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Nothing but HEAVY DUTY.®

# Selecting the Right Personal Protection Equipment

Tony Wilcox – Milwaukee Tool – VP Engineering
Michael Spensieri – Milwaukee Tool - Director of Safety

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# LEARNING OBJECTIVES

THIS SESSION WILL GIVE YOU INSIGHT AND KNOWLEDGE ON HOW TWO LEADING CATEGORIES (GLOVES & HELMETS) OF PPE ARE TESTED AND THE CRITERIA TO MEET SPECIFIC STANDARDS.

SELECTING THE RIGHT HELMET AND GLOVES IS A CRUCIAL DECISION FOR YOUR PEOPLE, THIS COURSE WILL HELP YOU UNDERSTAND THE DIFFERENT TESTING PROCEDURES, SHOW YOU ACTUAL TESTS PERFORMED BY MANUFACTURERS, REVIEW ANY POTENTIAL UPCOMING STANDARD CHANGES, AND GIVE YOU BEST PRACTICES TO EVALUATE DIFFERENT PPE SOLUTIONS.

**Head Protection**
- What are the types of head protection and the standards?
- How are the standards tested?
- How does this translate to construction?
- Key factors to consider when selecting Head Protection
- Where are the standards evolving?

**Hand Protection**
- What are the types of hand protection and the standards?
- How are the standards tested? Cut - Impact - Puncture
- How does this translate to construction?
- Factors to consider when selecting Hand Protection
- Where are the standards evolving?

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# INDUSTRY INFO

## 33.3MM+

workers in the United States are protected by head protection.

### Get the Facts

**195k**
Occupational head injuries reported from 2021-2022.
Source - BLS

**684**
Workers killed from intracranial injuries in 2022.
Source - NSC

**12.5%**
Percent of occupational fatalities in 2022 due to intracranial injuries.
Source - NSC

## 103.7MM+

workers in the United States are protected by hand protection.

### Get the Facts

**71%**
Of hand and arm injuries could have been prevented with personal protective equipment

**$26K**
Hand injuries are expensive, costing from $540 to $26,000, according to the National Safety Council

**454K**
Hand injuries annually in the US

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# INDUSTRY LANDSCAPE




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# PPE TESTING REQUIREMENTS

## Self Certification

- ANSI only requires self certification for both Head Protection and Gloves

ANSI

## 3rd Party Testing

- Many Labs and Agencies offer 3rd party testing
- Certified to test to ANSI, CSA, EN standards
- ***Ask your manufacturers for their 3rd party test reports***

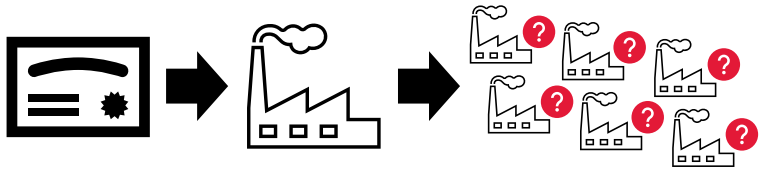

ICS INC. LABORATORIES
Test Report # T16242-01-1 Issue 1
ANSI/ISEA Z89.1-2014 (R2019)
UL LLC
Milwaukee Tool® 48-73-1300 (Front Brim Series) – Industrial Safety Helmet
UL File Number: MH6740
UL Project Number: 4789950477
2021 July 01
ACCREDITED Test Laboratory Certificate: 172181
Approved by:
Sarah Henderson
Head Protection, Hand Protection & Athletic Equipment - Laboratory Manager
Prepared by:
Shelley Brady
Head Protection, Hand Protection & Athletic Equipment - Laboratory Administrator


CERTIFICATE OF COMPLIANCE
Certificate Number MH6740
Report Reference MH6740-20210708
Issue Date 2020-NOVEMBER-21
Issued to: MILWAUKEE TOOL ELECTRIC CORP.
13135 W LISBON RD.
BROOKFIELD, W.I. 53005-2550
This certificate confirms that representative samples of: OCCUPATIONAL HEAD PROTECTION
SEE Next Page for Models
Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety: ANSI/ISEA Z89.1-2014, American National Standard for Industrial Head Protection
Additional Information: See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information.
This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.
Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.
Look for the UL Certification Mark on the product.

CSA CE UL ICS INC. LABORATORIES COLTS | Laboratories bsi

## In-Line and Re-occurring Testing

- ANSI only requires testing every 5 years* (gloves)
- If no design change is made, no additional testing required for life of the product
- Manufacturing variances, sub-supplier changes, etc. can all effect conformity
- ***Ask your manufacturers if they consistently test their product for conformity***



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# HEAD PROTECTION REVIEW- THE BASICS

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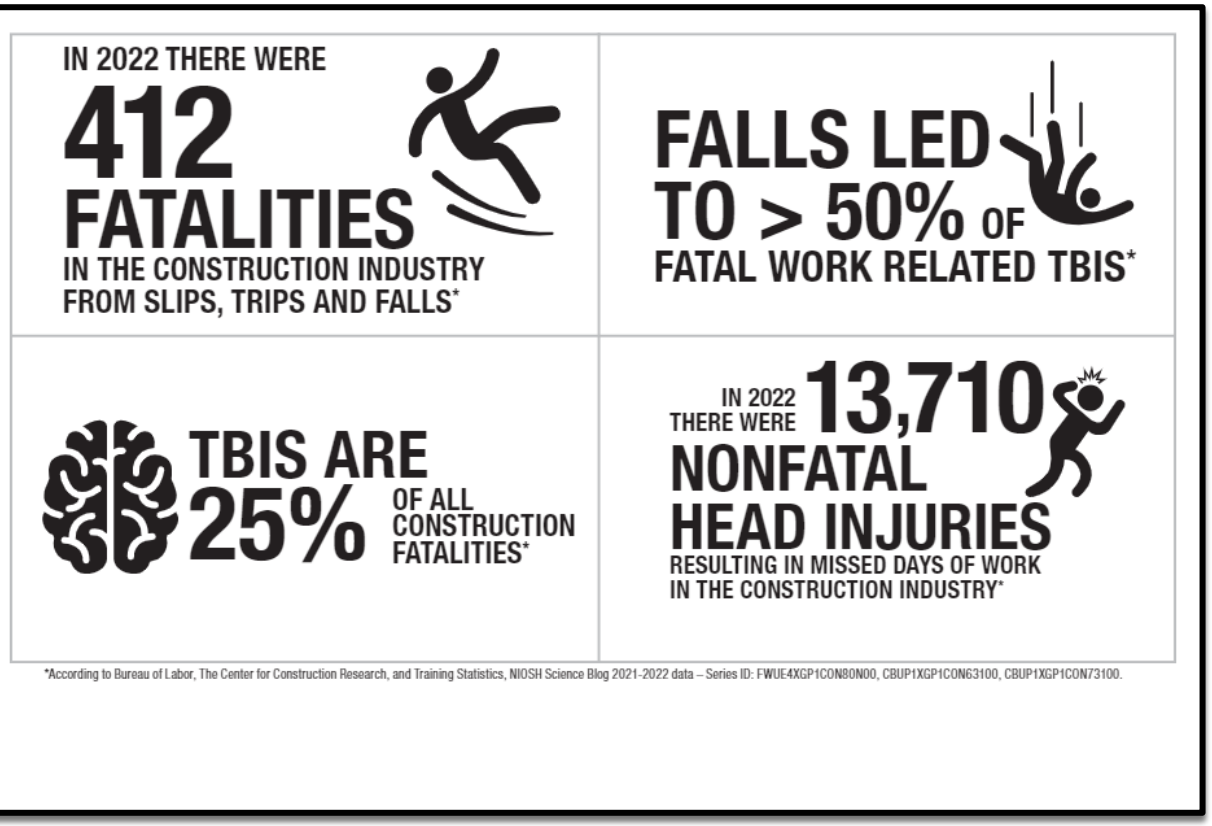
# HEAD INJURY STATS

## FREQUENCY




## COST

National Council on Compensation Insurance (NCCI)

- TBI Claims for all industries (2013-2018)
  - Average total costs per TBI claim: **$136,000**
  - Average lost-time costs per any injury claim: **$51,000**

