

# SHOCK, IMPACT, & PENETRATION TESTING

Industrial hard hats are subjected to many types of testing to provide the best protection possible. Learn about shock and impact testing requirements for ANSI, CSA, and EN.



## TYPE I INDUSTRIAL

### APPROVALS

ANSI Z89.1-2014 R2019  
CSA Z94.1-15

### MSA HARD HATS

V-Gard® Hard Hat  
V-Gard 500 Hard Hat  
V-Gard H1 Safety Helmet  
Topgard® Hard Hat  
Skullgard® Hard Hat  
SmoothDome® Hard Hat  
Thermalgard® Hard Hat  
Comfo-Cap® Hard Hat



## TYPE II INDUSTRIAL

### APPROVALS

ANSI Z89.1-2014 R2019  
CSA Z94.1-15

### MSA HARD HATS

Super V Hard Hat



## EN397 INDUSTRIAL

### APPROVALS

EN 397:2012

### MSA HARD HATS

V-Gard H1 NoVent Safety Helmet  
V-Gard H1 BiVent Safety Helmet



## EN12492 MOUNTAINEERING

### APPROVALS

EN 12492:2012

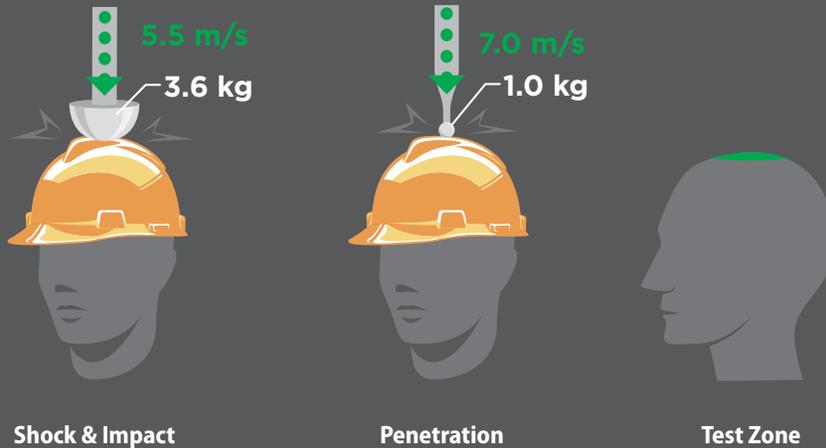
### MSA HARD HATS

V-Gard H1 TriVent Safety Helmet

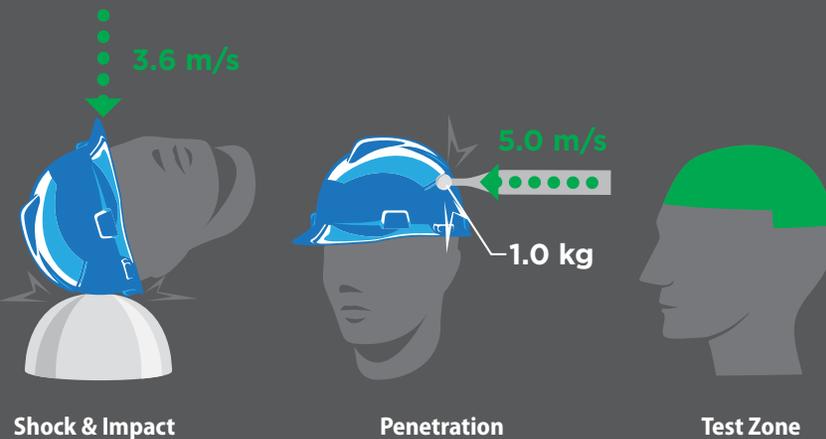
WE KNOW WHAT'S AT STAKE.

# ANSI Z89.1-2014 R2019

## TYPE I & TYPE II INDUSTRIAL



## TYPE II INDUSTRIAL



\*The lower the g value, the longer it takes your head to slow down, which means the impact will inflict less harsh force on your brain.  
 \*\*Most MSA helmets are tested to this optional standard. Check your approval label to confirm performance specifications.

