Welding helmet

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A **welding helmet** is a type of headgear used when performing certain types of welding to protect the eyes, face and neck from flash burn, ultraviolet light, sparks, infrared light, and heat.

Most commonly used with arc welding processes such as shielded metal arc welding, gas tungsten arc welding, and gas metal arc welding. Welding helmets are necessary to prevent arc eye, a painful condition where the cornea is inflamed. Welding helmets can also prevent retina burns, which can lead to a loss of vision. Both conditions are caused by unprotected exposure to the highly concentrated ultraviolet and infrared rays emitted by the welding arc.[1] Ultraviolet emissions from the welding arc can also damage uncovered skin, causing a sunburn-like condition in a relatively short period of welding.

The modern welding helmet used today was first introduced in 1937 by Willson Products.[2]

Most welding helmets include a window covered with a filter called a lens shade, through which the welder can see to work. In most helmets, the window may be made of tinted glass, tinted plastic, or a variable-density filter made from a pair of polarized lenses.

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Speedglas Auto-Darkening Filters

In 1981, a Swedish manufacturer named Hornell introduced the Speedglas Auto-Darkening Filter, an LCD electronic shutter that darkens automatically when sensors detect the bright welding arc.[3]

Speedglas welding helmet.

With such electronic auto-darkening helmets, the welder no longer has to get ready to weld and then nod their head to lower the helmet over their face. The advantage of an Auto-Darkening Filter (ADF) versus a traditional passive filter is that the welder does not need to adjust the position of welding helmet manually which not only saves time but also reduces the risk of exposure to the extremely bright and harmful light generated by the welding process.

In January 2004, 3M acquired all assets of Hornell, including the Speedglas auto darkening helmets brand name and patents. Speedglas helmets are now sold by 3M.[4]

MannGlas

In the 1970s and 1980s, Steve Mann introduced the Generation-1 and Generation-2 "Digital Eye Glass", initially as a vision aid to help people see better. Some of the early versions of this apparatus were built into welding helmets, and used for welding.[5][6][7][8][9] See also, IEEE Technology & Society 31(3)[10] and the supplemental material entitled "GlassEyes".[11] The device is an example of the full Virtuality Mediality continuum, on both the Virtuality axis and the Mediality axis, thus being able to implement, for example, Diminished Reality.[12]

In the 1980s and early 1990s, Mann invented high-dynamic-range imaging (HDR) which combines multiple images to allow highlights and shadows to be seen better.[13][7]

Safety

All welding helmets are susceptible to damages such as cracks that can compromise the protection from ultraviolet and infrared rays. In addition to protecting the eyes, the helmet protects the face from hot metal sparks generated by the arc and from UV damage. When overhead welding, a leather skull cap and shoulder cover are used to prevent head and shoulder burns.[14]

MannGlas welding helmet. Unlike Speedglas, the MannGlas helmet implements high-dynamic-range imaging (HDR) to augment the image in dark areas and diminish it in bright areas, thus implementing Computer-mediated reality.

Welding goggles

Green glass goggles are needed use for torch welding and also have ANSI standards. When viewing metal that is visibly hot (even before)(or the torch) for longer periods protection is needed for the eyes. While it seems to be low light the wavelengths are bright in non-visible spectrum. These are easier to see through and wear than helmets.

ANSI standards

In the United States, the industry standard for welding helmets is ANSI Z87.1+ which specifies performance of a wide variety of eye protection devices. The standard requires that auto-darkening helmets provide full protection against both UV and IR even when they are not in the darkened state. The standard is voluntary, so buyers should confirm that the helmet is ANSI Z87.1 compliant (indicated by appropriate labeling).

Notes

1. Elvex Safety Products *How Light Affects the Eye* (http://www.elvex.com/facts11.htm)
2. "One Piece Helmet Cut To Protect The Welder (https://books.google.com/books?id=79oDAAAAMBAJ&pg=PA217&dq=Popular+Science+1933+plane+%22Popular+Mechanics%22&hl=en&ei=RasMTuyGFYifsQLC3sGzCg&sa=X&oi=book_result&ct=result&resnum=2&ved=0CC0Q6AEwATgK#v=onepage&q&f=true) *Popular Mechanics*, August 1937 -- bottom-left of page 217
3. 3M Speedglas Auto-Darkening Welding Helmet (http://www.3m.com/product/information/Speedglas-Welding.html)
4. 3m.com (http://news.3m.com/press-release/company/3m-acquire-hornell-international-expands-safety-products-line)
5. Wworld (2016-10-04). "Best Welding Helmets: The Comprehensive Buyer's Guide 2016". Retrieved 2016-10-04.
6. Quantigraphic camera promises HDR eyesight from Father of AR, by Chris Davies, SlashGear, Sep 12th 2012 (http://www.slashgear.com/quantigraphic-camera-promises-hdr-eyesight-from-father-of-ar-12246941/)
7. IEEE Spectrum (http://spectrum.ieee.org/consumer-electronics/gadgets/why-smart-glasses-might-not-make-you-smarter)
8. IEEE Computer (http://wearcam.org/ieeecomputer/)
9. A magical welding helmet that lets you see the world in HDR–in real-time (http://moteandbeam.net/eyetap-HDR-welding)
10. Through the Glass, Lightly, IEEE Technology & Society, Volume 31, Number 3, Fall 2012, pages 10-14 (http://wearcam.org/glassage)
11. "GlassEyes": The Theory of EyeTap Digital Eye Glass, supplemental material for "Through the Glass, Lightly", IEEE Technology and Society, Vol. 31, No. 3, Fall 2012 (http://wearcam.org/glass.pdf)
12. Mann, S., & Fung, J. (2001). Videoorbits on EyeTap devices for deliberately diminished reality or altering the visual perception of rigid planar patches of a real world scene. Proceedings of the Second IEEE International Symposium on Mixed Reality, pp 48-55, March 14–15, 2001.
13. *Estimation-theoretic approach to dynamic range enhancement using multiple exposures*, by Mark A. Robertson, Sean Borman, and Robert L. Stevenson, Journal of Electronic Imaging 12(2), p220, right column, line 26219–228 (April 2003): *The first report of digitally combining multiple pictures of the same scene to improve dynamic range appears to be Mann*
14. Miller, Mark R. (2007), *Welding Licensing Exam Study Guide*, McGraw-Hill Professional, p. 5, ISBN 978-0-07-149376-5.

Further reading

- Jeffus, Larry (1999). *Welding: Principles and Applications*. Albany: Thomson Delmar. ISBN 0-8273-8240-5 .