
Optical Quality Requirements and V-Gard® Visors

INTRODUCTION

MSA V-Gard Visors, regardless of size, are engineered to eliminate distortion and improve impact resistance. V-Gard molded Visors are manufactured with hand-polished molds for superior optical quality. They are among the finest available in the market today, exceeding the optical requirements for many global standards, including ANSI/ISEA Z87.1-2010, CSA Z94.3 and EN 166.

WHY LENS QUALITY IS IMPORTANT

The risk created by poorly performing lenses could be dangerous and costly. Studies have shown that visual strain causes health issues, such as debilitating headaches and a higher prevalence of musculoskeletal disorders. Other studies have concluded that workplace eye strain and eye injuries are not only common, but also cost billions in lost productivity each year¹. Additionally, if a protective device impairs vision, workers tend to wear it incorrectly to compensate or remove it altogether² — strongly increasing the risk of serious injury, as well as workers' compensation claims and other costs.

Eliminating offending causes of visual discomfort can reduce health issues and improve productivity.³

Measuring Lens Quality

Safety standards provide guidance as to the requirements and test methods⁴ needed to assure that face protection products meet the applicable "Optical Requirements." Under ANSI/ISEA Z87.1-2010, faceshield protectors must:

- Be free of visible defects; and
- Have a luminous transmittance level > 85% (if the lens is clear; and
- Not exhibit > 3% haze; and
- Be within acceptable tolerance levels (as defined in the Standard) for resolving power, prism, and prism imbalance⁵.

MSA conducts strenuous testing to ensure that V-Gard Visors exceed the "Optical Requirements" of ANSI/ISEA Z87.1-2010. Tests are conducted within our own research facilities, and are also verified by third-party test facilities. This paper details what the optical quality requirements are, how we meet them, and how we compare to competitors for these measures.

Visible Defects Rejected

In addition to verification by third-party labs, each V-Gard molded Visor undergoes a manual visual inspection as part of the rigorous MSA Quality Assurance process. Visors must be 100% free of striae, bubbles, and scratches – essentially anything that would impair proper use. Once the visor passes inspection, it is carefully over-packed to prevent damage in shipping. At MSA warehouses, another visual inspection occurs and visors damaged in shipping are rejected.

Test Method

To test optical quality, V-Gard molded Visors, as well as “comparable” competitor visors, were assessed according to the “Optical Requirements” test methodologies outlined in ANSI/ISEA Z87.1-2010.

V-Gard Visors (molded, clear) and each of three competing manufacturers’ visors were checked for optical distortion using measures of luminous transmittance, haze, prismatic imbalance, prismatic power and resolving powers. Though not a requirement for faceshields, each was also checked for refractive power and astigmatism. All testing was done with visors mounted onto the applicable manufacturers' frames.

Luminous Transmittance (LT)

Luminous transmittance is an optical property that indicates the amount of light passing through a lens. A clear lens should have a transmission value > 85%; the higher the transmission value, the more pristine the lens.

Luminous Transmittance (380 nm - 780 nm)

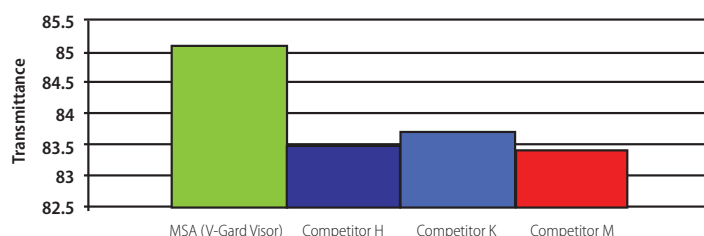


Figure 1.1: MSA V-Gard Visor passes LT ANSI/ISEA Z87.1-2010 requirements for clear, molded PC visors in this sample set.

Haze

Haze is the result of light “scattering” as it passes through an object, rather than being transmitted straight through. As haze percentage increases, clarity decreases, details are lost, and vision becomes obscured. Only clear lenses are tested for haze; products must have a haze value < 3 % to pass ANSI/ISEA Z87.1-2010.

Haze

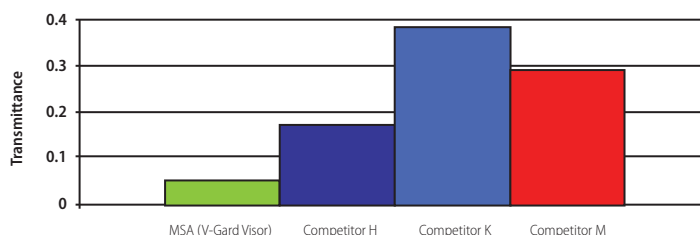


Figure 1.2: All visors meet the haze requirements in ANSI/ISEA Z87.1-2010; the lower the haze percentage, the clearer the visor.

