Preparing your business for the new glove dorsal impact protection standard

Lucie Ponting

ANSI / ISEA 138

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ISEA INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION


ITALY

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Introduction

The hand can be one of the human body's most vulnerable areas when it comes to injuries in the workplace, whether through cuts, chemical exposure, sprains, burns, pinching or fractures.

For many years, there have been US and European standards for industrial gloves that protect from injuries such as cuts, punctures, abrasion and chemical exposure, but until recently there was nothing to help assess the performance of personal protective equipment (PPE) designed to reduce the risk of back-of-hand (dorsal) impact injuries. The situation only changed in 2016 when the wider European hand protection standard EN 388 was updated to include impact for the first time.

This was an important move, welcomed by many manufacturers and end-users in Europe and elsewhere. But the US market remained without any performance-based standard to assess glove impact protection.

There has been an explosion of industrial dorsal impact protection products in the past decade. Yet, there were no consensus standards or performance test methods that could be used to substantiate the protective claims being made across the growing industrial market. This left safety and PPE procurement professionals without a reliable way to evaluate and assess the quality of impact protection on offer, and no way of differentiating between the many materials and designs.

Ultimately, the absence of an agreed standard in such an important area of worker protection leaves the end user vulnerable. Without a reliable guide, buyers and safety departments may under or over-specify gloves, incurring unnecessary expense or leaving workers open to injury. In some cases, over-specifying can be as costly and dangerous as under-specifying. Evidence shows workers will not wear PPE if it is cumbersome, uncomfortable or restricts the task.

In response to this significant standards gap, the main manufacturers – together with materials expert D3O – got together under the auspices of the International Safety Equipment Association (ISEA) **(see** Appendix A**)** to establish testing, classification and labelling requirements for products that offer dorsal impact protection. The brand new voluntary standard, an industry first, is known as ANSI/ISEA 138, American national standard for performance and classification for impact resistant hand protection.

ANSI/ISEA 138

DEMAND FOR A STANDARD

The bones and tissues in the back of the hand are all vulnerable to impact injuries, which are common in industries as varied as offshore oil and gas, construction, mining, manufacturing, warehousing and transport (see Appendix C). Impact-related injuries may be anything from a bump or bruise to the knuckles, pinching fingers between two pieces of equipment, to a severe bone fracture and everything in between. "This makes the hand impact protection sector a very broad based market," says Rodney Taylor, Global Sales and Marketing Manager for industrial PPE at D3O.

"...you need to be able to provide some type of performance specification"

"With almost every product, you need to be able to provide some type of performance specification when it comes to the wearer," adds Paul Harris, VP of Product Strategy and Innovations at PPE manufacturer MCR Safety. "In our industry, the main measurements you have are for cut, abrasion, tear and puncture, so those are the ones people typically lean on. But up until now we haven't had anything in the US domestic market to measure impact resistance."

One of the reasons why setting a standard for impact may have lagged behind protection against cuts, abrasion, puncture and tears is that the market for dorsal impact protection is relatively young, compared with more traditional protective glove markets. "Cut resistant materials have been on the market for over 30 years," explains Harris, "with Dupont Kevlar being one of the oldest."

"...it will eliminate some of the unscrupulous and underperforming products that could put the worker at risk."

"What is significant now is that there has really been an explosion within the back-of-hand impact category in the industrial market in the last eight years," he adds. Because of the newness of the technology, design and market, it has taken a while to generate the need for an impact standard. Now that the market has grown to a value of more than $100 million globally, a standard is long overdue.

"We now have some of our larger end-users asking why we don't have a standard, especially those in areas that have been flooded with product choices and availability over the last eight years," says Harris. "From the other side, manufacturers that are doing things right for the worker want a performance-based standard because it will eliminate some of the unscrupulous and underperforming products that could put the worker at risk."

Material Advances

The materials technologies brought to the impact gloves market in recent years have also played a role in driving need for a standard, increasing the variety of designs and materials on offer. A wide range of materials is now being used in the market, from foams such as EVA (ethylene-vinyl acetate) to TPRs (thermoplastic rubbers), silicones and proprietary materials such as D3O®. The different materials and thicknesses perform all across the board, which makes having some kind of specification against which to measure products a must.

