Filter, with filtration efficiency of >99.97% of 0.3 micron (MPPS) particles. The Omnifilter was surrounded by a heated external housing device (VADI® VH-210 Bacterial Filter Heater, 100-120V, 10W, constructed of PC plastic with aluminum sleeve), heated to 55-70 degrees Centigrade. The filter was placed inline with the expiratory limb of the oscillator circuit proximal to the high pressure relief valve and mean pressure control valve, to effectively filter all expired gases. Silastic 22mm ID connectors were used to connect the filter to the circuit without loss of circuit pressure, to avoid leaks, and to ensure a tight seal avoiding risk of accidental disconnection. This circuit modification resulted in an overall lengthening and sharper angle of the expiratory limb, resulting in an increased likelihood of expiratory tubing kinks proximal to the new filter. We added a short length of hard plastic splinting coil surrounding the tubing to mitigate this issue, effectively splinting the tubing and preventing kinks from occurring. The weight of the heated VADI housing (total weight = 1.02 kg with filter) was supported through the addition of a metal bracket manufactured by biomedical technicians within our Healthcare Technology Management team. The new circuit modification and heated filter was benchtested in our lab to ensure no increase in expiratory resistance when used at differing bias flows with heated humidity. Problems with condensation and water drainage have not been an issue. Delivered pressures including mean airway pressure and measured delta P were not affected by the use of the modified circuit. The filter is kept in line with the circuit and not changed during the course of oscillation treatment within our facility.

The modification of the Sensormedics 3100B high frequency oscillator circuit to include an effective heated expiratory filter allows us to use this device for severe ARDS patients who are on airborne or enhanced droplet precautions. Use of the modified circuit mitigates the risk of exposure to aerosolized expired gases for critical care staff, families and other patients and is useful in a pandemic containment strategy within acute care facilities.

1. Chan, K.P., Stewart, T.E., & Mehta, S. **High-Frequency Oscillatory Ventilation for Adult Patients with ARDS**. *Chest* 2007; 131:1907-1916. DOI: 10.1378/chest.06-1549
2. Derdak et al. **High Frequency Oscillatory Ventilation for Acute Respiratory Distress Syndrom in Adults – A Randomized, Controlled Trial.** *American Journal of Respiratory and Critical Care Medicine* 2002; 166:801-808. DOI: 10.1164/rccm.2108052

Contact Information:
Shari McKeown, Practice Leader, Respiratory Services
Vancouver Acute
JPPN 2600, 855 West 12th Ave
Vancouver General Hospital
Vancouver, BC, Canada
Office – 604-875-4201
Mobile – 604-837-9198
Email – shari.mckeown@vch.ca

CareFusion SensorMedics 3100B Oscillator circuit specs:
- Flex patient circuit with dual heated wire, FP850 (16390-102)
- Bellows/water trap (p/n 766897)
- Control tubes (11438)

Tyco OmniFilter Bacteria Filter (Reusable) specs:
- Size 8.9 cm diameter x 14.6 cm long
- Resistance to Flow: 2.5 cmH20 at 100 L/min
- Filtration Efficiency: 99.97% retention of particles 0.3 microns or larger
- Leak Tested: 3psi (211 cmH20) internal pressure

VADI® Bacteria Filter Heater specs:
- 100-120V, 10 watts
- Heated temp = 55-70 °C
- Physical 11.4 cm high/10.8 cm wide/11.4 cm diameter
- Weight 0.79 kg (empty) 1.02 kg (with filter)
- Construction: PC plastic with aluminum sleeve
- P/N:800-21101

Spiral anti-kink wrap:
- White Spiral Wrap
- available in 100 foot spools
- approx $100 spool
- Allied electric.com is suggested as vendor
Part # 805-3018
Manufacturer p/n = # 3 FRP 9c

Silastic connector:
- CONNECTOR, REUSABLE, 22 MM ID SILICONE
- Vendor = CARESTREAM MEDICAL LTD.
- Vendor p/n = NEW-ADP1802P
- Manufacturer = Newport Medical