- Mega claims (> $3 million; 2001-2017)**
  - Brain and Head Injuries for all industries:
    - 17% were **$3-5 million**
    - 27% were **$5-10 million**
    - 30% > **$10 million**

  - Mega claims over **$10 million** primarily arise from the **construction industry**, especially due to severe head and brain injuries

*National Council on Compensation Insurance: Traumatic Brain Injuries in Workers Compensation - Associated Medical Services and Costs*
***National Council on Compensation Insurance: Country Mega Claims. Obtained from: ncci.com/Articles/Pages/II_Country-Wide-Mega-Claims-Report-2020-BureauReady.pdf*

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# SAFETY HELMETS- THE STANDARDS

## ANSI Standards & Types

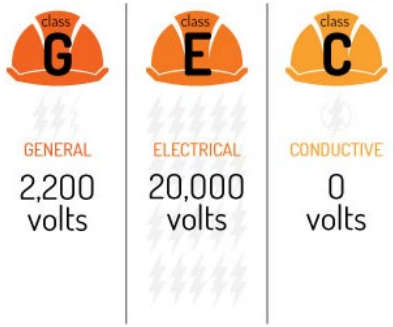
- **ANSI/ISEA Z89.1 – American National Standard for Industrial Head Protection**
- **Type I & Type II Hard Hats**
  - Type I hard hats reduce the force of an impact to the top of the head.
  - Type II hard hats reduce the force of impact to the sides or top of the head.

**Type I**

**Type II**

## ANSI & CSA Classes

- **Class G – General (Unvented)**
  - Limited voltage testing up to 2,200 volts
- **Class E – Electrical (Unvented)**
  - Tested against voltage shocks/burns up to 20,000 volts. Commonly used by electrical and utility trades.
- **Class C – Conductive (Vented)**
  - No protection against electrical hazards. Lightweight and comfortable with vents for temperature reduction.




Disclaimer: The head protection (class E) is proof-tested at 20,000 volts, but this number is not intended as an indication of the voltage at which the helmet protects the wearer.

## EN 12492 Clauses

- **EN 12492 is the European Standard for Mountaineering Helmets.**
- **Some safety helmet manufacturers in the U.S. test to certain clauses within this standard.**
  - **This is because not all clauses of this standard are relevant to the construction industry.**
- **The most common clauses called out from this standard for safety helmets in the U.S. are:**
  - **Energy Absorption Capacity clauses 4.2.1.2 (Front), 4.2.1.3 (Side), & 4.2.1.4 (Rear)**
  - **Retention System clauses 4.2.3 (Strength) & 4.2.4 (Effectiveness)**

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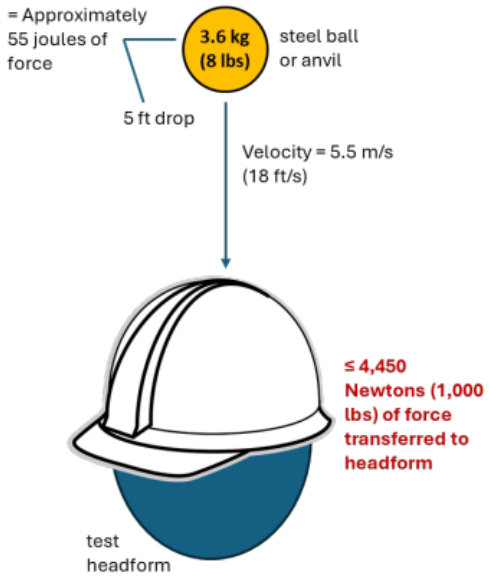
# SAFETY HELMETS- THE STANDARDS

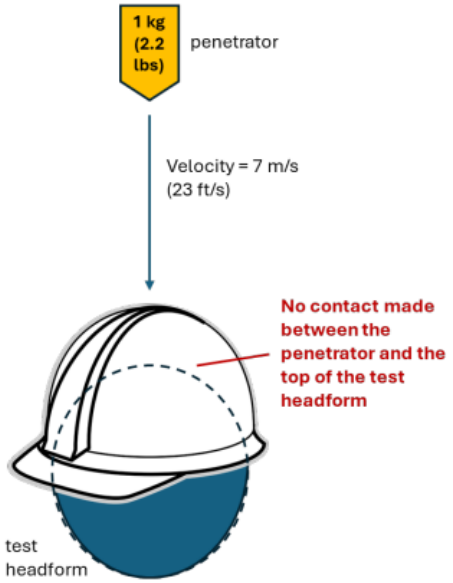
## Type I & II

Figure 1: TYPE I & TYPE II FORCE TRANSMISSION TESTING




~Hammer falling from over 21ft

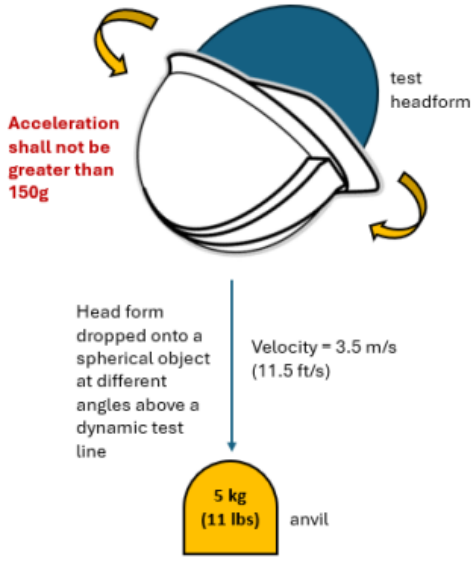
Figure 2: TYPE I & TYPE II APEX PENETRATION TESTING




~Hammer falling from over 10ft

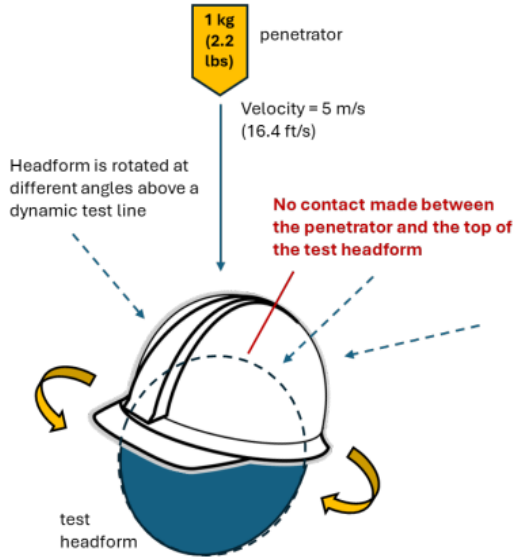
## Type II Only

Figure 3: TYPE II ONLY IMPACT ENERGY ATTENUATION



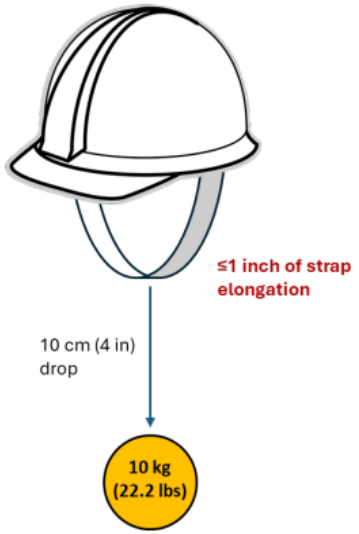

~Hammer falling from 12ft

Figure 4: TYPE II ONLY OFF-CENTER PENETRATION TESTING




~Hammer falling from 5ft

Figure 5: TYPE II CHIN STRAP RETENTION




CPWR FS-Selecting_Head_Protection.pdf

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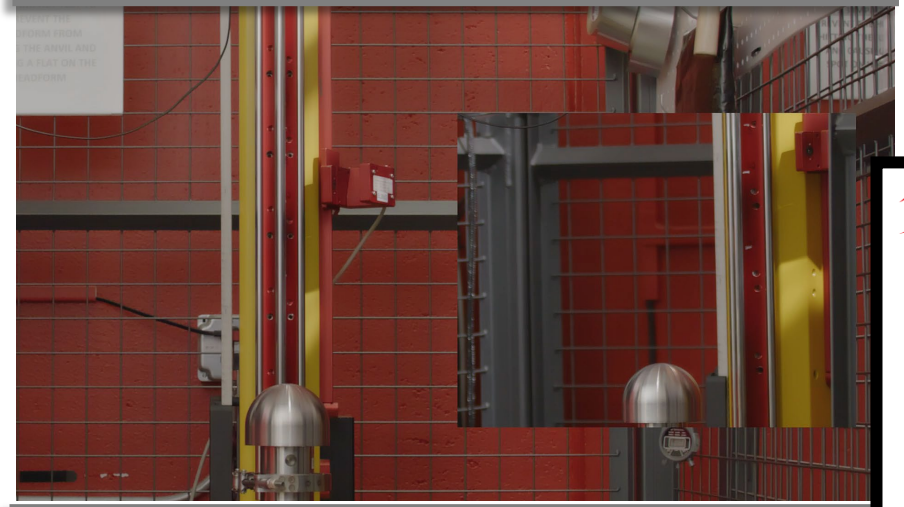
# SAFETY HELMETS- THE STANDARDS