"As the materials have got thinner, lighter and more malleable, companies have had the opportunity to come up with new product designs that are really innovative," confirms Cristine Fargo, ISEA's Director of Member and Technical Services. "In 138, things have come a long way from foam at the top and stiff fingers that looked like straight emery boards painted on top. Now there is the ability to manipulate and configure things differently, so end-users are getting a nice fit and comfort."

"With a European standard already in place, we thought we could use that as a base and make it better,"

The addition of impact testing into the EN 388 standard also added to the impetus for a US standard. "With a European standard already in place, we thought we could use that as a base and make it better," says Harris. "A lot of [the momentum] was driven by the fact that the European standard had recently included an impact element riffed off the motorcycle glove standard," says Fargo. "Many of the companies are global, so they were able to draw on some of that experience and bring it to the US."

"When we started building gloves for the oil and gas industry, they asked us whether there was a standard for impact," adds Brian Lunniss, Director of Research and Development at industrial glove manufacturer Mechanix Wear. At the time, the only standard available related to motorcycle gloves. This subsequently became the basis for the impact provisions included in the 2016 EN 388 revision. "But the motorcycle standard focused on the implications of coming off a bike at speed, which has very little applicability to industrial risks," explains Lunniss.

Marketing Claims

Another driver was the need to sift through the plethora of marketing claims accompanying impact protection gloves. With no recognised standard, there is no way to confirm or dispute these claims. "We'd seen that in other standards development as well," says Fargo. "You see some marketing and claims being made – or represented – but you can't really identify what that looks like. So a standard is a way to help put some shape around the verbiage."

Ron Hope, Value Safety Manager for Luck Companies, which includes Luck Stone, the US's largest family-owned operator and producer of construction aggregates in the US, agrees that the range of styles on the market can be confusing. In his industry, the primary wearers of hand impact protection are maintenance workers in the screen houses, where they carry out tasks involving heavy lifting, handling steel and swinging hammers.

"There are so many vendors offering different gloves," says Hope. "And the cost is not standard either; it varies a lot depending on what you are looking for. A standard, as a recommendation at least, with defined performance levels, will help when trying to decide which glove is appropriate for each task." He also points out that a standard should finally allow end-users to start being able to compare like with like. "For the glove manufacturers it will help standardize what they are offering," he adds. It won't eliminate different styles, comfort levels or features, but it will consolidate what a protection level one glove means, and so on.

ANSI/ISEA 138

THE STANDARD

Figure i
Product marking to identify performance levels

The ANSI/ISEA 138 standard's stated scope is to:

- Establish "minimum performance, classification and labelling requirements for hand protection products designed to protect the knuckles and fingers from impact forces, while performing occupational tasks".

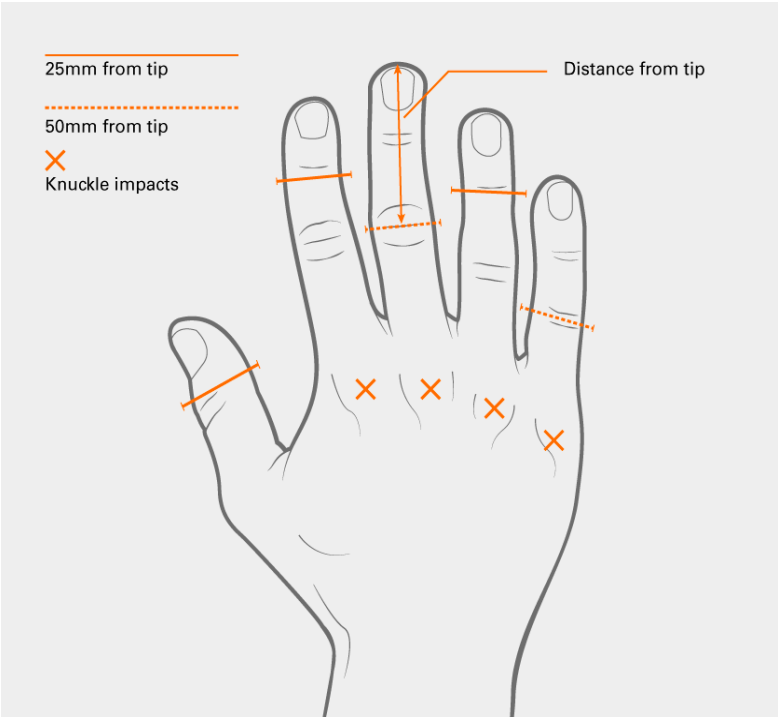
It aims to:

- Evaluate compliant gloves "for their capability to dissipate impact forces on the knuckles and fingers" and to classify them accordingly. "The resulting classifications can be used by employers as a reliable means of comparing different products on an equal basis when selecting hand protection relative to the tasks being performed".

