

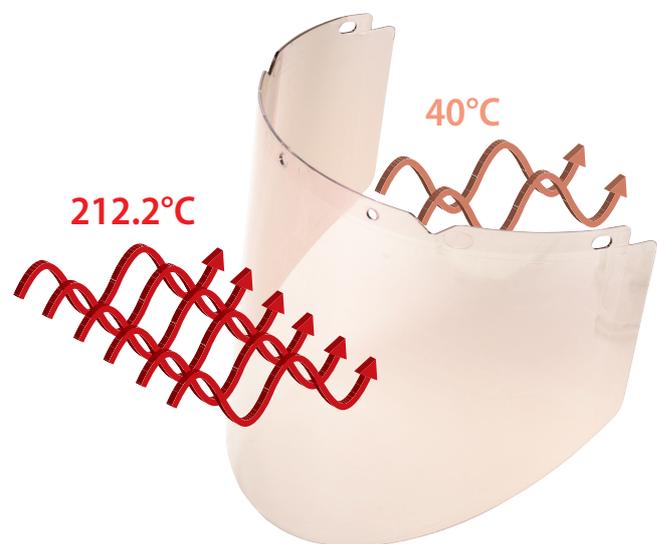


## Introduction

Controlling body temperature through workload and environmental management is critical to help prevent heat-related illness and injury. Workers in foundries, steel mills, smelters, and other elevated temperature working environments are particularly vulnerable to heat stress due to frequent exposure to thermal radiation and resulting electromagnetic radiation (EMR). Reflective-coated visors not only help distort heat, but can also help to prevent skin and eyes from absorbing EMR, including infrared (IR) and ultraviolet (UV) radiation.

Misinformation exists in the marketplace regarding reflective-coated visor performance against heat, IR and UV. As result, MSA Chemical Research and Materials Science evaluated the performance of MSA V-Gard Reflective-Coated Visors. Those evaluations determined the amount of heat in front of visors versus what eyes/face experience behind it, as well as the measurement of irradiance<sup>1</sup> at the eye.

The findings show that V-Gard Reflective-Coated Visors distort a significant amount of heat. During evaluations, temperature in front of the visor reached 212.2°C, but behind it (near the eyes) reached ~40°C<sup>2</sup> (see Figure 1). V-Gard Reflective-Coated Visors reflect 99%+ of irradiance, allowing <1% to pass through<sup>2</sup>. This finding is significant because for environments >35°C, ocular irradiance levels should not exceed 0.1 kW/m<sup>2</sup> (for lengthy exposures, >1000 seconds).<sup>3</sup> (See "Important Findings" for additional information.)



**Figure 1:** V-Gard Reflective-Coated Visor surfaces were exposed to irradiance of 9.5kW/m<sup>2</sup>. For comparative purposes, firefighters are typically exposed to radiant heat fluxes between 5-10 kW/m<sup>2</sup> during a fire.<sup>4</sup>

<sup>1</sup> EMR rate of transfer across a surface.

<sup>2</sup> When subjected to irradiance on the visor surface as indicated (either 15 kW/m<sup>2</sup> or 9.5 kW/m<sup>2</sup>) by placing it 17.8 or 24 cm respectively, from heat source of 793.3°C for five minutes.

<sup>3</sup> From Internal Commission on Non-Ionizing Radiation Protection, "Guidelines on Limits of Exposure to Incoherent Broadband Optical Radiation," 1987.

<sup>4</sup> The Commission also indicates that higher irradiance levels could be sustained for shorter periods.

<sup>5</sup> V-Gard Reflective-Coated Visors are not intended for firefighting and should not be used for that purpose.

## Important Findings

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V-Gard Reflective-Coated Visors reduce the temperature on the outside of visors versus that measured at the nose and eyes, and they significantly reduce irradiance. However, these important caveats should be considered:

1. While these visors withstood temperatures much higher than 200°C, the temperature experienced by workers under visors would likely exceed common industry understanding of "safe levels". In other words, although the visor itself may not be adversely affected, the worker wearing it could be.
2. The V-Gard frame ET (Elevated Temperature) and Thermalgard helmet to which these visors ideally attach are tested to withstand 150°C for the helmet and 177°C for the frame. Means till +150°C you can rely on the whole assembly (visor, frame, helmet), beyond this MSA did no performance tests.
3. V-Gard Reflective-Coated Visors help to prevent a significant amount of irradiance from reaching areas under visors, such as eyes and face, under the conditions stated. However, these conditions may not be the same as those in working environments. That is why it is important to select the proper visor for the temperature, distance and duration of/from an EMR source.
4. EMR consists of UV and IR; these hazards should be carefully considered when selecting Personal Protective Equipment (PPE). Visors tested and marked for proper protection levels against such hazards should be chosen.
5. V-Gard Reflective-Coated Visors are certified for EN166 "R", ensuring that the spectral reflectance of IR between 780nm and 2000nm is >60%. Moreover UV filtration is certified (see product marking or datasheet). But do to specific requirements in the EN166 the IR filtration and molten metal-resistance are not certified. Clear reflective visor has an IR transmittance of 16,1% (780-1400nm) or 10,61% (780-2000nm). The resistance to molten iron is proven (but not to molten aluminium).

### ADDITIONAL BENEFITS OF V-GARD REFLECTIVE-COATED VISORS

*Many hazards that workers face within radiant heat conditions are addressed by V-Gard Reflective-Coated Visors that offer:*

- *Thick, injection moulded Polycarbonate with best optical class 1*
- *Blocking efficient UV*
- *EN166 'R' mark, signifying that the mean spectral reflectance of IR between 780nm and 2000nm is >60%, helping to protect skin and eyes from IR exposure*
- *High speed particle resistance "B" (120 m/s) at extreme of temperatures "T"*
- *Protection against droplets and splashes of liquids "3"*
- *Clear or tinted options for dark vs. glare-riddled environments*

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<sup>5</sup> When skin temperature skin reaches 45°C, humans feel pain and tissue damage occurs. Nachum Dafny, Ph.D., Department of Neurobiology and Anatomy, The UT Medical School at Houston <http://neuroscience.uth.tmc.edu/s2/chapter06.html>.

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Rev 01, May 2014

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