

## General Recommendations for Filter Eyewear

Author's note: this document was originally written in 2002, and since then research has shown that there are hazards in the visible light range (see: Visible Light Hazards and the Glassworker). That document is the most up-to-date information available at this time. I have edited this document to reflect current thinking to keep confusion about our recommendations to a minimum.

I am asked quite frequently to give my recommendations on what eyewear should be worn for a particular task. This is a difficult problem because of the complexity of the equation: Glass type, torch and gas combination, personal requirements, etc. The following commentary is a distillation of on-line discussions over the past 12 years or so. Note that these are general recommendations based on general usage. Your particular situation may require more protection.

## General Recommendations

The main concern for lampworkers (or torch-workers in general) is IR radiation. NIOSH feels that normal glassworker eyewear is adequate to shield the eye from this radiation. This final conclusion from 2769 (NIOSH HETA 98-0139-2769): Page 7, Discussions and Conclusions, 6th paragraph: "... Since the levels of optical radiation produced in these glass bead operations are generally below occupational exposure levels, many beadmakers may believe that they do not need to wear any type of eye protection. NIOSH investigators believe that appropriate eyewear needs to be worn for the following reasons:

- To minimize sodium flare and IR levels.
- b) To protect the eyes from broken glass.
- c) To prevent burns of the eyelids."

While sodium flare is NOT hazardous, it is difficult to see through and filtering it out serves the wearer of such glasses well by allowing them to see their work and see the glass as it changes temperature. The key here is the word minimize. You do not have to eliminate IR from your workplace. Incidental IR exposure takes place all the time, and eliminating it with the technology available today would cause additional problems (example: the inability to discern the color red).

UV is not a major concern to anyone who wears glasses. This is because most optical materials today do an excellent job of filtering UV to about 380 nm. UV radiation injury from any source is almost impossible for anyone who wears glasses of any kind.

However, if you do not wear glasses, a pair of plano (non-prescription) safety glasses will provide all the UV protection you will need.

Sodium flare is filtered by didymium and the didymium variants. The only distinguishing factor is the additional filtration that is provided by the variants. These additional filtration lines serve to help the wearer by eliminating a higher percentage of the sodium flare, as well as distinguishing color temperatures.

IR is much more difficult to filter out because it is so pervasive in everything the hot or warm glass worker does. With so many varieties of work and IR sources, it becomes difficult to choose the best type of eyewear for a specific task. For furnace/kiln/glory-hole workers, a lens that offers good visible light transmission is required for workplace safety as well as excellent IR protection.

Contrary to popular belief, a gold-coated lens, does not by itself, filter a sufficient quantity of IR to justify the cost or loss of visible light transmission. A white lens coated with 99.99% pure gold still transmits up to 25% IR energy from 1000 nm to 2500 nm. What is required instead is a lens that absorbs IR. There are several varieties of lenses, beginning with the welder's series.

A shade 2.0 welders lens has an average IR transmission of 5% from 1000 nm to 2500nm, while a welders shade 2.5 has an average of just 2.5% in that same range. The shade 2.0 has an averages 25% visible light transmission with a peak of 40%, while the shade 2.5 averages 15% with a peak of 22.5%.

Another type of lens is the IR absorber. An IR absorbing glass type, like the Schott KG series, is used in the AGW™ series filters supplied by Aura Visual Concepts. These filters provide truly excellent IR absorption from about 800 nm to over 3,000 nm. These are the same filters used in IR laser protective eyewear.

On final way to block IR is to stack ¼" tempered plate glass with an air gap. Two or more sheets will provide approximately 80-85% IR filtration until they absorb enough energy to become IR radiators themselves.

The key point to remember in selecting proper eyewear is that you need good visible light transmission coupled with any additional IR protection that you may require. Dark lenses are hazardous to wear: you cannot see anything unless you are either outside or using floodlights in your studio. As soon as you move away from the furnace/glory hole, you cannot see. How are you going to take your glasses off when you have both hands on the punty?

One additional thought – the eye is a marvelous machine: it has its own brightness filter: the pupil. When the light is too bright, the pupil closes down. When it is dark, the pupil opens up. However, when we fool the eye with dark lenses, the pupil opens wide – allowing any hazardous radiation that the dark lenses do not filter to flood into the eye. A lighter colored shade allows the pupil to help protect the more delicate and sensitive structures of your eye.

Ask to see transmission charts before you buy protective eyewear. If the eyewear supplier cannot or will not provide transmission charts, find another supplier. Remember that price does not always indicate that you are getting the best product for the money. And finally, what is good for someone in one shop is not necessarily good for you in yours.

## Myth, Superstition and Urban Legend

### UV Hazards – Myth

Unless your work or torch/furnace exceeds 5000 degrees F, there is NO UV hazard. Small amounts of UV are generated, but they are absorbed by any eyewear you may choose to wear. If you are working quartz, be aware that heating quartz generates vast amounts of UV, so quartz workers should wear additional UV protection or select filters that provide sufficient UV protection.

### Sodium Flare – Myth/Superstition

Sodium Flare is NOT a hazard to the eye. It is an inconvenience, a distraction. It can be bright enough to hide your working area. It will not burn your retinas. It will not give you cataracts or glaucoma.

### Visible Light Hazards – Not a myth

There are cases where too much light is no good either, especially when working borosilicate glass. Borosilicate glass requires higher temperatures to work (See IR Hazards) and because of these high temperatures, the color flares are much brighter. Some color flares, like dark cobalts and silver, can require as much as a shade 8 or darker filter. Green glass types have a very strong potassium flare, and until we find a notch filter for it, shade 8 is the only filter available for it.

### IR Hazards – Definitely not a myth

This is where general knowledge seems to break down. Most glassworkers, especially Hot Shop workers (traditional glassblowers, fusers, slumpers, and casters) totally ignore the IR hazard, thinking that didymium lenses are sufficient protection. Look at a transmission chart for didymium, and you will see that didymium transmits over 70% IR.

Hot Shop and borosilicate workers are exposed to extreme amounts of IR and must take steps to protect their eyes. IR causes long term, non-correctable cumulative injury to the eye. There are plenty of options available, from welding filters to high tech, nearly clear specialized IR filters.

### Urban Legends

Many books have been written about our art/craft — each has many hint, tips and suggestions about many facets of our work. As the case in point, Cindy Jenkins' book is about her particular torch, the HotHead. This torch is nothing more than a modification of the propane torch you can get at any hardware store. It is not capable of high temperature operation like many of the oxy-propane torches that many lampworkers use. Problems develop when recommendations made for the HotHead torch are applied to other torches and other glass types.

I now recommend that glassworkers under no circumstances wear clear safety glasses while working with any kind of glass torch unless they are using some other secondary filter, such as a table or torch mounted filter shield.

Working with a kiln, furnace, or glory hole requires special IR filters. Any statement to the contrary is false and hazardous to your long-term vision.

By all means, read everything you can get your hands on — but take care when reading about safety, especially when someone makes a comment 'you don't need to worry about this'. Get recommendations from several other sources, including your own physician, or eyecare specialist.

The more you know about the hazards involved, the safer you will be.

-originally written 2002-

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