There are three performance levels specified by the standard, which offer a numerical representation for the impact protection a glove will offer, with the lowest protection offered by level one and the highest by level three. Under the standard, "a higher performance level indicates a greater degree of protection (reduced transmitted force)".

The overall performance level of a glove reflects the lowest performance level recorded, so that if the fingers and thumb meet level one but the knuckles level two, the glove will still be rated as performance level one.

Figure ii
Sites impacted during product performance testing, showing distribution of impacts over knuckles and fingers/thumb



"A higher performance level indicates a greater degree of protection"

The standard also outlines test requirements, equipment and method {see Appendix B}, including preparation of samples and conditioning of the gloves. Within this, it defines specific test sites for the knuckles and fingers and thumbs, and requires that the sites be marked on the outside and back side of the glove (see Fig. ii).

Another key aspect of the standard is packaging, labelling and product marking. Gloves will be marked with an agreed pictogram at level one, two or three (see Fig. i). These markings have to be "visible and legible throughout the normal useful life of the glove".

Standout Features

According to Taylor, ANSI/ISEA 138 has two standout features that differentiate it from many other US voluntary standards. First, unlike most standards from ANSI, where manufacturers are on an "honours system" with regard to publishing test results, 138 requires testing in a laboratory that meets the requirements of ISO/IEC 17025:2017.

The requirement for testing only by ISO/IEC 17025:2017 labs should increase credibility and trust. A significant difference between Europe and the US is that, in Europe, third party testing is mandatory for gloves. "In the US, it's self-certification on cut, abrasion, tear and puncture," says Harris.

The second distinctive feature is the use of a mandatory pictogram marking on the gloves for each level. "While marking and use of pictograms is routine in European standards, this is not so common in North America," says Taylor.

The fact that many manufacturers in North America are already familiar with the impact testing element of the recently revised EN 388 should be helpful in encouraging acceptance of the ISEA standard. But while EN 388 is based on a motorcycle impact standard for hand protection, ISEA 138 is specifically designed for industrial gloves and the special protection they offer to workers.

Both EN 388 and ANSI/ISEA 138 use essentially the same test method, but there are key differences between the two:

- EN 388 is a pass/fail result, while ANSI/ISEA 138 incorporates three performance levels, giving greater choice and flexibility to the end-user;

- EN 388 only covers the knuckles but ANSI/ISEA 138 will cover knuckles and fingers, which is critical for industrial glove users where the fingers are frequently at risk.

"... we are looking for knuckle and finger impact protection..."

The oil and gas sector, which is a large user of impact protection gloves, has collected figures through the International Association of Drilling Contractors showing that in 2016 the fingers remained the most vulnerable part of the body in terms of both lost time and recordable injuries. Injuries to fingers accounted for a third of all total recordable injuries and almost 20% of lost time injuries. Meanwhile the hand and wrists accounted for around 11% and 10% respectively.

Because the ISEA 138 working group was keen to ensure the final standard was really aimed at reducing impact injuries at work, it brought in Dr Lloyd Champagne, a surgeon based in Phoenix, Arizona, who focuses on plastic and reconstructive hand surgery. His role was to advise on the real-life injuries he sees in his hand trauma practice.

"...in general, [injuries] are divided into cutting injuries and smashing"

"As far as what anatomy in the hand is most vulnerable," says Champagne, "the two main problem areas are the fingertips, which are very commonly injured because they are the part that is universally in contact with everything, and the big knuckles, which are frequently impacted by things such as wrenches slipping or people catching their hands under the hood of car."

