3M™ Head Protection
Hard Hats 101

This document provides basic information on hard hat use, testing and standards compliance. In all cases a risk/hazard assessment should be carried out and use limitations considered to ascertain the protection required.

The main function and purpose for wearing a protective hard hat is to:

1. Help protect workers from head trauma due to small objects falling from above

2. Help prevent force from transmitting down the spine if an impact from above occurs

3. Help protect from low level electrical shock (Applies only to hard hats that meet ANSI/ISEA Z89.1-2009 Type I, Class G and E.)

How does the hard hat protect workers from each hazard?

Hazard	Provides Protection
Head trauma from small falling objects 	Hard outer shell usually made from HDPE (High-Density Polyethylene), ABS (Acrylonitrile Butadiene Styrene) or other Thermoplastic material.
Force transmission down the spine from impact 	Inner suspension that is attached to the shell reduces forces that would otherwise be transmitted to the head and spine
Low level electrical shock 	Hard outer shell. The homogeneous material insulates against low level electrical shock. Not all hard hats provide electrical protection. Always review the hard hat user instructions and warnings to evaluate electrical protection.

Typical applications for the Hard Hats, when used with other appropriate PPE include:

- Construction work
- Heavy and light industrial
- Petrochemical
- Mining
- Road construction
- Forestry
- Utilities

In all cases a risk/hazard assessment should be carried out and use limitations considered to ascertain the protection required.

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Compliance Standards

ANSI/ISEA Z89.1-2009	
Overview	Establishes the minimum performance requirements for protective helmets that reduce the forces of impact and penetration and that may provide protection from electrical shock.
Impact Type	– Type I: Intended to reduce force of impact from blow to top of the head – Type II: Intended to reduce force of impact from blow to top or sides of the head

Electrical Classes	– Class C (Conductive)
	  – Not intended to provide protection against contact with electrical hazards
	– Class G (General)
	  – Reduce the danger of contact with low voltage conductors
	  – Proof-tested at 2,200 volts
	– Class E (Electrical)
	  – Reduce the danger of contact with higher voltage conductors
	  – Proof-tested at 20,000 volts

Test	Compliance to the ANSI/ISEA Z89.1 Standard means…
Force Transmission	Helmets shall not transmit a force to the test head form that exceeds 4450 N (1000 lbs). Maximum transmitted force of each individual test sample shall be averaged. The averaged values shall not exceed 3780 N (850 lbs).
Apex Penetration	The penetrator shall not make contact with the top of the head form.
Flammability	No flame shall be visible 5 seconds after removal of the test flame.
Class C	Class C helmets are not tested for electrical insulation.
Class G (Electrical)	Shall withstand 2200 volts (root mean square), AC, 60 Hertz, for 1 minute. Leakage shall not exceed 3 milliamperes.
Class E (Electrical)	Must first pass the Force Transmission Test. Shall withstand 20,000 volts (root mean square), AC, 60 Hertz, for 3 minutes. Leakage shall not exceed 9 milliamperes. At 30,000 volts, the test sample shall not burn through.

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Test Type	Summary of ANSI/ISEA Hard Hat Testing Guidelines
Force Transmission (Individual tests / Average)	• Impactor shall have a mass of 8 lbs. • Striking face of impactor shall be spherical with radius of 1.9 inches • Impactor shall remain rigid upon impact • Impactor shall be dropped from a height that yields an impact velocity of 18 ft/s. (12.2 mph)
Apex Penetration (Pass / Fail)	• Penetrator shall have a mass of 2.2 lbs., with a steel tip, a 60 degree included angle and a spherical tip radius of 0.010 inches. • Penetrator shall remain rigid upon impact. • Penetrator shall be guided and electrically insulated from metal head form. • Penetrator shall be dropped from a height that yields an impact velocity of 23 ft/s (15.7 mph)
Flammability (Pass / Fail)	• Bunsen burner is adjusted to produce a 2.0 inch blue flame with an inner cone of 1.0 inch. • The temperature of the flame at the tip of the inner cone shall be 1472 – 1652 degrees F. • The flame shall be applied so the inner cone is within 0.08 inches from the helmet surface. The flame is applied for 5 seconds. • The sample is inspected for any visible flame, 5 seconds after removal of the test flame.

ANSI/ISEA Z89.1-2009 Test Guidelines

- Total number of hats for protocol: 30
- All testing shall be performed at room temperature (73.4°F, 23°C)
- “Hot” test samples shall be placed in forced air circulating oven maintained at 120°F (48.4°C) for at least two hours.
- “Cold” test samples shall be placed in an environmental chamber maintained at 0°F (17.7° C) for at least two hours.
- “Low Temp” test samples shall be placed in an environmental chamber maintained at a temperature of -22°F (-30°C) for at least four hours.
- All hot, cold and low-temp samples shall be tested for impact and penetration within 30 seconds after removal from the conditioned environment.

