



## Pandemic Virus Protection Systems

### Introduction

Similar to other professions involving hazardous environments, healthcare workers who come into contact with COVID-19 patients need equipment that provides high levels of airborne virus protection. Most healthcare institutions that treat COVID-19 patients use disposable N95 masks and plastic face shields which

- (1) Do not fully protect the head and neck of the healthcare worker.
- (2) Leave marks and bruises due to tight fitting straps around face and ears.
- (3) Can be improperly worn without a tight seal.
- (4) Can be difficult to breathe through after hours of use.
- (5) Are expensive to replace every day for every healthcare worker.

A potential good solution to this problem is to provide each healthcare worker with a Powered Air-Purifying Respirator ([PAPR](#)). However, the cost of commercially available PAPRs is extremely high (\$1K to \$2K/unit) and the availability is insufficient to support the estimated 18 million healthcare workers in the United States alone. What is needed is a safe and effective PAPR design that can be rapidly mass produced anywhere in the world with standard manufacturing equipment and can be made for as low a cost as possible.

This document outlines the high-level goals, specific technical specifications, and measured performance of the PVPS PAPR.

### High Level Goals

- **Safety**
  - Positive pressure keeps virus away from staff
  - Quality replaceable air filter (HEPA) keeps breathing air clean
  - Check for filter life with simple flow meter (Like commercial PAPR machines)
  - Battery indicator allow staff to assure continuous blower function
  - (New) Air exiting the PAPR must be filtered to prevent transmission from an infected healthcare worker using the device.
- **Visibility**
  - Large replaceable visor for full viewing visibility
  - Clear hood allows safety without isolation
- **Comfort and Mobility**
  - Unit should be easy to wear while working for many hours
  - Face shield provides easy doffing and donning
  - No long hoses to keep track of
  - Wide shroud makes it possible to operate stethoscope



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- **Disinfection**

- Throw away plastic curtain to facilitate easy cleanup
- Simple shape plastic shroud can be cleaned easily with spray and wipes
- Inside of shroud can be cleaned from one person to another easily

- **Financial**

- Cost must be < \$400 for a new unit
- Operating cost must be less than the cost of using disposable respirators (N95 masks) and face shields.

### Technical Specifications

- Airflow through filter and blower must be  $\geq 6.0$  CFM (169.9 L/min)
- Weight of entire unit must be < 40 ounces (1,133.98 grams)
- Noise level inside face shield must be  $\leq 50$  dBA
- Battery life with continuous use must be  $\geq 6$  hours
- Battery status must indicate amount of battery remaining
- HEPA filter replacement time must be  $\geq 3$  months
- Assigned Protection Factor must be  $\geq 1,000$
- Unit must operate for more than 2 years in a healthcare setting

### Performance

We have conducted several performance evaluation tests including quantitative tests and healthcare provider evaluations. This section will be updated soon with the results of these tests.



Revision History			
Revision	Date	Who	Description
0	3/16/2021	Rick Avila	Creation