Beyond this, the picture is complex. "There is no average injury; they come from every different type of mechanism you can imagine," he says. "But in general, they are divided into cutting injuries and smashing." There is already a standard for cutting, so when looking at impact the group was defining it against generic causes, such as missing a nail with a hammer or perhaps people getting their hand smashed by industrial machinery.

Ron Hope at Luck Stone confirms the importance of protecting different parts of the hand from impact, depending on the task. "For more rugged tasks, we are looking for a little bit more padding around the thumb and index finger, plus some in the palm," he says. Whereas for some operations involving loading and unloading rail cars, the requirements are different. "Here we are looking for knuckle and finger impact protection as well, because the guys are swinging hammers and pulling on bars to close rail car doors."

Simplicity by Design

One of the key principles driving the standard's development has been simplicity. "We kept a common goal of having an applicable standard that is understandable and can be replicated in labs worldwide," says Harris.

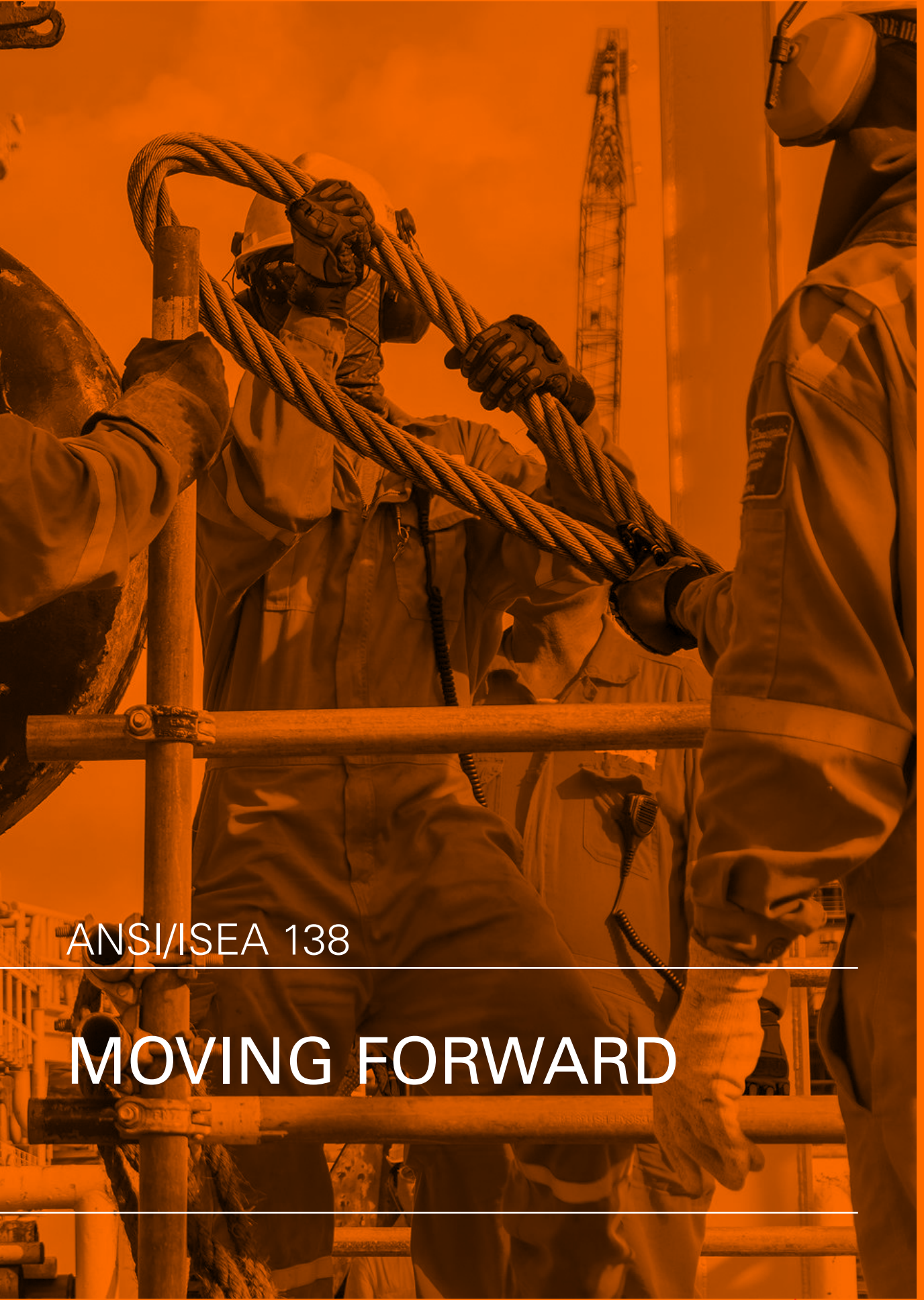
This is always a challenge in standards development and there are existing standards that are so complicated that the people actually conducting the testing cannot say how it is done. "That is something we did not want for the impact standard," emphasises Harris. "We wanted this to be very clear for the people using it, along with the labs that will be performing the test."

