



UNDERSTANDING CHANGES TO

# ANSI Standards

**Z87.1, Z89.1 and Z117.1**



The 2003 revisions to three American National Standards Institute (ANSI) standards affect protective equipment and techniques used by millions of workers and safety professionals, as well as the manufacturers and testers of that equipment. While only the actual ANSI standards that cover Eye and Face Protection, Head Protection, and Confined Space safety should be followed, these highlights and summaries should help workers, safety officers, and employers understand the changes that concern you.

For more help, contact your nearest MSA distributor.

## Scope of Z87.1 - 2003

The American National Standard Practice for Occupational and Educational Personal Eye Protective Devices

ANSI Z87.1-2003 covers the same eye protectors (spectacles, goggles, faceshields, welding helmets, and handshields) as the old standard. However, the new standard has also been expanded to include performance requirements for full-face and loose-fitting respirators (for both welding and non-welding applications), many of which are the same as those for spectacle lenses.

Z87.1-2003 covers the description, general requirements, testing, marking, selection, care and use of protectors designed to minimize or prevent eye and face injuries from impacts, and non-ionizing radiation. Protectors covered by this standard are designed for use during machinery operations, welding and cutting, assembly, etc.

## Revisions to Z87.1 - 2003

Emphasizing materials instead of performance, the new standard eliminates many physical requirements such as lens thickness. Instead of prescribing how thick a lens must be, the new standard focuses on how well it resists impact or penetration.

The new standard's most significant change is the **introduction of two categories of impact resistance: basic and high**. Under the new standard, protectors offering "basic" impact protection are marked "Z87" while protectors offering "high" impact protection are marked "Z87+." This seems simple enough until you consider that old standard "Z87" and new standard "Z87+" protectors both offer roughly the same "high" impact protection.

To eliminate confusion, the new standard requires the addition of a warning label on new-standard basic impact protectors. To make sure you're using **high impact** protectors, you should look for the "Z87+" mark. **MSA recommends using only "Z87+" high-impact protectors.**

While not in the old standard, the new standard says that **protective components intended for use as part of an assembly** must be tested as an assembly. Also, component packaging must list all other components with which it has been tested. This means that, to remain in compliance, users may have to replace both visors and faceshield assemblies and/or frames.

## About MSA Products Which Are Affected By This Standard:

- With two exceptions (the Wire Screen Basic Visor and Welding Helmet Lenses), MSA's entire line of Face Protectors is marked "Z87+."
- Every permissible combination of MSA component assemblies has passed Z87.1-2003-compliant tests. To differentiate between pre-Z87.1-2003 and current products, we've added a "+" to the name of our Defender faceshield frames and changed their color. MSA's Faceshield Assemblies and Frames for use with Slotted Caps are now labeled "Defender+" and are dark gray instead of black.



Look for the manufacturer's name or mark and "Z87+" to be sure your spectacles comply with Z87.1 - 2003 High Impact performance requirements.

# 2003 ANSI Standards

Requirement	Z87.1 - 1989 (R1998)	Z87.1 - 2003
<b>Impact Resistance</b>	Single tier of impact resistance	Introduction of two-tiered performance classification system <ul style="list-style-type: none"> <li>• High Impact</li> <li>• Basic Impact</li> </ul>
<b>Impact Testing</b>	High Velocity Impact (1/4" steel ball at 150 fps)  High Mass Impact (17.6-ounce pointed projectile dropped from 51.2 inches)  Drop Ball Impact (1" steel ball dropped from 50 inches)  Plastic Lens Penetration Test (1.56-ounce projectile dropped from 50 inches)	<b>High Impact</b> <ul style="list-style-type: none"> <li>• High Velocity Impact</li> <li>• High Mass Impact</li> <li>• Plastic Lens Penetration Test</li> </ul> <b>Basic Impact</b> <ul style="list-style-type: none"> <li>• Drop Ball Impact</li> <li>• Minimum Thickness (3.0 mm)</li> <li>• Plastic Lens Penetration Test</li> </ul>
<b>Minimum Lens Thickness</b>	2.0 mm Plano 3.0 mm non-Plano	Lens thickness requirements removed in most cases; reflects standard's emphasis on performance requirements.  Exception: 2.0 mm thickness requirement for Non-Plano lenses to ensure retention in frame remains.
<b>High Velocity Impact</b> (1/4" steel ball shot at lens at 15° intervals)	Vertex at corneal front One failure in 20 allowed	Vertex 10 mm posterior of corneal front Zero failures in 20 allowed  Side coverage extended back 10 mm to provide better coverage of soft tissue area of the orbital
	<b>Improved Side Coverage</b> →	
<b>Marking</b>	Manufacturer's mark or logo "Z87"	Manufacturer's mark or logo "Z87" Basic Impact  User-removable warning tag to indicate Basic Impact protection only; helps differentiate between pre- and post- Z87.1 - 2003 Basic Impact Protectors.  "Z87+" High Impact



## Scope of Z89.1 - 2003

### American National Standard for Head Protection

The new standard was approved in July 2003 and continues to cover requirements for two types of impact-resistant helmets:

1. **TYPE I** (Top Impact)  
Helmets intended to reduce the force of an impact to the top of a wearer's head.
2. **TYPE II** (Top and Lateral Impact)  
Helmets intended to reduce the force of an impact resulting from a blow received *off-center* or to the top of a wearer's head.

