

TECHNICAL BULLETIN

POWERED AIR-PURIFYING
RESPIRATOR (PAPR) IN A
HEALTHCARE SETTING



INTRODUCTION

This is a general document and is not specific to any contaminant, including viruses and bacteria.

During these unprecedented times respiratory protection will be recommended for certain workers in a healthcare setting. The recommendations often focus on approved respirators such as "N95, FFP2, FFP3 or similar." When used correctly, respirators can help reduce wearers' exposures to airborne particulate hazards but no matter how well a respirator seals to the face and how efficient the filter media is, no respirators will eliminate exposures entirely.

This document will guide you through Centurion Safety Products ConceptAir and its use in a healthcare setting.

PAPR - PRINCIPLE OF OPERATION

Contaminated air is pulled through a High efficiency particulate arrestor (HEPA) filter on the power unit. Clean, filtered air flows up the hose and into the visor breathing space for the wearer. Some clean air is expelled through intentional venting spaces between the visor and the wearer. The airflow is in one direction only and at a rate of 200 litres per minute. This higher flow of air out of the power unit into the headpiece than the wearer requires creates positive airflow and helps keep the wearer protected. Any contaminant stays on the filter unless disturbed.

PAPR – FITTING

The visor headpiece should be placed on the head and the fit adjusted using the ratchet wheel at the rear of the helmet to ensure a secure, comfortable fit. The sweatband should be sitting comfortably on the forehead and above the eyebrows for optimal comfort. The face seal should be touching the face under the chin and around the sides of the face. For very small faces, sometimes the face seal can feel too loose however due to the positive airflow design, the wearer remains adequately protected. Additionally, the face seal tension can be adjusted for comfort. The face seal is attached to the headband using hook-and-loop tape, which wraps around the headband. To increase the tension of the elastic, pull the elastic towards the headband and shorten it.

PAPR - AIRFLOW TESTING

The ConceptAir system has been designed and certified to allow the electronics to manage the airflow to the wearer. When the unit is switched on, the electronics undertake an airflow check to ensure there is sufficient air to operate the unit safely. In the event that the unit alarms, the user can check if the cause of the alarm is the filter or the battery using the visual indicators on the top of the unit. The user can undertake a manual check of the functioning of alarm by detaching the hose from the unit and sealing the outlet with their hand that the unit will recognise as a restriction in airflow and trigger the alarm.

PAPR – FILTERS

PAPR filters protect against the inhalation of airborne particles for multiple shifts and function in a different way to disposable face masks. Filters should be changed based upon your organisation's recommendations taking account of the manufacturer's guidelines. Centurion Safety Products recommend changing the PAPR filter every 3 to 5 days or in line with your organisation's risk assessment whichever is the lower. You should not wait for the 'filter blocked' alarm to sound before changing the filter. Filters should always be changed wearing appropriate PPE and following the manufacturer's

instructions and your organisation's local decontamination procedures. Filter paper media cannot be wiped clean and should be appropriately disposed of according to your organisation's requirements and according to the environment that the unit has been exposed to.

The main filters for the ConceptAir System are certified to EN12941 TH2 giving an Assigned Protection Factor of 20. This is the same assumed protection level as an FFP3 disposable mask but in a positive air system.

The main filter is a High Efficiency Particulate (HEPA) Filter, with >99.99% Viral Filter Effectiveness (VFE) >0.3 microns.

PAPR – FILTER EFFICIENCY

Filter efficiency is based on the percentage (%) of airborne particles that are 0.3 microns in diameter or larger that are filtered by the filter (i.e. the particles do not pass through the filter). Some examples are:

Please remember that all these may be negative pressure systems whilst the ConceptAir is a positive pressure system.

FFP1 & P1	At least 80% filtration efficiency
FFP2 & P2	At least 94% filtration efficiency
N95	At least 95% filtration efficiency
N99 & FFP3	At least 99% filtration efficiency
P3	At least 99.95% filtration efficiency
N100	At least 99.97% filtration efficiency

HOW BIG IS THE CORONAVIRUS, AND CAN RESPIRATORS FILTER IT?

Respirator filters are tested against particle sizes of between 0.3 microns and 1 micron but have demonstrated filtration capabilities of particles as low as 0.007 microns. Coronavirus particles are typically around 0.1 microns in size.

A recent paper* quantified that the coronavirus ranges from between 0.06 and 0.14 microns in size. The reason why filters are tested against particle sizes of 0.3-1 microns relates to how the filter media provides filtration. Particles of 0.3 microns are the most penetrating particle size (MPPS).

Particles above this size move in ways we might anticipate and will get trapped in a filter with gaps smaller than the particle size. Particles smaller than 0.3 microns exhibit what's called Brownian motion which makes them easier to filter. Brownian motion refers to a phenomenon whereby the particle's mass is small enough that it no longer travels unimpeded through the air. Instead it interacts with the molecules in the air (nitrogen, oxygen, etc), causing it to pinball between them, moving in an erratic pattern.

According to researchers this point between "normal" motion and Brownian motion is the hardest particle size for filters to capture.

* A Novel Coronavirus from Patients with Pneumonia in China, 2019

PAPR – CLEANING

The ConceptAir system can be disinfected using a $\geq 1\%$ to $< 2.5\%$ Sodium Hypochlorite (NaOCl) and/or Sodium Hydroxide (NaOH) solution in order to disinfect and prevent cross contamination.

Compatible branded cleaning/disinfection agents include: -

- Distel solution/wipes and Jet Foam (manufactured by Tristel Solutions Ltd). The solution should be at a dilution in accordance with manufacturer's recommendations.
- Chemgene HLD4H solution/wipes can be used. The solution should be at a dilution in accordance with manufacturer's recommendations.
- Clinell general purpose wipes are also suitable but contain Benzalkonium chloride an antimicrobial agent which when used over time could cause premature ageing of certain components.
- Isopropyl and Ethanol solutions or wipes may also be used but they should not contain $> 80\%$ concentration level.

Care and consultation with Centurion Safety Products should be considered when choosing an alternative disinfecting or cleaning agent for any of our products.

External surface disinfecting/cleaning only is recommended.

Prolonged exposure to, and or immersion in bleaches or any other product is not recommended.

The products are not suitable for cleaning by Autoclave process.

Do not allow any cleaning product to enter the power unit, air hose (interior) or hood/helmet air channel. If this occurs, please allow the items to air dry thoroughly before use and inspect carefully for any detrimental effect.

The ConceptAir system should be allowed to air dry once cleaned

HELMET OR HOOD

The helmet or hood and visor should be wiped clean both inside and outside. It is particularly important to clean the inside of the hood and visor following use, paying attention to the breathing zone.

PAPR UNIT, BELT & HOSE

The PAPR unit, belt & hose can be wiped clean. The battery and hose should be disconnected from the PAPR unit before cleaning. Care must be taken to not get any solution inside the motor unit or battery connection.

FILTERS

Filters media cannot be wiped clean. Filters situated inside the PAPR unit should not be disturbed unless being removed for replacement and disposal.

CENTURION RESPIRATORY PRODUCTS – CONTACT

If you would like further technical information, or any clarification regarding our Powered Respiratory Kits please contact:

techsupport@centurionsafety.co.uk or go to:

<https://centurionsafety.eu/>

Cleaning Video: <https://www.youtube.com/watch?v=5EIPzxKrn8I>

How to video: <https://www.youtube.com/watch?v=WLjRdel2hf8>



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