AUTO-DARKENING HOOD WINDOWS

White Paper, February 3, 2004

Background: Since the development of arc protective faceshields and shield windows, there has been interest in the potential use of auto-darkening welding windows for arc protection.

Testing Objective: Tests were recently conducted to determine the arc protective performance of auto-darkening windows used in a welding faceshield. The objective was to determine if an auto-darkening welding window could be substituted for an arc rated shield window in order to improve visual acuity and reduce color distortion while maintaining the needed protection level from the arc incident heat energy.

Visual Acuity: A search was conducted to identify the auto-darkening window with the highest level of visible light transmission (VLT). The lightest auto-darkening window available was found to be equivalent to a Shade 4 tint or similar to the green tint of an ARC65 Hood Shield Window. This means that for arc rating levels up to 65 cal/cm^2, the VLT or visual acuity of an Oberon shield window with arc ratings up to 65 cal/cm^2 would be as good or better than with an auto-darkening window in the "clear" state. The size of the largest auto-darkening window available is five inches wide and three inches high, as shown in Figure 1.

Figure 1: Auto-Darkening Window in Welding Helmet Type Face Shield

This relatively small area would be further reduced due to the need to secure the auto-darkening window within an arc rated hood assembly, as shown in Figure 2. The resulting usable viewing area of the largest auto-darkening window available would be a small fraction of the standard viewing area of an arc rated shield, as shown in Figure 3. A comparison of Figures 2 and 3 shows that the small viewing area of the auto-darkening window would further impede range of view and visual acuity relative to a standard arc rated hood window.

Figure 2: Auto-Darkening Window in an ARC100 Hood

Color Distortion: Since the auto-darkening window has a green tint similar to that of arc rated shield windows, the color distortion issue would not be decreased by an auto-darkening window. In the process of evaluating shield windows for color distortion, it was determined that the most prominent distortion occurs with the color blue which shifts to green, and yellow which shifts to white. Other colors are not significantly distorted by the tinted shield windows. There is a relatively small shade change for greens and a minimal change or no change for blue, red, orange, yellow, and gray.

Figure3: Auto-Darkening Window in an ARC100B Hood

Cost for an Auto-Darkening Window: The cost for an

Mailing Address:
PO Box 61008
New Bedford, MA
02746-0008

Telephone: 800/322-3348
Facsimile: 508/999-4443
Internet: www.oberoncompany.com
E-mail: Sales@oberoncompany.com

Shipping Address:
22 Logan Street
New Bedford, MA
02740-7324

auto-darkening window with a viewing area of three by five inches is approximately $200. Figure 1 shows the three by five inch auto-darkening window fitted into a wrap-around, helmet type welding face shield. The cost of the auto-darkening window alone is more than the cost of an arc rated face shield and comparable to the cost of an Arc Rated hood with a protection level in the range of 50 cal/cm^2.

Auto-Darkening Window Arc Exposure Test Results: The auto-darkening window test specimen consisted of three independent layers, an outer layer of green tinted plastic plate for scratch and abrasion protection, a clear/dark glass middle layer which included the auto-darkening mechanism, and an inner layer of clear plastic. The auto-darkening assembly was 4.5 inches by 5.25 inches, but the viewing area of the window was only three by five inches.

Figure 4: Auto-Darkening Window in Welding Helmet After Arc Exposure

The auto-darkening window was first tested as received in the wrap-around welding helmet shown in Figure 1. Figure 4 shows the welding helmet assembly after it was subjected to a moderate level arc exposure with an incident energy level of 21.7 cal/cm^2. The testing was conducted according to the ASTM F2178 Standard Test Method, but only a single exposure was done. The outside layer of tinted plastic material was somewhat charred but remained intact within the assembly. The glass window layer appeared undamaged and was still functional using the on/off darkening switch. The inside layer of clear plastic was undamaged. The black plastic "helmet" material was slightly degraded. The eye, mouth and chin sensor did not indicate a second-degree burn injury. The optional neck sensor did indicate a second-degree burn, but this area was not covered by the welding helmet assembly.

A second test was conducted with the auto-darkening window fitted into an ARC100 Hood as shown in Figure 2. Figure 5 shows the auto-darkening window and hood assembly after a very high-level arc exposure with an incident energy level of 89.7 cal/cm^2.

Figure 5: Auto-Darkening Window in ARC100 Hood After Arc Exposure

Arc testing was conducted according to the ASTM F2178 Standard Test Method, but only a single exposure was done for each test specimen. The outside layer of tinted plastic material was heavily charred and fell out of the window assembly immediately after the arc exposure. The glass window layer had an oily film on the outer surface but appeared undamaged and was still functional using the on/off darkening switch. The inside layer of clear plastic material was undamaged. None of the head or neck sensors indicated a second-degree burn injury, i.e. the eyes, mouth, chin and neck were shielded from the very high incident energy of the arc exposure.

Conclusions: The auto-darkening window performed comparably to arc rated shield windows in providing protection from moderate to high levels of arc incident energy. The available auto-darkening windows do not offer increased visual acuity or reduced color distortion to electrical workers versus arc rated shield windows. Relative to commercially available arc rated shield windows, auto-darkening windows are unattractive alternatives due to their significantly reduced viewing area and high cost. A welding helmet with an auto-darkening window would not provide protection to the sides or back of the head if the arc exposure occurred from the back or to the side of the worker.