The new standard's performance requirements for Type I and Type II Helmets are equivalent to those specified in the 1998 revision.

### Electrical Performance

1. **CLASS E** (Electrical)  
Helmets intended to reduce the danger of exposure to high-voltage electrical conductors, proof-tested at 20,000 volts.
2. **CLASS G** (General)  
Helmets intended to reduce the danger of exposure to low-voltage electrical conductors, proof-tested at 2,200 volts.
3. **CLASS C** (Conductive)  
Helmets not intended to provide protection from electrical conductors.

The electrical performance requirements in the new 2003 standard are identical to those in the 1997 standard.

## Revisions to Z89.1 - 2003

Helmets that provide some degree of *top* and *off-center* protection were addressed in ANSI Z89.1-1997 with the introduction of Type I and Type II helmets. In comparison, most revisions to Z89.1-2003 are minor editorial changes. For example, the description of the test headform was moved from "9.3.2 Apparatus" to "9.3.3 Mounting."

The new standard recognizes advances in material and technology. Physical requirements that did not add value or "limited design or performance" were removed, shifting the standard's emphasis to performance.

Requirement	Z89.1 - 1997	Z89.1 - 2003
<b>Physical Requirements</b>	Old standard contained 13 entries covering helmet components like headbands, sweatbands, winter liners, chin and nape straps, etc.	New standard has a single entry for accessories:  Accessories installed by the manufacturer shall not cause the helmet to fail the requirements of this standard.
<b>Test Methods</b>	<b>Impact Anvils</b> • Flat impact face • Hemispherical impact face	<b>Impact Anvil</b> • Spherical (formerly called hemispherical)
<b>Not Required</b>	<b>Z89.1 - 1997</b>	<b>Z89.1 - 2003</b>
<b>Hat Sizes</b>	6½ to 8	6½ to 8½



Z89.1-2003



## Type I (Top Impact Protection)

### V-Gard® Hats and Caps

- Popular styling, lightweight.
- Meet Class E and Class G electrical performance requirements.

### Advance™ Caps

- Vented for improved cooling.
- Non-vented for areas where a Class E Helmet is needed.
- 4- and 6-point suspensions.

### Topgard® Hats and Caps

- Uni-ridge design, comfortable fit.
- Meet Class E and Class G electrical performance requirements.

### Thermalgard® Caps

- Protect against elevated temperature.
- Meet Class G electrical performance requirements (low-voltage).

### Skullgard® Hats and Caps

- Heavy-duty, protect against elevated temperatures.
- Meet Class G electrical performance requirements (low-voltage).

## Type II (Top and Lateral Protection)

### Vanguard™ II Helmets

- Fit full range of head sizes.
- Exceed applicable test requirements of ANSI Z89.1 Standard and CSA Z94.1 1992 standard (Canadian lateral protective helmet standard).

### Super V®

- Certified to CSA Z94.1 1992 standard (Canadian lateral protective helmet standard) and meets the requirements for a Type I helmet as outlined in ANSI Z89.1 (Class E).



## Scope of Z117.1 - 2003

### Safety Requirements for Confined Spaces

ANSI Z117.1-2003 was issued in February 2003 to help protect the nearly two million American workers who enter and work in confined spaces every year. It establishes procedures, performance requirements and minimum safety requirements for confined space operations.

### Revisions to Z117.1 - 2003

Most changes to Z117.1-2003 involved definitions and procedures. For example, the definition of "Confined Space" was broadened by the removal of some language (See Table). The new standard adopts as requirements some procedures that were offered as Explanatory Information in the 1995 version.

Definition	Z117.1 - 1995	Z117.1 - 2003
Confined Space	An enclosed area that is large enough and so configured that an employee can bodily enter and has the following characteristics:  <ul style="list-style-type: none"> <li>• Its primary function is something other than human occupancy</li> </ul> <b>AND</b> has restricted entry and exit <b>AND</b> may contain potential or known hazards	An enclosed area that is large enough and so configured that an employee can bodily enter and has the following characteristics:  <ul style="list-style-type: none"> <li>• Its primary function is something other than human occupancy</li> </ul> <b>AND</b> • has restricted entry and exit
Horizontal Rescue	N/A	Methodology to move the entrant to safety while the entrant's weight is supported by the surface of the space's floor or other horizontal level within the space.
Vertical Rescue	N/A	Methodology to move the entrant to safety while the entrant's weight is supported by life-safety rope or wire. This methodology would include Diagonal Rescue where a portion of the entrant's weight is supported by a surface within the space.