"If you make it simple, easy to understand and to implement, and clear that it protects workers' hands - based on the performance of materials and coverage" says Vincent Kruiniger, General Manager at PPE manufacturer Majestic Glove, "then the value will continue to increase."

"We want to be able to write and design something that people are going to use," adds Fargo. "End-users ultimately need to understand why a particular standard exists – why there is a number or mark on the product label and what that means for the selection process.

"We want to be able to write and design something that people are going to use"

"With a classification scheme – if you've got levels one, two or three – you want to make sure you're helping someone select a product by looking at the hazards, and at the current workplace structure," she says. "They don't want to be overprotecting, because there might be a trade-off, whether that is in dexterity or user comfort."



ANSI/ISEA 138

MOVING FORWARD

"Bosses at a plant need to know what glove they need; and it must be simple."

The new standard is voluntary, so manufacturers and end-users are not under any obligation to use it. The proof of its success will be in the extent to which the sector picks it up and runs with it. The main manufacturers are on board, but they now have to inform their customers of the benefits: how the standard will help them sort through the products on the market and choose the right protection for their workers on the ground.

"Obviously, we are not going to solve all the problems," says Champagne. "There are always going to be hand injuries that gloves cannot protect against. The question is: 'Are we going to make it a bit better for people?'"

"The standard is not just about how to make gloves better mechanically," he adds. "That's 50% of the problem. It's also about how we can help workplace managers understand gloves – that's the other 50% of the problem. If you go on any website, there might be multiple different offerings; if you're a customer or a factory manager or owner, how can you know which to choose? Bosses at a plant need to know what glove they need; and it must be simple. It's very important that the standard be decoded for the end-user."

"You are going to be able to tell if it's meaningful when you see it specified in say commercial bids for companies buying products," suggests Fargo. "When end-users are asking manufacturers: 'Show me the label; show me this glove meets the 138."

A Benchmark Tool

Larger end-users, once they are familiar with a PPE standard and its performance levels, will often benchmark against that, producing a global specification outlining protective items and minimum performance levels for each application on their job sites.

At Luck Stone, Hope is looking forward to using the standard in practice. "I do think an impact performance standard will be of huge benefit," he says. "Even though it will not be mandatory, it will provide a structure for us to work with. It will help us know what we are looking for and decide what level of impact resistance we need for a specific job."

He also recognizes the advantage in helping organizations to standardize protection internally and ensure company-wide consistency. "It will give us an ally to help implement a glove policy or procedures within our company," he suggests. "So if we know people are going to be heavy lifting on a particular task, we can say: 'Here's an ISEA standard recommendation and we feel it's going to offer you the best hand protection.'"

He welcomes manufacturer guidance on the application and benefits of the standard. "We will be sharing that with our safety team and upper and middle management to help us understand how this will support us in developing our procedures and in educating those in the field to make choices depending on the task they do," he says. "For all of us, the bottom line is to reduce or eliminate hand injuries and offer the best hand protection for the different tasks."

"Ultimately, the worker's safety is the most important thing," agrees Harris, "and we think this standard will allow them to make a more educated decision. We believe the standard will really shine a spotlight on the true performance levels of the many products in the market."

"It's going to take some time for people to look for and consider the icons," acknowledges Kruiniger. "However, as the market better understands impact protection, they'll recognize the icons and say: 'That's the protection I need."

Appendix A

ISEA: standardization by consensus

Work on ANSI/ISEA 138 started in 2016 and has been carried out by a specialist sub-group of the International Safety Equipment Association's (ISEA) long-established hand protection group. The impact standard working group includes seven major glove manufacturers as well as impact materials expert D3O.

