An e-Hazard.com White Paper

3018 Eastpoint Parkway
Louisville, KY 40223
502-716-7073
http://www.e-Hazard.com

Arc Flash Cooling Hoods Using Fans

Hugh Hoagland, Sr. Managing Partner, e-Hazard.com
President, ArcWear.com

Updated 12/11/19

Contents

I can't see a reason for a flash suit I can't see in

Since flash suit hoods came out fogging has been an issue. Mostly this has been solved by flapping the bottom of the hood. With the advent of ASTM F2178 hood designs changed to prevent burn injury under the chin and on the eyes and mouth sensors making the hoods a little closer fitting and the bib (front) portion of the hood incrementally longer. When this happened, another issue surfaced which was oxygen in the hood. When hoods first start getting used, we often see someone put a confined space oxygen sensor inside the hood and quickly it goes off. The worker usually claims the hood doesn't meet the OSHA standard for 19.5% oxygen. This is a misuse of a confined space oxygen sensor and a misinterpretation of the OSHA law but it illustrates the issue that hoods aren't extremely comfortable. Exhaled air is about 13% oxygen so respirators and hoods will not have 19.5% oxygen in them. We have known of two instances of workers becoming dizzy or passing out wearing hoods, but oxygen deficiency was not determined to be the cause. One worker had a heart condition and the other had emphysema, so any lowering of oxygen could have affected these classes of workers. When this happened, we began working with three manufacturers to find a solution. PAPR's were installed by one and another installed a centrifugal blower, but all had issues. Claude Maurice and I at the lab developed the first fan system for hood installation to test to see if it could work for arc. We decided not to patent the idea but to give it to the industry to see if it would work. Obviously, it caught on.

Due Diligence on Fans in Arc Exposures

Where to place fans.

When the fans were developed our first agenda was to make them work and to assess their safety. The first company decided to install them in the rear of the hood for counter balance with the shield to make the hood more comfortable and to let the air move around the head to avoid dry eye issues. Additionally, it was considered the safest place for installation since it is less likely to receive direct arc flash energy. Side placed fans have been shown to be effective too.

Does a fan need to be covered?

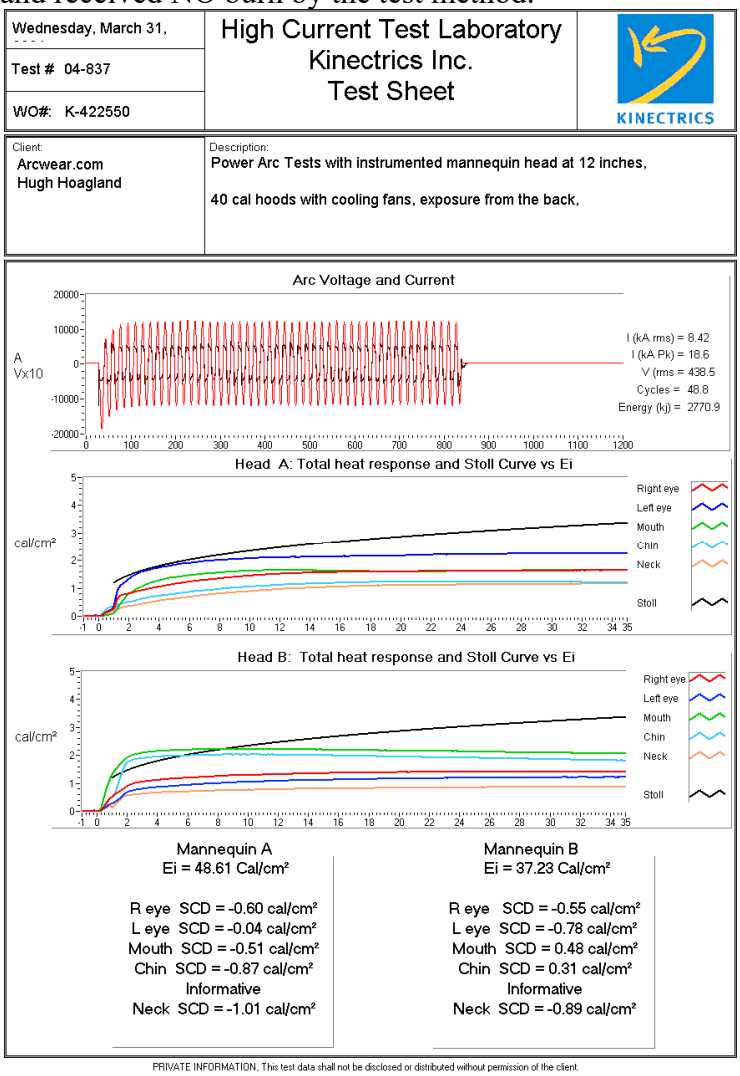
Pretty quickly on in was decided the fans should be mostly covered to prevent direct contact from an arc and possible fan ignition.

Can an arc travel through the fan?

This is unlikely. The arc is ionized gases. The arc propagation will be away from the energy source and to continue will have to be electrically connected to the source. Upon passing through a fan the air currents will be disrupted extinguishing the arc. This is like the way some breakers operate.

What about the hot, toxic gasses in the arc won't they be drawn in by the fan?

To test this theory, we have tested three different fans and fan designs. In all three cases we cut the covers off of the fans, left the fans running and exposed them to an arc flash equal to the rating of the hood. In all cases we measured no substantial temperature rise inside the hood with the F2178 set up. The worst-case scenario was tested once when we installed a hood with a larger fan on the mannequin with the fan blowing onto the face sensors. We discharged the arc into the face and the fan was running, uncovered straight onto the sensors. Two of the four sensors showed no predicted second degree burn and two showed second degree burn but this was less than ½ cal/cm² greater than the Stoll Curve Criteria. Just a slight second-degree blister burn. The fan running with the cover on received more than the rating of the hood and received NO burn by the test method.



A second type of hood system from a second manufacturer was made of another material which displayed more smoking in arc exposures. This hood fan was pouring more smoke OUT of the hood than was in the room from the arc. The fan might have saved the worker from breathing the smoking from the hood. This test is one of the reasons I recommend hoods with materials which have low afterflame times AND low smoke production. It should be noted we have on positive evidence of hood performance in electric arc and even the hoods which produce the most smoke in arc flash have saved lives every time on record. A small amount of smoke from an arc flash hood or an arc flash is unlikely to injure a worker. The breathed in unprotected face is much more likely to suffer injury. We also have NO record of lung burns under hoods with or without fans. Several with no hoods have died from inhalation burns.

Points to Consider

What features should I want when choosing a hood with a fan?

1. Choose a fan system which has been arc tested to assure the design doesn't ignite.
2. Choose one which doesn't cause dry eyes (wear it to see).
3. Check the noise level of the fans and durability.
4. Can they be removed for laundering?
5. Do they give sufficient air flow for comfortable breathing?
6. How long do the batteries last? Can they be recharged? Are they commonly available?
7. Can I replace the fan if defective or damaged or do I have to purchase a new hood?
8. Is the design of the hood well balanced?
9. What is the after-flame time on the hood and what is the extent of the afterflame visually (requires an expert opinion)?
10. Do you work in a hazardous atmosphere? (FANS DO NOT FILTER AIR TO MAKE IT BREATHABLE.) The surrounding air must be 19.5% oxygen coming in and free of hazardous contaminates or you must reevaluate and protect the respiratory system with additional or other means.

Hugh Hoagland owns two companies which focus on arc flash testing and electrical safety and arc flash training. He may be reached at hugh@e-hazard.com or 502-314-7158.