Z117.1-2003



Requirement	Z117.1 - 1995	Z117.1 - 2003
<p><b>3.3.6</b> Strategies for controlling the hazards</p>	<p>3.3.6 Seek engineering solutions before using personal protective equipment</p>	<p>3.3.6 Hazards should be eliminated or controlled to the extent that an acceptable level of risk is attained prior to conducting confined space entries. The following hierarchy of control should be followed:</p> <ul style="list-style-type: none"> <li>• Eliminate the hazard</li> <li>• Substitute (material procedure, etc.) with a less hazardous replacement</li> <li>• Isolate the hazard</li> <li>• Use engineering controls</li> <li>• Use administrative controls</li> <li>• Use PPE</li> </ul>
<p><b>8.2</b> Isolation</p>	<p>The old standard offered the information to the right as "Explanatory Information." As such, it was not part of the standard. The first sentence read, "A confined space could be isolated..." The word "could" was changed to "shall" and the entry was moved from the right column to the left. In the new standard, this information is a requirement.</p>	<p>A confined space shall be isolated to prevent entry of material(s) and hazardous contaminants using one or more of the following methods:</p> <ul style="list-style-type: none"> <li>• Inserting a blank sized for the proper pressure in piping nearest to the confined space.</li> <li>• Depressurizing and disconnecting contaminant supply line(s) and providing a blank or blind on piping leading into the confined space.</li> <li>• Misaligning pipe(s) at connections closest to the confined space and capping, blinding and plugging ends.</li> <li>• Utilizing two (2) blocking valves with an open vent or bleed valve between the blocking valves. If the bleed valve is not the same diameter as the line, then the bleed point should be monitored periodically during the work shift.</li> </ul>
<p><b>3.6</b> Written Program</p>	<p>3.6 If the employer determines that employees will enter confined spaces, the employer shall develop and implement a written confined space entry program.</p>	<p>Written program requires:</p> <ul style="list-style-type: none"> <li>• Periodic written performance assessment of Z117.1 requirements</li> <li>• Establish methods to correct deficiencies</li> <li>• Assign action steps and responsibility</li> </ul>
<p><b>6.1.6</b> Instrument reliability verification</p>	<p>N/A</p>	<p>Calibration of direct reading portable atmospheric testing instruments shall be conducted:</p> <ul style="list-style-type: none"> <li>• According to the manufacturer's recommendations</li> <li>• As necessary to ensure accuracy</li> <li>• Functional (bump test) prior to each day's use</li> </ul>
<p><b>Continuous monitoring</b></p>	<p>Testing of confined spaces shall be conducted in a manner that represents the atmosphere throughout the confined space.</p>	<p>*E6.2 Continuous monitoring should be considered in situations when a worker is present in a space where atmospheric conditions have the potential to change. For example, broken or leaking pipes or vessels.</p>
<p><b>Decontamination</b></p>	<p>Cleaning or decontamination of space as preferred method of reducing or eliminating exposure.</p>	<p>Requires cleaning/decontamination of entry team members and equipment.</p>

\* explanatory information

Requirement	Z117.1 - 1995	Z117.1 - 2003
Emergency Response	<p>Written plan of action for timely rescue</p> <ul style="list-style-type: none"> <li>• Determine methods of rescue</li> <li>• Designate rescue personnel</li> <li>• Type and availability of rescue equipment</li> <li>• Summon rescuers in a timely manner</li> <li>• Train and drill attendants and rescue personnel</li> <li>• Respiratory Protection Equipment</li> </ul>	<p>Written plan of action for timely rescue</p> <ul style="list-style-type: none"> <li>• Evacuation</li> <li>• Non-Entry Retrieval</li> <li>• Rescue by trained emergency response personnel</li> <li>• Determination of rescue methods</li> <li>• Horizontal Rescue</li> <li>• Vertical Rescue (Fall Protection)</li> <li>• Type and availability of rescue equipment</li> <li>• Designation of trained rescue personnel for PRCS rescues</li> <li>• Effective means to summon rescuers in a timely manner</li> <li>• Atmospheric monitoring</li> <li>• Respiratory Protection Equipment</li> <li>• Rescue Equipment Inspection</li> </ul>

This bulletin contains a summary of major changes to ANSI Standards and is not intended as a substitute for the actual standards.

**Z117.1 (Safety Requirements for Confined Spaces)**

is available for purchase from:

American Society of Safety Engineers  
 1800 East Oakton Street  
 Des Plaines, IL 60018  
 1.847.699.2929  
[www.asse.org](http://www.asse.org)

**Z87.1 (American National Standard Practice for Occupational and Educational Personal Eye and Protective Devices)**

and

**ANSI Z87.1 (American National Standard for Industrial Head Protection)**

are available for purchase from:

International Safety Equipment Association  
 1901 N. Moore Street, Suite 808  
 Arlington, VA 22209-1762  
[www.safetysystem.com/order.html](http://www.safetysystem.com/order.html)



**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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