Resolving Power

Resolving power, also known as “resolution,” is the ability of the visor to allow the wearer to see fine details and sharp, separate images when objects are placed close together. The more detail able to be resolved under specified proximity conditions, the higher the resolving power of the visor. See Figure 1.3 for a picture of the NBS-1952 Resolution Test Chart.

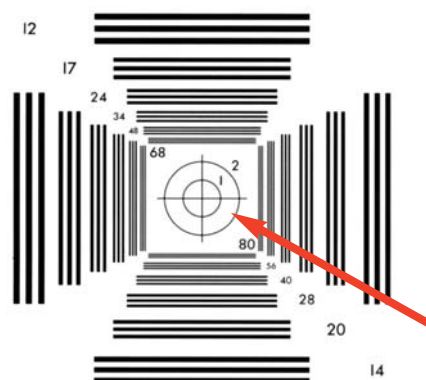
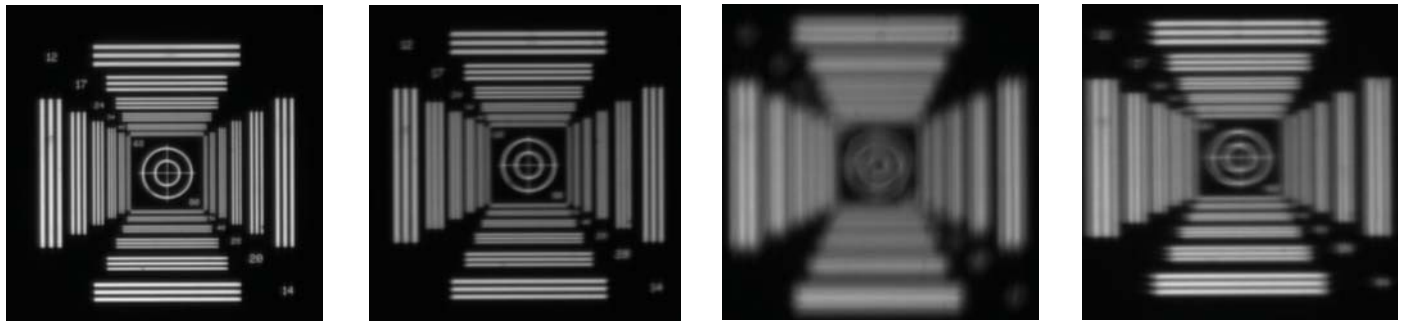


Figure 1.3: Picture of NBS-1952 Resolution Test Chart. A pattern 20 is the minimum allowable in the Standard. Resolving power increases with readable, clear patterns closer to the bull's-eye at the back of the figure.

The photos below show the MSA V-Gard molded Visor results vs. competitors' using the NBS-1952 Resolution Test Chart. ANSI/ISEA Z87.1-2010 requires at least a pattern 20 reading; however, the resolving power is greater if the bars closer to the target are crisp and distinct.



MSA Molded V-Gard Visor

Competitor H

Competitor K

Competitor M

Figure 1.4: Right eye NBS resolution readings. The MSA visor is clear and distinct to a pattern 40 (see Figure 1.5.) Competitor K does not reach a pattern 20; all others offer varying patterns of resolving power.

Prismatic Power and Imbalance

Prismatic power is the deviation of a ray of light through a specified point on a lens. Prism in a visor can be produced when the front surface is not parallel to the back surface (i.e., surfaces are tilted relative to each other). When light passes through the prism, the object viewed appears to be displaced. Imbalance occurs when the wearer sees differing prismatic effects side-to-side, or above-to-below, the optical center (point where light passes through the lens and travels straight). Prism beyond accepted industry tolerance (< .37 diopters for faceshield protectors, per ANSI/ISEA Z87.1-2010) could cause discomfort to the wearer.

Visor	Resolving Power		Prism		V Imbalance	H Imbalance (out)
	R (20)	L (20)	R (.37 max)	L (.37 max)	.125 max	.75 max
MSA V-Gard	48	40	0.028	0.034	0.004	0.006
Competitor H	34	34	0.072	0.087	0.001	0.155
Competitor K	10	12	0.153	0.054	0.004	0.172
Competitor M	20	24	0.030	0.081	0.030	0.070

Figure 1.5: Seeing things clearly. The closer the R and L prism, the less imbalanced the lens. The V-Gard Visor shows both the vertical (V) and horizontal (H) imbalance consistent and minimal, meaning the visor offers an undistorted view, regardless of whether the wearer is looking up/down or side-to-side. All visors are within tolerance.