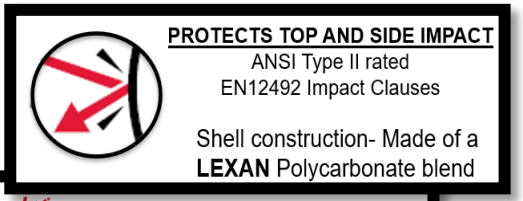
## APEX IMPACT TEST

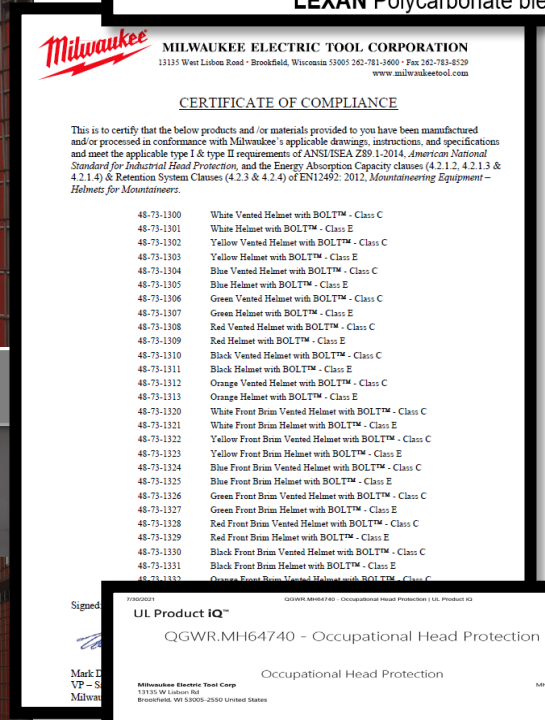
## IMPACT ATTENUATION TEST



## OFF CENTER IMPACT TEST

## FORCE TRANSMISSION TEST



MILWAUKEE ELECTRIC TOOL CORPORATION
13135 West Lisbon Road • Brookfield, Wisconsin 53005 262-781-3600 • Fax 262-783-8529
www.milwaukeetool.com

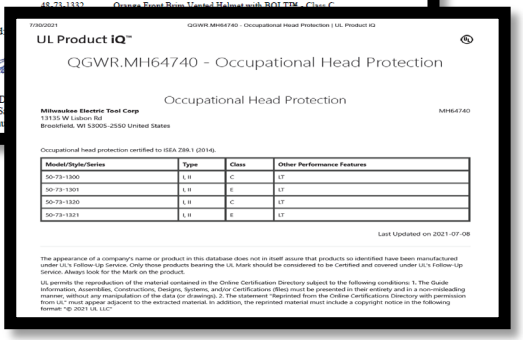
CERTIFICATE OF COMPLIANCE

This is to certify that the below products and /or materials provided to you have been manufactured and/or processed in conformance with Milwaukee's applicable drawings, instructions, and specifications and meet the applicable type I & type II requirements of ANSI/ISEA Z89.1-2014, *American National Standard for Industrial Head Protection*, and the Energy Absorption Capacity clauses (4.2.1.2, 4.2.1.3 & 4.2.1.4) & Retention System Clauses (4.2.3 & 4.2.4) of EN12492: 2012, *Mountaineering Equipment – Helmets for Mountaineers*.

| | |
|---|---|
| 48-73-1300 | White Vented Helmet with BOLT™ - Class C |
| 48-73-1301 | White Helmet with BOLT™ - Class E |
| 48-73-1302 | Yellow Vented Helmet with BOLT™ - Class C |
| 48-73-1303 | Yellow Helmet with BOLT™ - Class E |
| 48-73-1304 | Blue Vented Helmet with BOLT™ - Class C |
| 48-73-1305 | Blue Helmet with BOLT™ - Class E |
| 48-73-1306 | Green Vented Helmet with BOLT™ - Class C |
| 48-73-1307 | Green Helmet with BOLT™ - Class E |
| 48-73-1308 | Red Vented Helmet with BOLT™ - Class C |
| 48-73-1309 | Red Helmet with BOLT™ - Class E |
| 48-73-1310 | Black Vented Helmet with BOLT™ - Class C |
| 48-73-1311 | Black Helmet with BOLT™ - Class E |
| 48-73-1312 | Orange Vented Helmet with BOLT™ - Class C |
| 48-73-1313 | Orange Helmet with BOLT™ - Class E |
| 48-73-1320 | White Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1321 | White Front Brim Helmet with BOLT™ - Class E |
| 48-73-1322 | Yellow Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1323 | Yellow Front Brim Helmet with BOLT™ - Class E |
| 48-73-1324 | Blue Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1325 | Blue Front Brim Helmet with BOLT™ - Class E |
| 48-73-1326 | Green Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1327 | Green Front Brim Helmet with BOLT™ - Class E |
| 48-73-1328 | Red Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1329 | Red Front Brim Helmet with BOLT™ - Class E |
| 48-73-1330 | Black Front Brim Vented Helmet with BOLT™ - Class C |
| 48-73-1331 | Black Front Brim Helmet with BOLT™ - Class E |

Signed:

Mark D
VP – S
Milwau



7/30/2021 QGWR.MH64740 - Occupational Head Protection | UL Product iQ

UL Product iQ™

QGWR.MH64740 - Occupational Head Protection

Occupational Head Protection

Milwaukee Electric Tool Corp
13135 W Lisbon Rd
Brookfield, WI 53005-2550 United States

MH64740

Occupational head protection certified to ISEA Z89.1 (2014).

| Model/Style/Series | Type | Class | Other Performance Features |
|---|---|---|---|
| 50-73-1300 | I, II | C | LT |
| 50-73-1301 | I, II | E | LT |
| 50-73-1320 | I, II | C | LT |
| 50-73-1321 | I, II | E | LT |

Last Updated on 2021-07-08

The appearance of a company's name or product in this database does not in itself assure that products so identified have been manufactured under UL's Follow-Up Service. Only those products bearing the UL Mark should be considered to be Certified and covered under UL's Follow-Up Service. Always look for the Mark on the product.

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# OFF CENTER TEST COMPARISON

## ANSI Z89.1 - Type II

**MORE EXTREME IMPACT**
**LOWER ALLOWED FORCES**


**<1,650 LBF$_{(<150g)}$ Transmitted**

## EN12492


**<2,250 LBF Transmitted**

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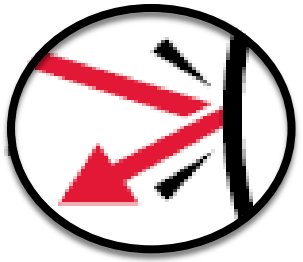
# SELECTION CONSIDERATIONS


