

## 1. Summary

This report provides results from testing conducted by the Bioengineering Department on the Anschutz Medical Campus in Aurora Colorado. Test procedures were adapted from the American National Standards Institute (ANSI) standard Z87.1-2003 [1] and guidelines compiled for the Journal of Occupational and Environmental Hygiene [2]. This test does not assess mechanical impacts.

### 1.1. Test Articles

Test articles reported on are described in Table 1.

*Table 1: Test articles.*

Test Article	Part #/Lot #	Number of Samples	Material	Date
Prusa RC2/3 v2	Not Provided	2 Shields 2 Halos 2 Rubber Bands	PETG PETG	Original Tests: 4/8/2020 4/9/2020
Make4Covid Titan Face Shield w/ Visor	Not Provided	2 Shields 2 Halos 2 V1 Visors 2 V2 Visors 1 TPU Band	PETG PETG PETG PETG TPU	Original Tests: 4/20/2020

### 1.2. Summary of Reconfiguration

The purpose of the following tests was to see if reconfiguring the Prusa v2 shield with visors from the Titan system would modify previous relevant test results. Initially, when using the full Prusa v2 system with the visor addition, neither visor models were able to attach to the assembly due to greater shield height (Figure 1A). Flipping the halo facilitated visor attachment successfully in the reconfigured device (Figure 1B). Both visor models were able to attach to the Prusa v2 system successfully when shield height over the halo was minimized.



*Figure 1: (A) Titan vs. Prusa V2 shield height. (B) New configuration.*

## 2. Additional Results

### 2.1. Usability

Halo flexure did not cause either visor model to pop off, including during donning and doffing (Videos in VisorConfig2 Folder).

### 2.2. Spray Testing

Halo flipping was previously used to reduce liquid penetration in the visor-less Prusa v2 system (Figure 2). With the addition of both visor models, no liquid penetration was observed (Figure 3).

## 3. Additional Conclusions

The addition of a visor has allowed the Prusa v2 system to pass spray testing. Additionally, the Prusa v2 halo has improved usability over the titan system

since flexure does not cause the visor to pop off. Given that many shield configurations are possible within these systems, visual cues on the device could ensure users can quickly assemble the system (ie. "This Side Up!"). Recommendations regarding forehead padding, the elastic strap, and shield films still remain: added padding would reduce irritability, a non-sticky elastic strap would prevent hair pulling, and peeling up the shield films slightly before shipping would improve usability.

## 4. References

- [1] American National Standards Institute. "ANSI Z87. 1-2003 Standard Practice for Occupational and Educational Eye and Face Protection." (2003).
- [2] Roberge, Raymond J. "Face shields for infection control: A review." *Journal of Occupational and Environmental Hygiene*, 13.4 (2016): 235-24

Spray Test 1: 4/8/2020



Spray Test 2: 4/9/2020



*Figure 2: Previous spray tests with visor-less Prusa V2 model.*



*Figure 3: Spray tests with visor-inclusive Prusa V2.*