**KEY:**

- High Temp.
- Higher Temp.
- Water Immersion
- Ambient Temp.
- Low Temp.
- Lower Temp.
- Solvent Wipe
- UV Exposure

## SHOCK & IMPACT

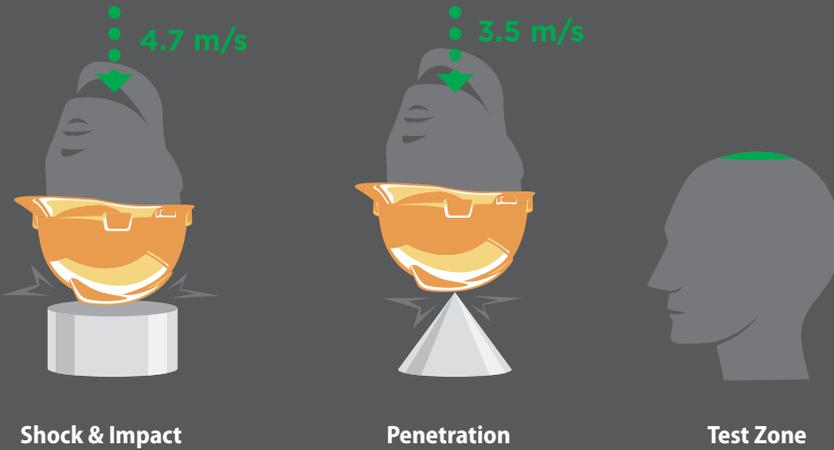
TYPE I & TYPE II INDUSTRIAL	TYPE II INDUSTRIAL
<b>Test:</b> Force Transmission <b>Equivalent:</b> Hammer falling from over 21 ft. (6.4 m) <b>Impact Force:</b> 54.5 Joules (40.2 ft.-lb.) <b>Pass Criteria:</b> Transmitted force < 4450 N (1000 lb.) Sample average < 3780 N (850 lb.)	<b>Test:</b> Impact Energy Attenuation <b>Equivalent:</b> Hammer falling from nearly 12 ft. (3.7 m) <b>Impact Force:</b> 30.6 Joules (22.6 ft.-lb.) <b>Pass Criteria:</b> Maximum acceleration ≤ 150 g*
<b>Mandatory Pre-Test Helmet Conditioning:</b> 49°C ±2°C, 2 hours       -18°C ±2°C, 2 hours	<b>Optional Pre-Test Helmet Conditioning:**</b> 60°C ±2°C, 4 hours       -30°C ±2°C, 4 hours

## PENETRATION

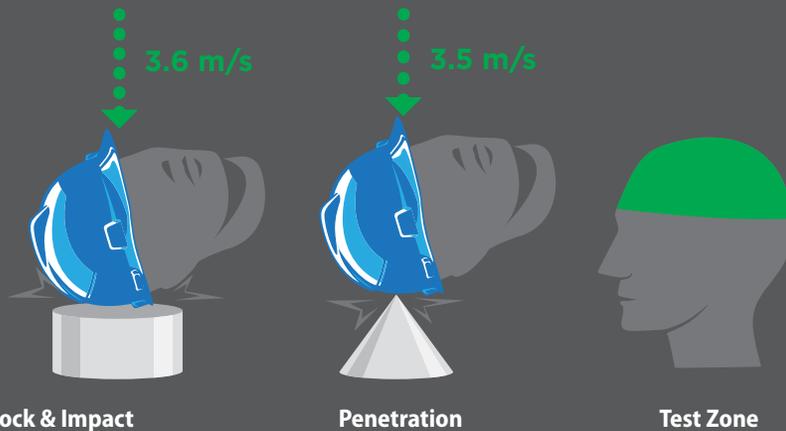
TYPE I & TYPE II INDUSTRIAL	TYPE II INDUSTRIAL
<b>Test:</b> Apex Penetration <b>Equivalent:</b> Hammer falling from over 10 ft. (3.0 m) <b>Impact Force:</b> 24.5 Joules (18.1 ft.-lb.) <b>Pass Criteria:</b> Penetrator shall not make contact with top of test headform.	<b>Test:</b> Off-Center Penetration <b>Equivalent:</b> Hammer falling from nearly 4.9 ft. (1.5 m) <b>Impact Force:</b> 12.5 Joules (9.2 ft.-lb.) <b>Pass Criteria:</b> Penetrator shall not make contact with top of test headform.
<b>Mandatory Pre-Test Helmet Conditioning:</b> 49°C ±2°C, 2 hours       -18°C ±2°C, 2 hours	<b>Optional Pre-Test Helmet Conditioning:**</b> 60°C ±2°C, 4 hours       -30°C ±2°C, 4 hours

# CSA Z94.1-15

## TYPE I & TYPE II INDUSTRIAL



## TYPE II INDUSTRIAL



\*The lower the g value, the longer it takes your head to slow down, which means the impact will inflict less harsh force on your brain.