**Users need greater side of the head protection**


**Users need to modify their helmets to use multiple PPE accessories**

**Helmet suspensions are uncomfortable and hot**

## FRUSTRATIONS



**PERFORMANCE / PROTECTION - TOP AND SIDE IMPACT**
ANSI Type II rated,
EN12492 Impact Clauses

**INCREASED FUNCTIONALITY**
Allows use with additional PPE and accessories

**COMFORTABLE PADDED SUSPENSION**
Moisture wicking and anti-microbial sweatband and liner

## SOLUTIONS

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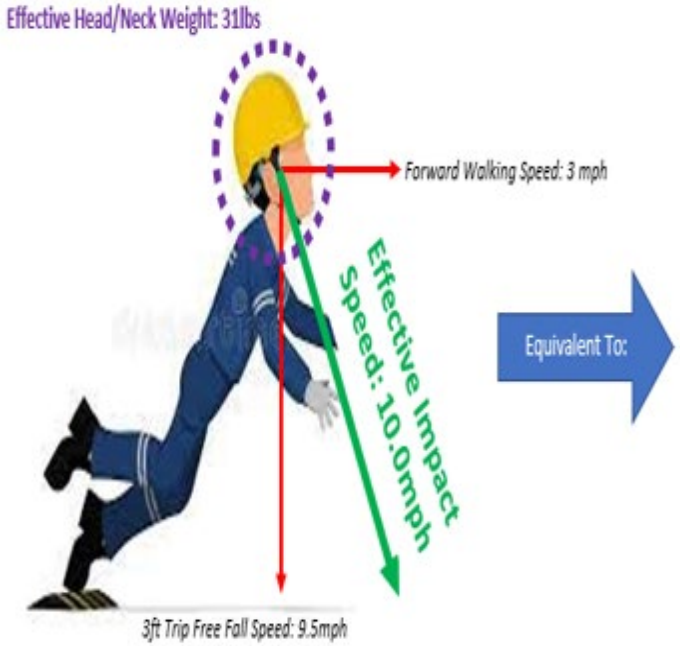
# BRAIN INJURIES- TRADE PROFESSIONAL




Equivalent To:

Being hit by a 95 MPH Slap Shot

Being hit by a 101 MPH Fast Ball Pitch.

If a person weighing 200 ILBS, walking 3 MPH trips forward hitting their head – it is the same as

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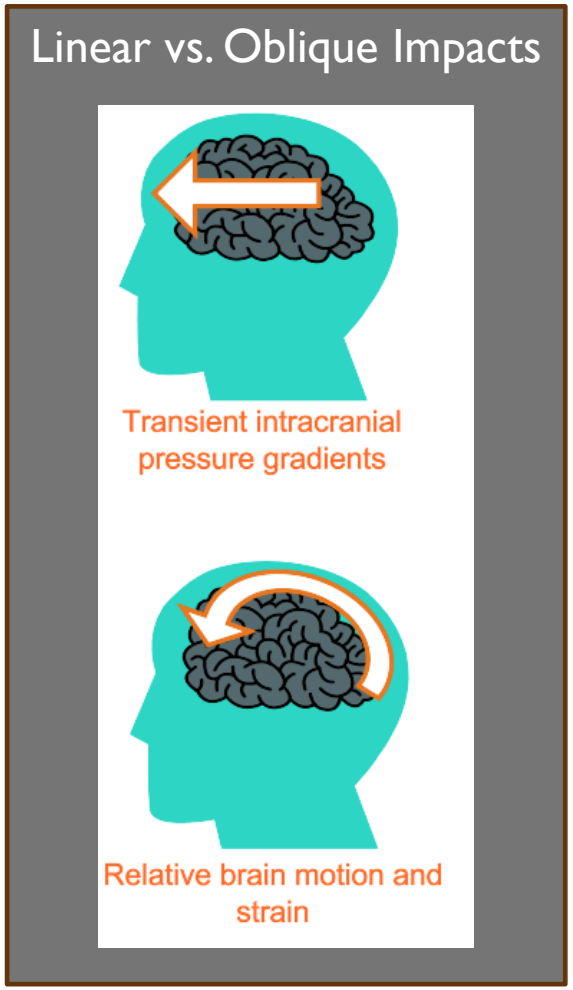
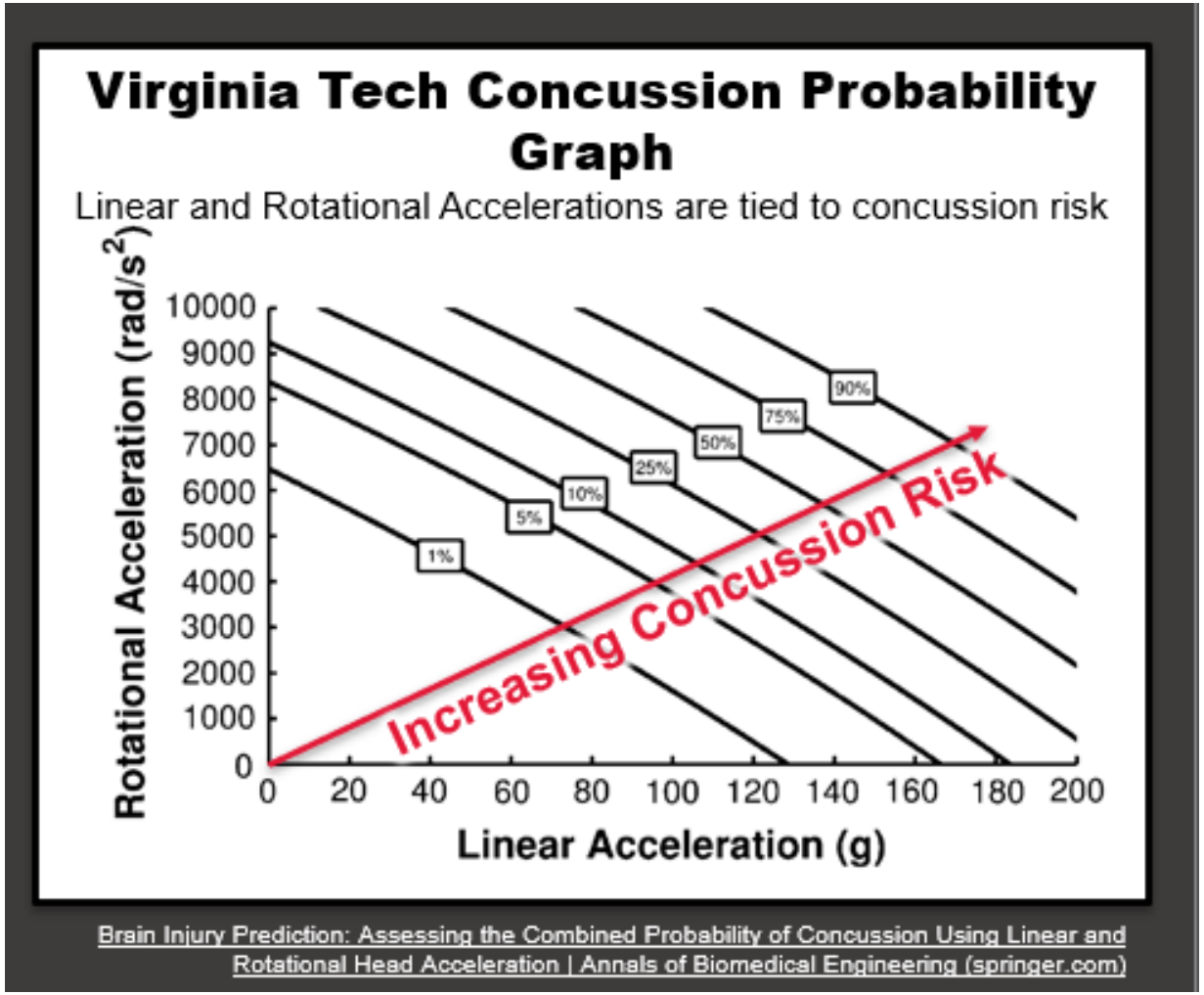
# WHAT'S NEXT FOR HEAD PROTECTION STANDARDS

**Objective:**
Develop test methods and standards for rotational acceleration performance



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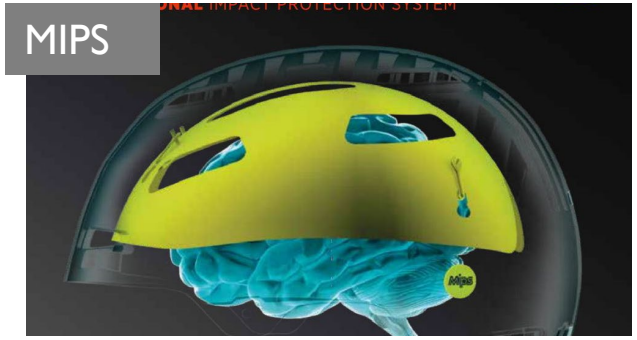
# PREMIUM SAFETY HELMETS: PROTECT FOR ROTATIONAL IMPACTS