ISEA is a trade association representing manufacturers of safety and personal protective equipment (PPE) covering everything from head, feet and hand protection to respiratory protection, emergency eye wash and showers. The association also includes distributors, test laboratories and other stakeholders as affiliate or associate members.

"We are an accredited standards developing organisation under the American National Standards Institute (ANSI), which has its own operating procedures for the development of documents to be recognised as American National Standards," says Cristine Fargo, ISEA's Director of Member and Technical Services.

As well as the standards managed by ISEA, the association is officially represented on other national, multinational and international standards committees. The standards achieve consensus either through a formal review by a panel of all interested parties or by submission to an accredited standards committee. With either method, the standards undergo rigorous public review before they are approved as American National Standards.

Transparency and consensus are key principles in the development of voluntary industry standards, and all ANSI standards must be revised, reaffirmed or rescinded at least every five years.

"Most of the documents are based in product performance," says Fargo, "so we tend to lean heavily on manufacturers who have research and development capability and the technical acumen to help write a standard that has defined test methods, pass/fail criteria or performance levels, and labelling or markings so the user can identify that a product meets a prescribed set of criteria." They may also include a conformity assessment component (how to demonstrate that a product does what it says it does).

Several ISEA-developed standards are codified into US regulations, through the Occupational Safety and Health Administration (OSHA) or the Federal Highway Administration or through state or local regulations. There is also broad based recognition for some of the standards at best practice level – where a regulatory organisation may not have adopted it yet but it is recognised as industry good practice.

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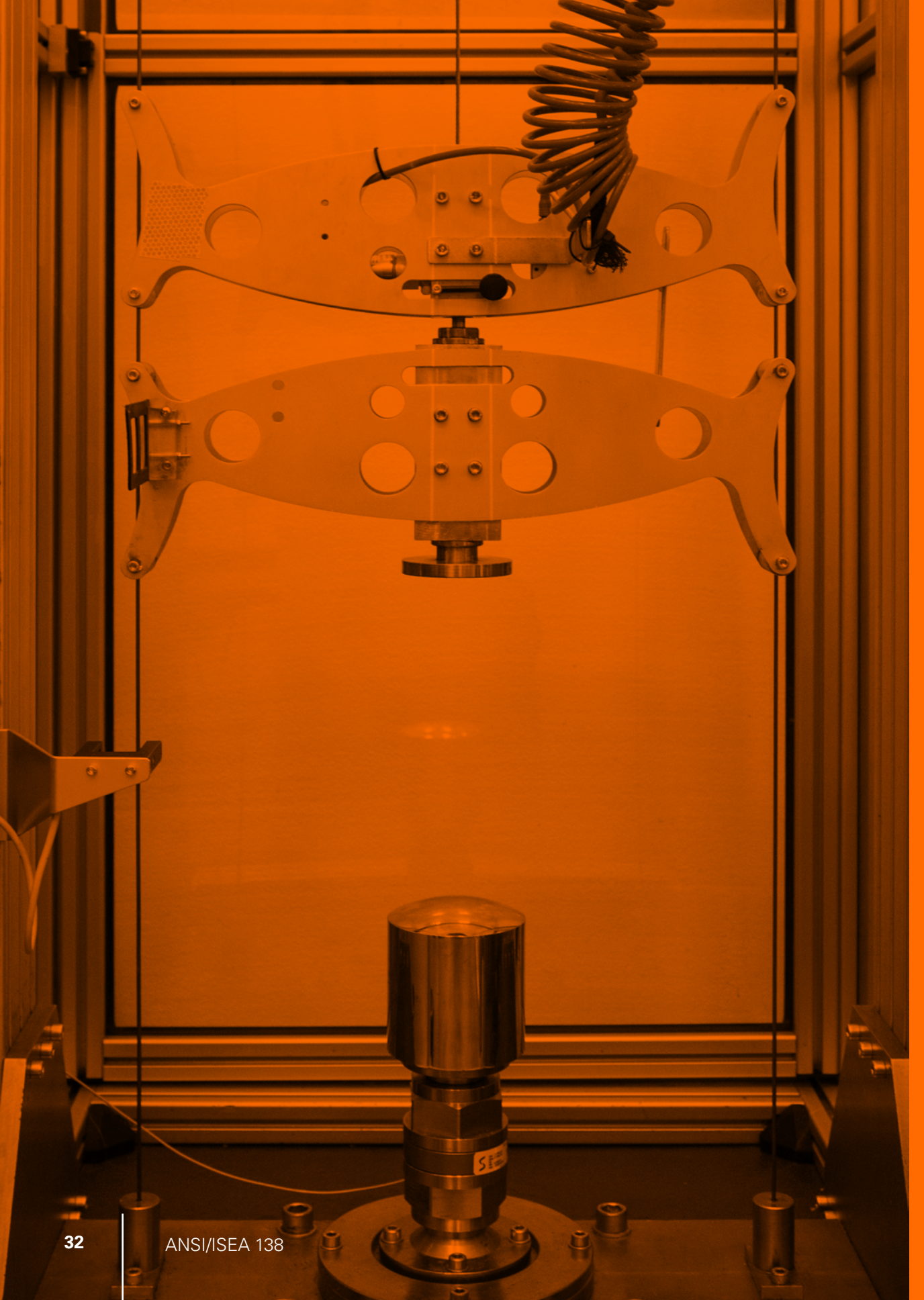