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Optional Testing Requirements for ANSI/ISEA Z89.1-2009		
Requirement	Test	Designation on Warning Label
Reverse Wearing	Pass the force transmission test when mounted in the reveres position on the test head form.	
Low Temperature	Test samples placed in environmental chamber maintained at -22°F (-30°C) for at least four hours and then tested to the impact and penetration test requirements.	LT
High-Visibility	Hard hat demonstrates chromaticity that lies within one of the areas defined within Table 1 of the ANSI/ISEA Z89.1-2009 standard. (Fluorescent yellow-green, Fluorescent orange-red, Fluorescent red)	HV

Replacement Recommendations

Hard hat should be immediately replaced if subjected to impact. 3M recommends the wearer replace the hard hat suspension at least every twelve months and the hard hat shell at least every two to five years depending on work environment. Inspect the hard hat, including the suspension and shell, prior to each use. Replace at first sign of wear. Refer to user instructions for proper installation and replacement of the suspension.

Hard Hat Inspection

A hard hat shell should be inspected prior to each use. Immediately replace the hard hat if any sign of wear appears or if there is any evidence of damage, abuse or plastic degradation as this may be a sign that protection is reduced. Any hard hat that shows signs of worn or damaged parts should be removed from service immediately and replaced.

Workers in environments with higher levels of exposure to sunlight, heat, cold or chemicals should replace their hard hats more frequently than workers in other environments. If the hard hat shell becomes faded in color, exhibits a chalky appearance, or feels stiff and brittle, degradation of the shell may be occurring. A hard hat should be replaced immediately at the first sign of any of these conditions.

Hard hat suspensions should also be inspected closely for cracks, frayed straps or other signs of wear. Any suspension that is damaged must be removed from service and replaced immediately. It is recommended to replace the entire suspension system at least every 12 months.

Maintenance and Storage

Clean the hard hat and suspension with mild soap and water. Rinse and wipe dry. Do not use paints, solvents, chemicals, adhesives, gasoline or like substances on this hard hat. Store the hard hat away from direct sunlight.

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Frequently Asked Questions

Q. When should head protection be provided to workers?

A. When there is potential for:

1) Objects to fall from above
2) Contact with fixed objects (exposed beams, pipes, etc.)
3) Contact with exposed electrical conductors

Q. How does a hard hat protect the worker?

A. It helps protect workers in the following ways:

1) Resists and deflects blows to the head
2) Reduces shock to protect the neck and spine
3) Can insulate against electrical shock (Applies only to hard hats that meet ANSI/ISEA Z89.1-2009 Type I, Class G and E.)

Q. Is a hard hat compliant if worn backwards by the worker?

A. Only if the hard hat was tested to the standard with the suspension in the reverse position and the hard hat is marked with the "reverse donning" symbol.

Q. What factors can damage a hard hat?

A. All of the following:

1) Impact to the hard hat
2) UV exposure
3) Chemical exposure
4) Abuse

Q. How often should a hard hat be replaced?

A. Under any of the following circumstances:

1) Immediately if a blow to the hard hat occurs.
2) Shell – Recommended to replace every 2 – 5 years dependant on environment and use
3) Suspension – Recommended to replace at least every 12 months dependant on environment and use

There is currently no official standard or regulatory requirement for replacing a hard hat or suspension – only recommendations.

Additional Hard Hat Warnings:

- Hard hats are designed to provide limited head protection from small falling objects striking the top of the hard hat.
- Type 1 hard hats are not designed to provide front, side or rear impact protection.
- In order to provide maximum protection, the hard hat must fit securely on the head and the suspension must be adjusted to a snug fit.
- Never alter, puncture, modify or engrave the shell or the suspension of a hard hat.

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- Inspect your hard hat shell and suspension frequently. Check for cracks, frayed straps and any sign of damage before every use. Replace the hard hat immediately if you notice any signs of wear, damage, abuse or degradation.

- If the hard hat has sustained an impact, dispose of it immediately, even if damage is not visible.

- Prolonged exposure to direct sunlight will degrade the hard hat shell. Do not store in direct sunlight when not in use.

- Do not use paints, solvents, chemicals, adhesives, gasoline or like substances on this hard hat. These materials can cause deterioration to the shell's ability to withstand impact and penetration.

- Do not store objects between the suspension and the shell of a hard hat.

For More Information:

Technical Assistance	1-800-243-4630
Customer Care Center	1-800-328-1667
Internet	3M.com/OccSafety

WARNING!

3M™ Hard Hats provide limited protection only. **Misuse or failure to follow warnings and User Instructions may result in serious personal injury or death.** For proper use, see supervisor, User Instructions, or call 3M Occupational Health and Environmental Safety Division (OH&ESD) Technical Assistance.

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