## Helmet Impact Technologies

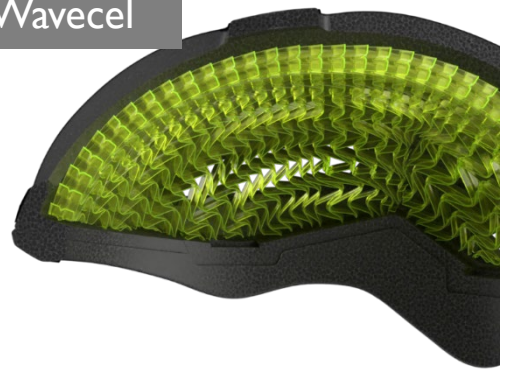
MIPS



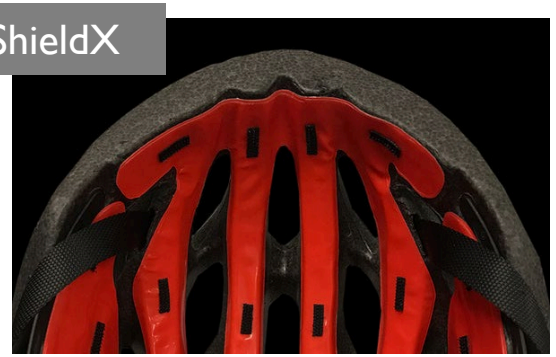
Koroyd


Rheon

Wavecel



ShieldX



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# HAND PROTECTION REVIEW- THE BASICS

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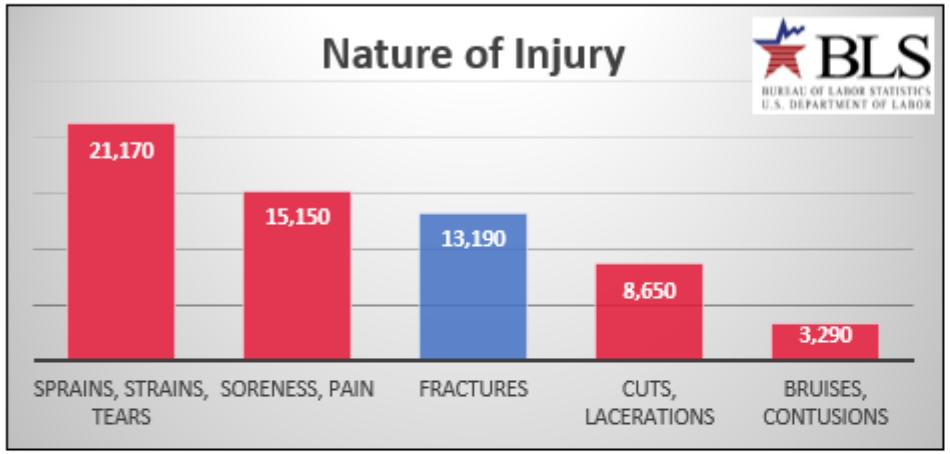
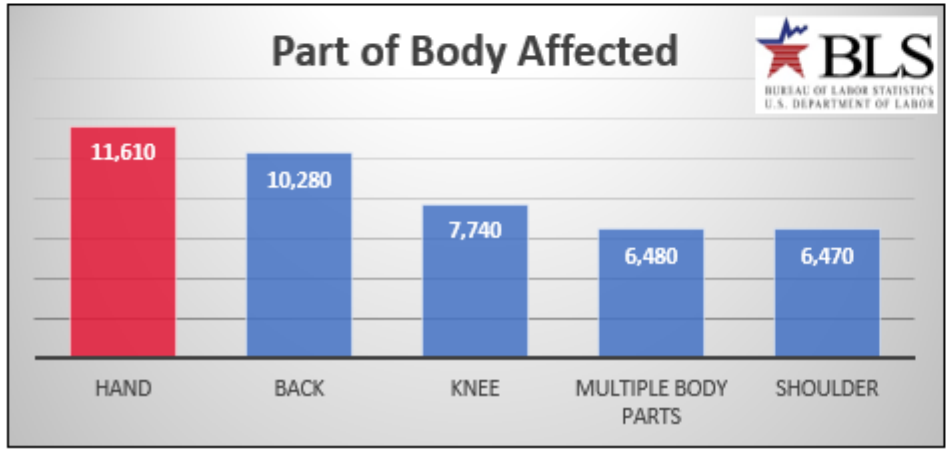
# HAND AND ARM PROTECTION

## Hand & Arm Injuries

**Number of nonfatal occupational injuries and illnesses involving days away from work in construction, private industry, 2019**




Harmful Vibrations can cause a variety of injuries to our end users




Hands are the most injured part of the body and are the #1 preventable injury on most construction sites


### Hand & Arm Injury Statistics

- Median days away from work – 6
- Average hand injury claim cost
  - **Median cost of a laceration: $6,000**
  - Stitches: $2,000
  - Butterfly: $300
  - Severed Tendon: > $70,000

BLS
BUREAU OF LABOR STATISTICS
U.S. DEPARTMENT OF LABOR

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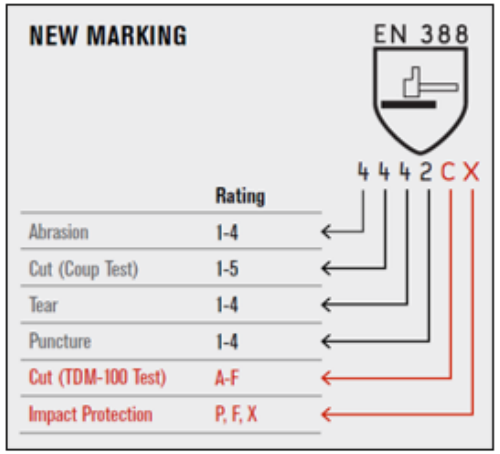
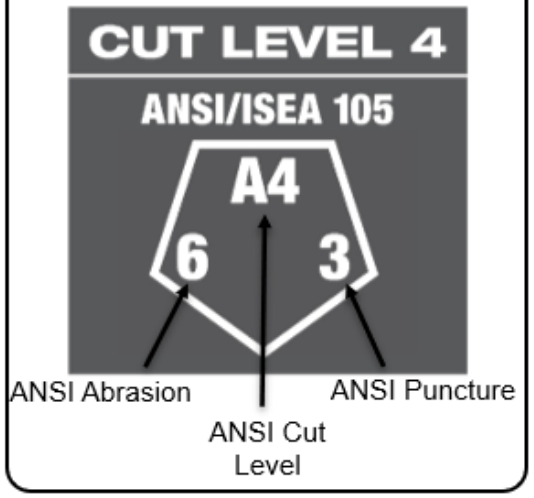
# HAND AND ARM PROTECTION

## EN STANDARDS




## UPDATED ANSI SHIELD




**ALL MILWAUKEE KNIT-AND-DIPPED GLOVES AND SLEEVES ARE EN388 AND ANSI RATED**


## ANSI/ISEA STANDARDS

### CUT RESISTANCE

| Cut Levels | Protects Against | Applications By Cut Level |
|---|---|---|
| A1 Light cut hazards (200 gf)<br>A2 Light/Medium cut hazards (500 gf)<br>A3 Light/Medium cut hazards (1000 gf) | Protect against scrapes | Material handling, small parts assembly (sharp edges), packaging, warehouse, general purpose, forestry, construction, pulp and paper, automotive assembly |
| A4 Medium cut hazards (1500 gf)<br>A5 Medium/Heavy cut hazards (2200 gf) | Protect against cuts for which stitches would be required | Appliance manufacturing, bottle and light glass handling, canning, drywall work, electrical, carpet installation, HVAC, pulp and paper, automotive assembly, metal fabrication and handling, packaging, warehouse, aerospace industry, food/prep processing |
| A6 High cut hazards (3000 gf)<br>A7 High cut hazards (4000 gf)<br>A8 High cut hazards (5000 gf)<br>A9 High cut hazards (6000 gf) | Protect against cuts for which stitches would be required<br>Protection against brutal or extreme injuries | Metal stamping, metal recycling, pulp and paper (changing slitter blades), automotive assembly, metal fabrication, sharp metal stampings, glass manufacturing, window manufacturing, recycling plant/sorting, HVAC, food prep/processing, meat processing, aerospace industry |