Other Considerations for Reducing Eye Strain

To ensure that visual discomfort is minimized, there are a few more considerations when selecting a visor.

Refractive Power and Astigmatism

Irregularly shaped visors with a lack of optical symmetry cause light to bend improperly creating astigmatism (i.e., refractive error that causes objects to appear blurry). Refractive power (measured in diopters) is the ability of the lens to focus light properly, keeping images crisp. There are no astigmatism and refractive power requirements for faceshields in ANSI/ISEA Z87.1-2010. These measures were reviewed, however, because they can help assess the consistency of lens curvature and its effect on eye strain.

Visor	Refractive Power		Astigmatism
	R (.06 max)	L (.06 max)	
MSA V-Gard	0.001	0.001	0
Competitor H	0.012	0.011	0.001
Competitor K	0.070	0.054	0.016
Competitor M	0.039	0.041	0.002

Figure 1.6: The V-Gard Visor offers the lowest, most consistent measure of R/L refractive power, and the lowest astigmatism measured (among those sampled).

Anti-Fog and Anti-Scratch (AF/AS) Coatings

MSA's AF/AS coatings improve vision under tough conditions by preventing fogging and scratching that easily happens during the course of the work day. Additionally, these coatings extend the life and use of the visor, improving overall costs.

MSA offers several V-Gard polycarbonate Visors coated with AF/AS that pass EN tests for resistance to distorted vision due to lens fogging, and surface damage by fine particles, respectively. ANSI/ISEA Z87.1-2010 and CSA Z94.3 do not specify either a test methodology or marking indication, so when manufacturers claim AF/AS under either of these standards, there's no real basis for comparison.

EN tests for AF/AS are particularly difficult to pass. V-Gard Visors with AF/AS have secured EN markings (N for anti-fog and K for scratch resistance). To secure an "N" marking, four (4) water, air and relative humidity-conditioned visor samples are subjected to water vapor (steam). The time required for the light transmission levels to drop to 80% of the unfogged baseline is measured, and visors must remain fog-free for a minimum of 8 seconds. To secure a "K" marking, two (2) clean visor samples are rotated on a plate while 6.6 lbs (+ 0.11 lb) of natural quartz sand is dropped from a nearly 5 ft tall gravity-fed tube. Once the test is complete, the samples are cleaned and the measured light transmission must remain within tolerance.

Ultraviolet (UV) Protection

All V-Gard clear and green tint polycarbonate Visors offer maximum UV filtering protection. All are marked as "U6" – the highest level of UV filtering measured in ANSI/ISEA Z87.1-2010. According to the Environmental Protection Agency (EPA), UV radiation increases the likelihood of cataracts, tissue growth that blocks vision, skin cancer, and degeneration of the macula. All of these problems can be decreased through the use of eye protection that filters 99%-100% of UV rays.⁶

V-Gard Visor Geometries, Assembled "Fitness"

V-Gard Visors offer geometries that not only extend peripheral view, but also provide required coverage for EN certification. Even though V-Gard molded Visors are among the thickest available (thick enough to secure impact ratings – even using propionate material), the thickness does not compromise optical quality. More importantly, V-Gard Visor curvatures are designed to work exclusively with V-Gard Frame curvatures. The "glove-fit" compatibility between a V-Gard Visor and Frame decreases stress on the visor, and eliminates horizontal prism often introduced when a visor is flexed during the attachment procedure.

Conclusion

When we say we have the premier molded visor product in the marketplace, we mean it. V-Gard Visors exceed ANSI/ISEA Z87.1-2010 requirements by offering pristine optics, impact ratings, and measured performance on AF/AS coatings and UV protection (where offered). V-Gard molded Visors are designed to exceed customer expectations, and they set a new level of performance for the market.

1 American Optometric Association's American Eye-Q® survey (2010).

2 Banerjee A. Effectiveness of eye protection in the metal working industry. BMJ 1990;301:645-6. (20 September).

3 Hemphälä H, Eklund J. A visual ergonomics intervention in mail sorting facilities: effects on eyes, muscles and productivity. Appl Ergon. 2012 Jan;43(1):217-29. Epub 2011 Jul 2. PubMed PMID: 21726852.

4 ANSI/ISEA Z87.1-2010, sections 5.1 and 9.1-9.4, respectively.

5 The ANSI/ISEA Z87.1-2010 standard does not provide a requirement for refractive power or astigmatism for faceshields.

6 <http://www.epa.gov/sunwise/uvandhealth.html#cataracts>.

Note: This bulletin contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.



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