KEY:							
	High Temp.		Higher Temp.		Water Immersion		Ambient Temp.
	Low Temp.		Lower Temp.		Solvent Wipe		UV Exposure

## SHOCK & IMPACT

TYPE I & TYPE II INDUSTRIAL	TYPE II INDUSTRIAL
<b>Test:</b> Impact Attenuation	<b>Test:</b> Impact Attenuation
<b>Equivalent:</b> Hammer falling from over 21 ft. (6.4 m)	<b>Equivalent:</b> Hammer falling from nearly 12 ft. (3.7 m)
<b>Impact Force:</b> 55 Joules (40.57 ft.-lb.)	<b>Impact Force:</b> 30 Joules (22.13 ft.-lb.)
<b>Pass Criteria:</b> Maximum acceleration $\leq 85 \text{ g}^*$	<b>Pass Criteria:</b> Maximum acceleration $\leq 150 \text{ g}^*$

### Mandatory Pre-Test Helmet Conditioning:

	50°C $\pm 2^\circ\text{C}$ , 4 hours		23°C $\pm 2^\circ\text{C}$ , 4 hours		50% toluene 50% isooctane 30 seconds
	-30°C $\pm 2^\circ\text{C}$ , 4 hours		18°C - 27°C, 4 hours		

## PENETRATION

TYPE I & TYPE II INDUSTRIAL	TYPE II INDUSTRIAL
<b>Test:</b> Penetrational Resistance	<b>Test:</b> Penetrational Resistance
<b>Equivalent:</b> Hammer falling from over 12 ft. (3.7 m)	<b>Equivalent:</b> Hammer falling from nearly 6 ft. (1.8 m)
<b>Impact Force:</b> 30 Joules (22.1 ft.-lb.)	<b>Impact Force:</b> 15 Joules (11.1 ft.-lb.)
<b>Pass Criteria:</b> Penetrator shall not make contact with top of test headform.	<b>Pass Criteria:</b> Penetrator shall not make contact with top of test headform.

### Mandatory Pre-Test Helmet Conditioning:

	50°C $\pm 2^\circ\text{C}$ , 4 hours		23°C $\pm 2^\circ\text{C}$ , 4 hours		50% toluene 50% isooctane 30 seconds
	-30°C $\pm 2^\circ\text{C}$ , 4 hours		18°C - 27°C, 4 hours		

# EN 397:2012

## INDUSTRIAL



Shock & Impact



Penetration



Test Zone

## SHOCK & IMPACT

### TYPE I INDUSTRIAL

**Test:** Shock Absorption  
**Impact Force:** 49.0 Joules (36.1 ft.-lb.)  
**Pass Criteria:** Transmitted force  $\leq$  5000 N (1125 lb.)

#### Mandatory Pre-Test Helmet Conditioning:

 50°C  $\pm$  2°C  
 20°C  $\pm$  2°C  
 -10°C  $\pm$  2°C  
 UV aging  
 4 hours      4 hours  
 4 hours      400 hours

#### Optional Pre-Test Helmet Conditioning:\*

 -30°C  $\pm$  2°C  
 4 hours

## PENETRATION

### TYPE I INDUSTRIAL

**Test:** Resistance to Penetration  
**Impact Force:** 29.4 Joules (21.7 ft.-lb.)  
**Pass Criteria:** Point of striker does not contact headform

#### Mandatory Pre-Test Helmet Conditioning:

 50°C  $\pm$  2°C  
 20°C  $\pm$  2°C  
 -10°C  $\pm$  2°C  
 UV aging  
 4 hours      4 hours  
 4 hours      400 hours