### PUNCTURE RESISTANCE

| | Puncture (Newtons) non-hypodermic needle | |
|---|---|---|
| 0 | < 10 | Paper/Cardboard Cuts, Light Material Handling, Parts Assembly |
| 1 | ≥ 10 | Light Construction, Material Handling, Parts Assembly, Packaging |
| 2 | ≥ 20 | Light Construction, Material Handling, Parts Assembly, Packaging |
| 3 | ≥ 60 | Construction, Light Metal Stamping, Light Glass Handling, Manufacturing |
| 4 | ≥ 100 | Construction, Metal Stamping, Glass Handling, Recycling, Injection Molding |
| 5 | ≥ 100 | Oil & Gas, Mining, Heavy Construction, Demolition, Manufacturing, Fabrication |

**HIGHER NUMBER/LETTER = BETTER PROTECTION**

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# HAND AND ARM PROTECTION IN CONSTRUCTION

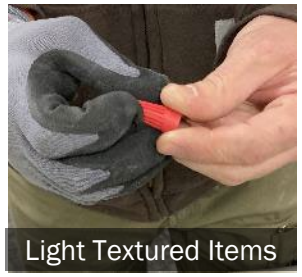
## LIGHT DUTY: A1-A3

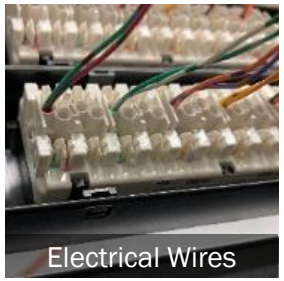
### Interior & Finishing Work

(e.g., house/yard work, finishing tasks, etc.)


Plastic Burrs


Sharp Smooth Edge


Light Textured Items


Electrical Wires

**MOST IDEAL FOR:**

- Finishers
- Plumbers (resi)
- Electricians (resi)
- Low voltage electricians

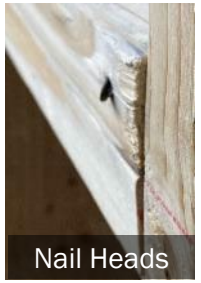
## MEDIUM DUTY: A4-A6

### Commercial Work

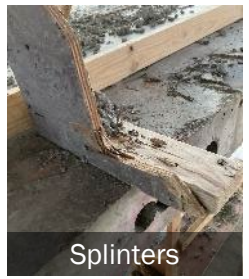
(e.g., working in/around steel studs, material handling, etc.)

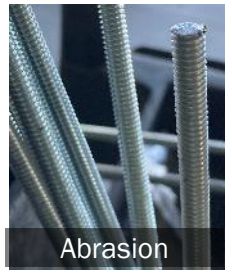

Serrated edges


Metal Burrs


Nail Heads


Glues & Primers


Splinters


Abrasion

**MOST IDEAL FOR:**

- Electricians (commercial)
- Plumbers
- Carpenters
- Mechanical (fitters)
- Laborers

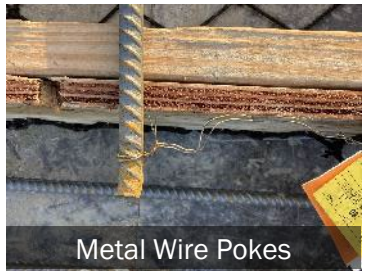
## HEAVY DUTY: A7-A9

### Extreme Cut & Abrasive Tasks

(e.g., sheet metal, rebar, mason, etc.)


'Fishhooks'


Coarse Materials


Metal Wire Pokes


Oils, Abrasion

**MOST IDEAL FOR:**

- Mechanical (HVAC + fitters)
- Masons & concrete
- Iron workers (rebar)
- Drywallers
- Steel stud framers
- Glazers
- Maybe laborers

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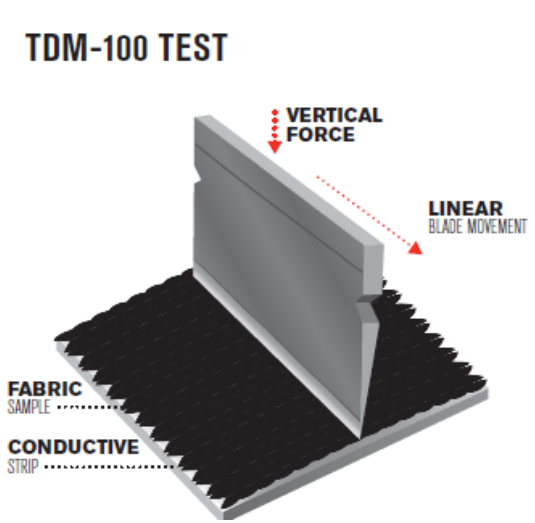
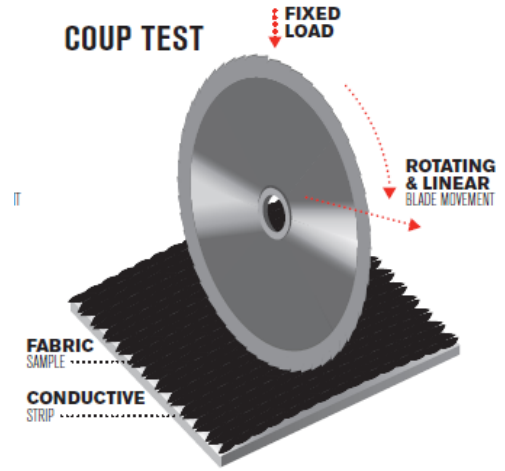
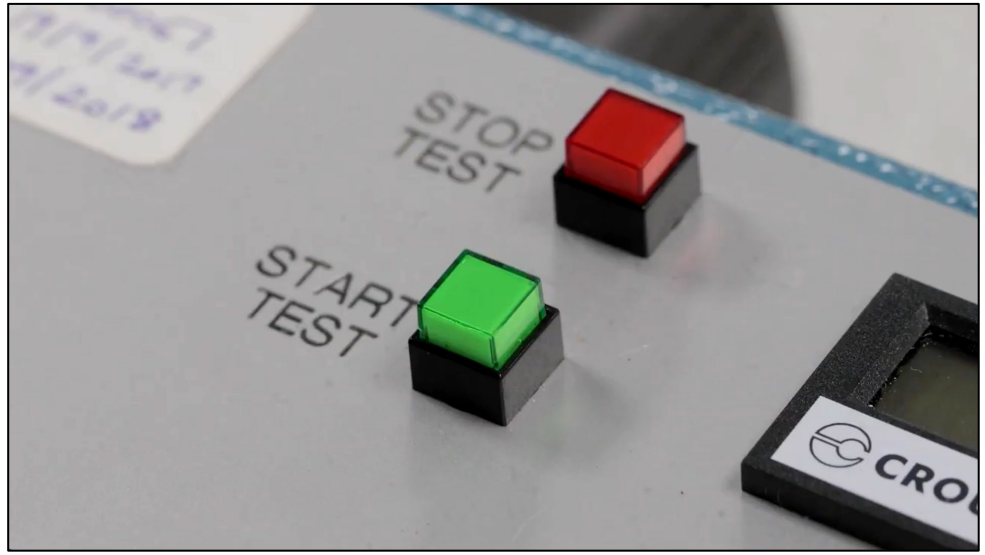
# HAND AND ARM PROTECTION- CUT RESISTANCE TEST

