Auto Darkening Filter Article
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Auto-darkening Filters 25 Years Old in 2006

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The auto-darkening filter (ADF) was developed and commercialized 25 years ago by Hornell, a Swedish company now part of 3M Welding. ADFs enable welders to see their work at comfortable light levels, but with constant eye and face protection.

Today, 3M™ Speedglas™ welding shields and helmets are among the global leaders in auto-darkening filter technology.

How the Filters Work

Each Speedglas filter, for example, is a laminate of nine layers—two replaceable protective plates, a UV/IR filter, three polarizers, two liquid crystal elements and a cover glass. The UV/IR filter continually blocks harmful radiation whether the filter is ON, OFF, light or dark. (See attached "exploded" view.)

The first layer after the replaceable protection plate is the UV/IR filter. This filter effectively blocks all but the specified visible light. The harmful infrared and ultraviolet wavelengths on either side of the visible spectrum are blocked at all times is the blue light within the visibile spectrum. The light waves allowed to pass the filter range from 380-780 nanometers.

Aided by surface-mounted electronics, the proprietary liquid crystal elements detect and orient light from the welding arc by twisting it to facilitate filtering by the

three polarizing layers. The LCDs do not, themselves, filter the light. The 3M Speedglas filters use twisted-nematic (TN) LCDs as do about 80 percent of all ADF units. Voltage applied to the TN layers causes the necessary alignment with polarizers. The amount of voltage determines the shade level.

The polarizers are oriented to block light based on the orientation achieved by the LCD layers. ADF units use two or three sets of polarizers. The Speedglas design incorporates three polarizers for increased effectiveness with darkening taking place in only .15 milliseconds.

An unenergized Speedglas filter is in an intermediate dark shade and must be turned ON to activate the light state. If anything catastrophic should happen to the filter while in use, it simply defaults to the darker intermediate OFF shade (Shade 6). As mentioned, UV/IR protection is always present.

Benefits of ADF

Properly functioning ADFs turn dark the instant an arc is struck and become semi-transparent again when welding stops. ADFs should provide full UV/IR protection at all times in accordance with ANSI Standard Z87.1-2003.

ADFs reduce the neck strain of “helmet nodding” while helping increase the accuracy of electrode placement. This, in turn, reduces the need for grinding and rework. In addition, welders can get into tighter, cramped spaces with full protection and a clear view, making awkward welds significantly easier.

Many ADF/helmet combinations offer lightweight construction. The 3M™ Speedglas™ units offer patented exhaust vents to help reduce fogging and patented side windows that greatly increase the viewing area.

Must Meet All Appropriate Regulations

ADFs should provide the same UV/IR filtration protection as traditional non auto-darkening welding filters. The filters must meet ANSI Standard Z87.1-2003 and comparable Canadian (CSA) regulations for welding safety standards.

Tips for ADF Users

- Be certain to purchase an ADF that is rated for the process and amperage range at which you intend to weld. This is especially true for TIG welding at under 50 amps and DC-inverted TIG welding at low amperage. (See ANSI Z87.1-2003 Shade Selection Guide.)
- If the ADF unit is not detecting an arc or is reacting to other arcs in a group-welding situation, set the sensitivity rating to an appropriate level based on the conditions and/or the welding process being used.
- Be certain that the sensors are not blocked either by obstructions in the workplace or dirt and grime on the outer protection plate. The plates should be cleaned often with a soap and water solution and replaced as necessary.
- Also note that the ADF/helmet selected must allow safety glasses or goggles to fit comfortably underneath in order to comply with ANSI Standard Z87.1-2003.
- Replace batteries as necessary. Look for an ADF with a battery-life indicator.

- Because electronics are involved, always keep the units dry and stored in a dry location.

ADF Costs

There is a wide range of costs for ADF filters and helmets. At low end, an ADF may be purchased for around $70. At the high end, units can run up to $400. As with any purchase, the more one pays, the more one can expect in terms of features and quality.

Can One Retrofit?

Many existing non-ADF helmets can be retrofitted with ADF units. This is rarely done, however, since the cost benefit is minimal and the new ADF-equipped helmet may offer significant benefits over an older used unit.

To Learn More

For more information about auto-darkening filters, contact 3M Welding at 1-800-243-4630 or log on to www.3M.com/welding.

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