Appendix B

Test Methodology

- Flat 80mm diameter striking face
- Palm side of glove removed
- Impact locations marked on gloves
- Samples mounted centrally on hemispherical (100mm radius) anvil
- 2.5kg mass dropped with an impact energy of 5J
- Peak transmitted force recorded by force transducer beneath anvil
- Lower transmitted force = greater degree of protection and a higher performance level
- Impact test performed on knuckles and fingers separately

Performance Levels in Standard

Performance Level	Mean Transmitted Force	Increasing protection
ANSI / ISEA 138 3	≤4 kN	
ANSI / ISEA 138 2	≤6.5 kN	
ANSI / ISEA 138 1	≤9 kN	

Figure iii
The test rig is set up to perform impact tests in line with the proposed new standard

Appendix C

Work Absences

892,270

Occupational injuries and illnesses in 2016 that resulted in days off from work

8 DAYS away from **WORK**

Per Injured employee

79,530

Fractures suffered by workers that required days off from work

317,530

Cases of sprains, strains or tears required days off from work

283,900

Unique cases of injuries or illness affecting the upper extremities were reported

42%

of which were injuries to the hand

The cost of occupational injuries

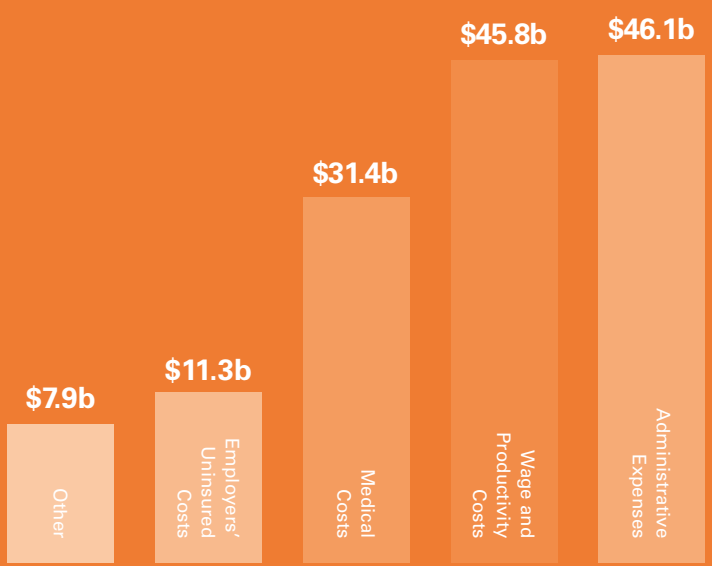
$142.5b

The NSC estimated economic cost of on the job injuries in 2015

$900

Per Injured employee

Cost Breakdown



This white paper was commissioned by D3O, world experts in impact protection and shock absorption.

D3O provides guidance and advice on impact protection to many of the world's leading regulatory bodies for personal protection, and its technology is widely used in the defence, sports, motorcycle, electronics and workwear industries.

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