## TDM Cut Test


## Coup Test



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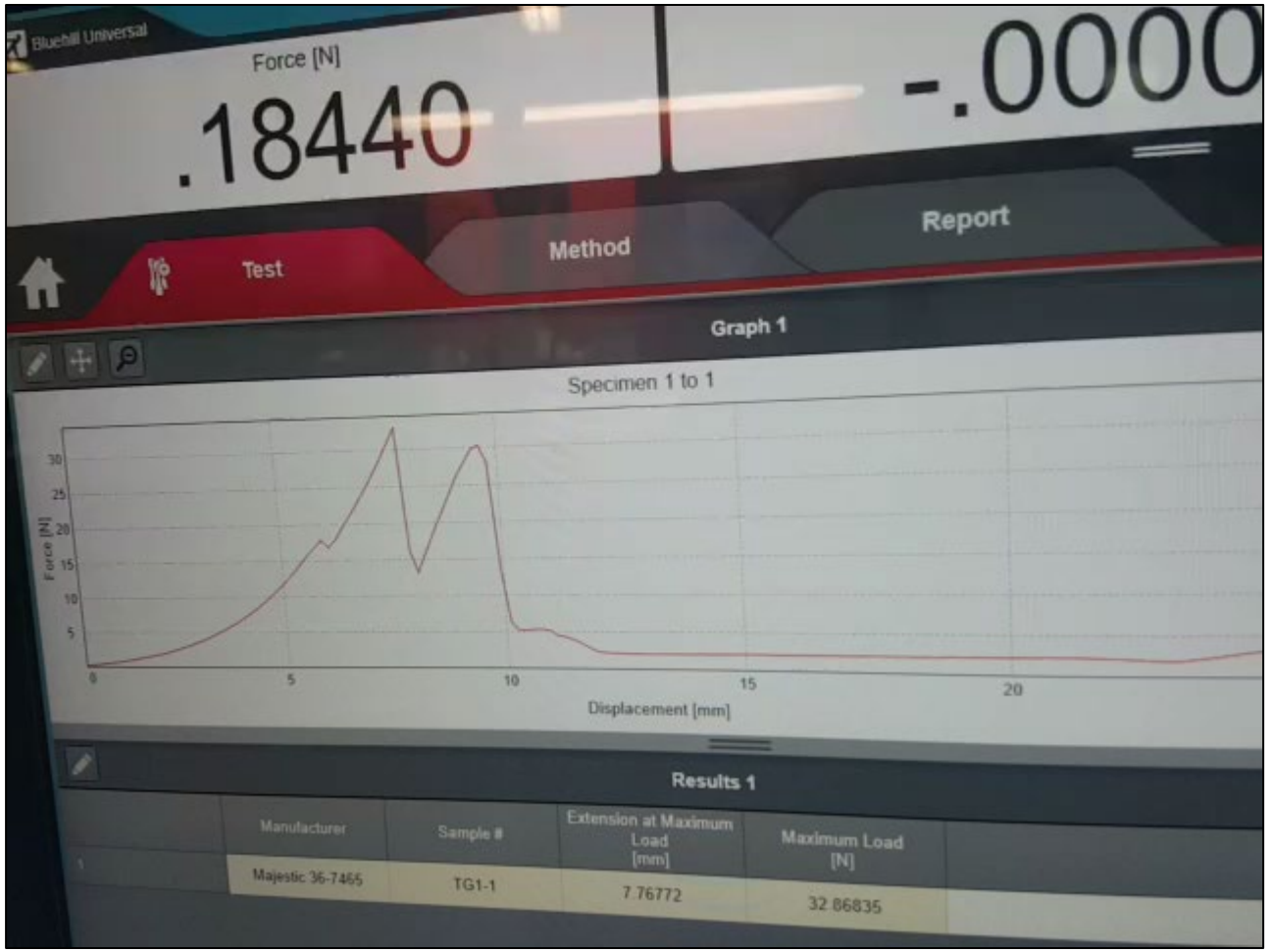
# HAND AND ARM PROTECTION-PUNCTURE TEST



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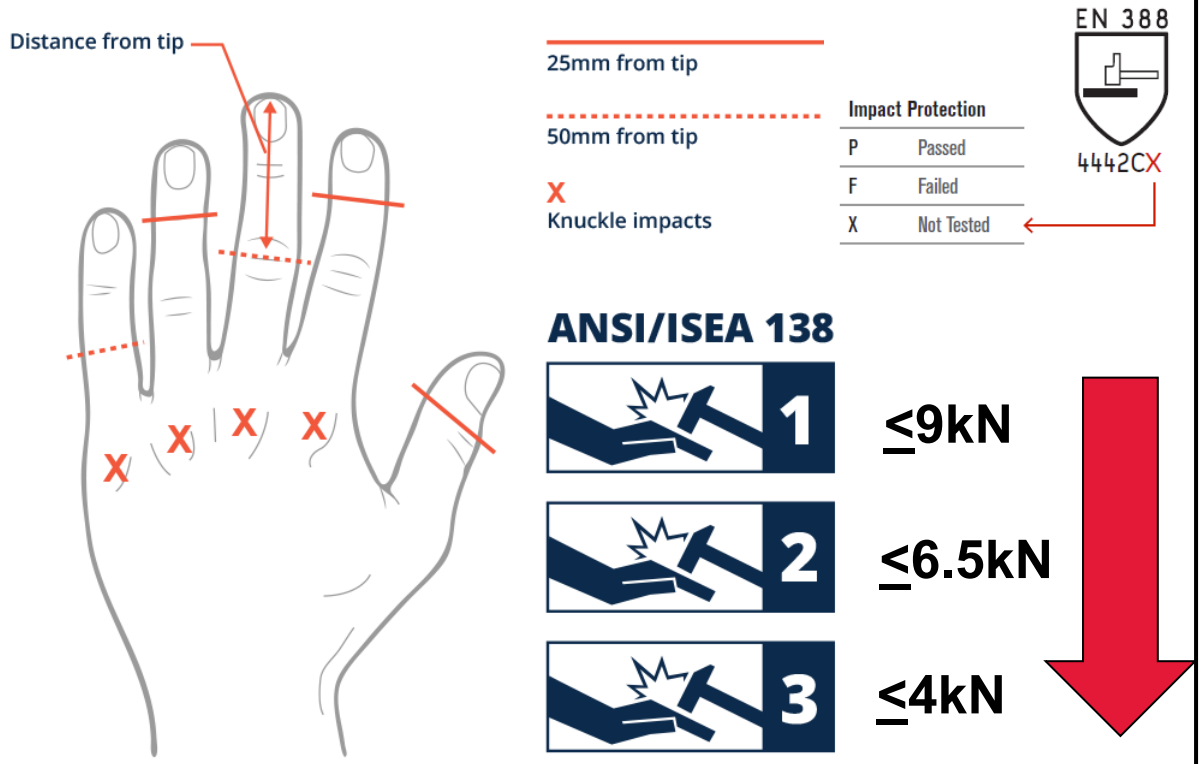
# HAND AND ARM PROTECTION- IMPACT TEST

## ANSI/ISEA IMPACT GLOVE STANDARDS

- **ANSI/ISEA 138-2019 is a newer standard**
  - Measures impact rating for all finger and knuckle impact sites
  - This is the premier standard for impact resistance
- **This standard assesses a glove's protection against back-of-hand (dorsal) injuries**
- **ANSI/ISEA 138-2019 replaces EN388**
  - EN388 rating ONLY tests knuckle location
  - EN388 is a Pass/Fail Test
- **Overall rating = lowest rating of all impact sites**

## IMPACT LOCATIONS




**HIGHER ANSI NUMBER = BETTER PERFORMANCE**

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# HAND AND ARM PROTECTION – SIZING AND FIT

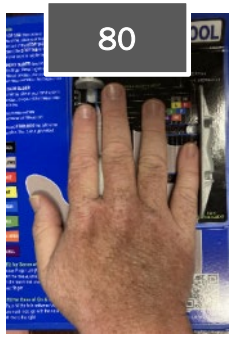
- Gloves need to fit a variety of hand shapes & sizes… finger girth, length, and palm width

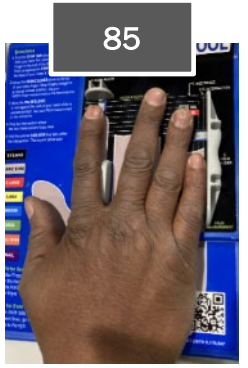
Pointer finger length:



Ultra thin fingers to thick fingers


Ration of pointer to middle finger length – some are much longer than others


Width of palm vary

- "**Dexterity**" if often used to describe fit -Dexterity means a number of things
- Fit greatly **impacts more than just comfort -** Safety, how much a glove is worn + how much focus & time is needed to complete a task
- Often the **field ends up with just L & XL** - even if they don't fit
  - Often least effort for foreman & fits 'most'

So…beyond just S, M, L, XL, XXL the gloves will also **need to stretch in all dimensions to provide a great fit** for all hands