#### Optional Pre-Test Helmet Conditioning:\*

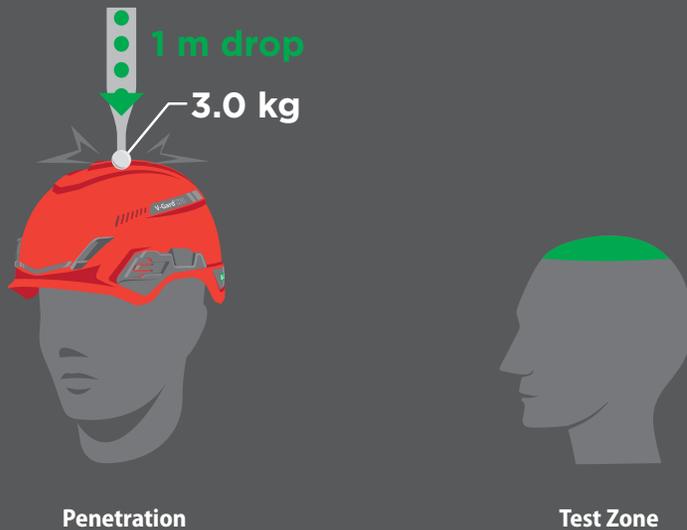
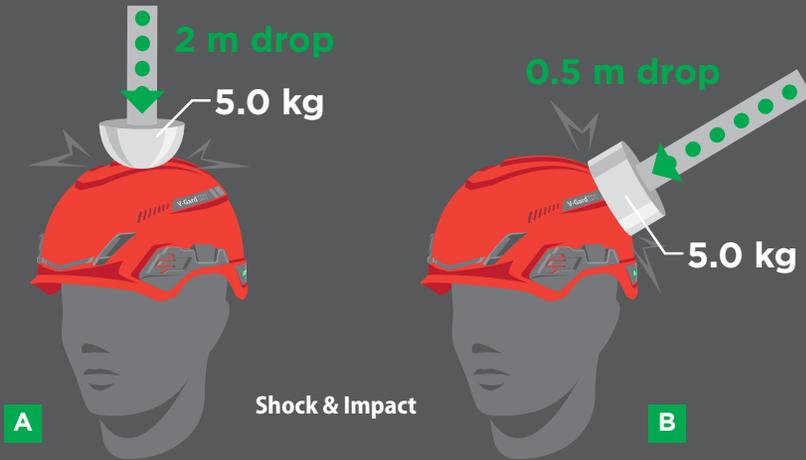
 -30°C  $\pm$  2°C  
 4 hours

### KEY:

 High Temp.       Higher Temp.  
 Low Temp.       Lower Temp.  
 Water Immersion       Ambient Temp.  
 Solvent Wipe       UV Exposure

\* MSA V-Gard H1 NoVent and BiVent Safety Helmets are tested to this optional standard. Check your approval label to confirm performance specifications.

## MOUNTAINEERING



## SHOCK & IMPACT

### INDUSTRIAL

**Test:** Shock Absorption

**Impact Force:** **A:** 98.1 Joules (72.35 ft.-lb.)  
**B:** 24.0 Joules (17.70 ft.-lb.)

**Pass Criteria:** Transmitted force  $\leq$  10000 N (2250 lb.)

### Mandatory Pre-Test Helmet Conditioning:

35°C, 2 hours    
 -20°C, 2 hours    
 23°C  $\pm$ 2°C, 4 hours    
 UV aging, 400 hours

## PENETRATION

### INDUSTRIAL

**Test:** Penetration

**Impact Force:** 29.4 Joules (21.7 ft.-lb.)

**Pass Criteria:** Point of striker does not contact headform

### Mandatory Pre-Test Helmet Conditioning:

35°C, 2 hours    
 -20°C, 2 hours    
 23°C  $\pm$ 2°C, 4 hours    
 UV aging, 400 hours

### KEY:

High Temp.    
 Higher Temp.    
 Water Immersion    
 Ambient Temp.

Low Temp.    
 Lower Temp.    
 Solvent Wipe    
 UV Exposure

# MSA—The Safety Company

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*Our business is safety. We've been the world's leading manufacturer of high-quality safety products since 1914. MSA products may be simple to use and maintain, but they're also highly sophisticated devices and protective gear—the result of countless R&D hours, relentless testing and an unwavering commitment to quality that saves lives and protects millions of hard working men and women each and every day. Many of our most popular products integrate multiple combinations of electronics, mechanical systems and advanced materials to help ensure that users around the world remain protected in even the most hazardous of situations.*

## Our Mission

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MSA's mission is to see to it that men and women may work in safety and that they, their families and their communities may live in health throughout the world.

**MSA: WE KNOW WHAT'S AT STAKE.**

Note: This Bulletin contains only a general description of the products shown. While product uses and performance capabilities are generally described, the products shall not, under any circumstances, be used by untrained or unqualified individuals. The products shall not be used until the product instructions/user manual, which contains detailed information concerning the proper use and care of the products, including any warnings or cautions, have been thoroughly read and understood. Specifications are subject to change without prior notice.

MSA operates in over 40 countries worldwide. To find an MSA office near you, please visit [MSAsafety.com/offices](https://www.MSA.com/offices).