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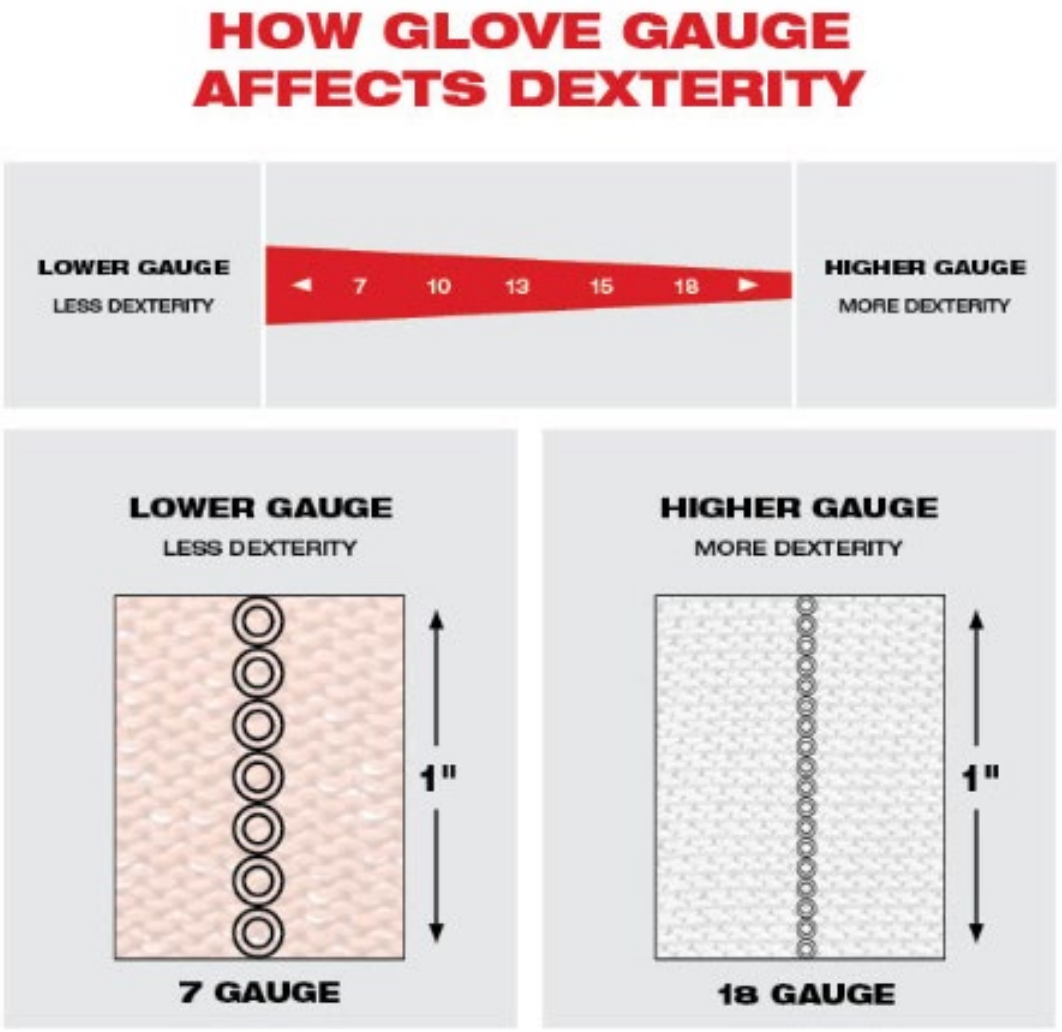
# HAND AND ARM PROTECTION-SIZING AND FIT

(15 Gauge Gloves)

(13 Gauge Gloves)




(18 Gauge Gloves)

(18 Gauge Gloves)

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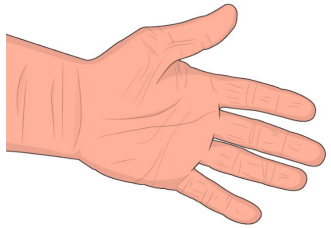
# WHAT'S NEXT FOR HAND PROTECTION STANDARDS

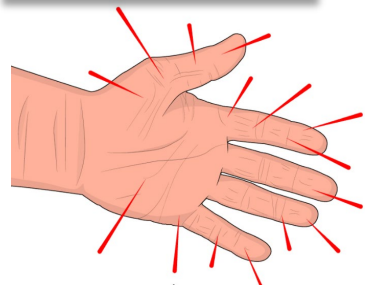
## Signs and Symptoms of HAVS

### Before HAVS



- Normal Hand

### Stage 1

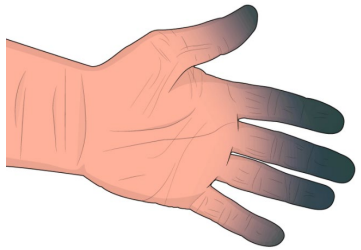


- Tingling
- Numbness

### Stage 2

- White Fingers
- Reduced Dexterity
- Pain

### Stage 3



- Atrophic
- Ulcerated
- Possible Gangrenous

Hand-Arm Vibration (HAVS), aka "White Finger", is a permanent and irreversible medical condition that causes loss of feeling in fingers and hands. Extreme cases can result in losing parts of or entire fingers.

Any kind of vibrating tool can result in hand-arm vibration, and longer exposure can increase the risk of developing HAVS.

Tools that have been linked to hand-arm vibration include:

- Grinders
- Riveters
- Drills
- Jackhammers
- Chainsaws
- Concrete saws
- Rotary Hammers
- Sanders

**2 MILLION USA WORKERS ARE EXPOSED TO HAND-ARM VIBRATION EVERYDAY**

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# WHAT'S NEXT FOR HAND PROTECTION STANDARDS

## ISO 10819 (Anti-Vibration Standard)

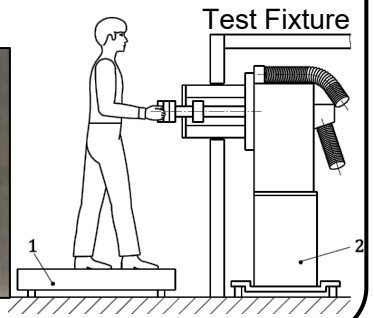
### Glove Markings

EN ISO 10819

### Milwaukee Glove Markings


### Standard Requirements

- Be full-fingered
- Have an uninterrupted palm pad from base to fingertips
- Have padding ≤ 8mm thick in the palm and ≥ 0.55 times the palm padding thickness in the fingers and thumb
- Reduce "medium range frequencies" by ≥ 10% vs. bare hand
- Reduce "high range frequencies" by ≥ 40% vs. bare hand




## TRM & TRH Values

Ratio of vibration passed from tool to hand in different vibration spectrums

TRM – Transmissibility Ratio for Medium Vibration Spectrum
- Rotary Hammer
- Jackhammer
- Reciprocating Saw

TRH – Transmissibility Ratio for High Vibration Spectrum
- Grinder
- Sander
- OMT

Ex: A TRM value of 0.67 means, on average, 67% of felt vibration from the tool is passed to the hand on the medium vibration spectrum

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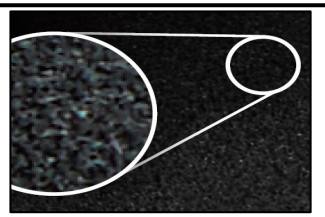
# SELECTION CONSIDERATIONS

| | |
|---|---|
|  | **Poor dexterity for precise applications** |
|  | **Gloves break down and rip in high wear areas** |
|  | **Dip material wears out too quickly** |
|  | **Temperature and Sizing** |

## FRUSTRATIONS

| | |
|---|---|
|  | **<u>MATERIAL GAUGE</u>**<br>Increased Mobility |
|  | **<u>DURABILITY</u>**<br>Reinforcements in the highest wear area |
|  | **<u>DIP RECIPES NOT CREATED EQUAL</u>**<br>Test and verify |
|  | **<u>MATERIAL AND SIZE SELECTION</u>**<br>Test and verify |

## SOLUTIONS

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# EVALUATION

2-3 WEEK TESTING

PRODUCT VS BUSINESS COST

ASK FOR STATISTICS / HELP

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# QUESTIONS

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# APPENDIX