Cut Performance Levels and Testing: Know what the levels represent

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Many safety and purchasing professionals question the level of cut protection they need and how the International Safety Equipment Association (ISEA) performance levels apply to their specific applications. During recent market research, customers identified better cut protection as their single most frequent requirement.

Requests for cut protection include not only cut resistant hand protection products but the accompanying education that will help keep workers safe and increase their ease and efficiency as they perform their jobs. Companies want their workers to have the right gloves and to know when and how to use them.

Cut protection vs. cut resistance

Cut protection is the combination of influences that help prevent a worker from suffering cut injuries. Material properties such as cut resistance, tear strength, abrasion resistance, grip and dexterity all fall beneath the umbrella of cut protection. Other factors unrelated to protective gloves and apparel also impact cut protection, including machine guarding, workplace set-up, working conditions and worker training.

Cut resistance is defined as a material's ability to resist damage when challenged with a moving sharp-edged object. Since it can be measured using the Cut Protection Performance Test or CPPT, cut resistance is often used to compare the safety of various products.

Cut resistance evaluation in Europe

In the European market, gloves are evaluated according to EN 388, the mandatory performance standard for all gloves as regulated by the CEN. During the evaluation process, the European test machine passes a blade back and forth across a material specimen, counting the number of cycles until the blade cuts all of the way through and makes electrical contact with the substrate. A cut index is calculated using data from the control fabric to compensate for the progressive dulling of the blade.

The European test method was developed by researchers at a French lab who were primarily concerned with cotton and wool fabrics, which makes the method generally unsuitable for highly cut resistant products, which are used in many of today's most hazardous industries. The blade used for testing these products is often worn dull after only one pass. In addition, the measured cut indices are hard to reproduce and the resulting data is not very meaningful.

Cut resistance evaluation in the U.S.

In the U.S., ASTM adopted an entirely different method, the CPPT, which has been approved for ASTM 1790-97 and 1790-05. ANSI approved ISEA performance levels based on the results of this test method provide guidance in selecting cut resistant safety apparel.

The CPPT provides data to differentiate the cut resistance of common materials by calculating the load required for a standard blade to slice through a protective material in a given distance. To conduct the test, a specimen of glove material is mounted on a cylindrical support and a standard blade moves across the material at a standardized speed until it cuts through, as measured by electrical contact with the substrate. Each blade is used only once and then discarded so blade dulling cannot affect the test results.

A minimum of 15 cuts are made on each glove material specimen, with varying amounts of load used to press the blade onto the specimen. Data is plotted as load on the blade versus blade movement across the material until failure. Cut resistance is usually reported as the load on the blade in grams force that produces a cut-through in 20 or 25 mm of blade travel.

The chart below shows the differences between the EN (Couptest) and the ASTM CPPT test method. The ASTM method is now required in Europe to evaluate highly cut resistant materials.

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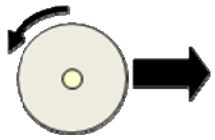
	EN (Couptest)		ASTM (CPPT)	
Blade Type	Circular Double Beveled		Straight Double Beveled	
Blade Motion	Counter-Rotating		Slicing	
Blade Reuse	Blade used until dull		New blade for each cut	
Blade Speed	Variable, 0-110 mm/s		Variable, 0-14 mm/s	
Force on Blade	Constant, 500 gf (1 lbf, 5 N)		Variable, 0-5000 gf (0-11 lbf, 0-50 N)	
Cuts per Sample	5		15	
Cut Detection Method	Electrical Contact		Electrical Contact	
Measured Property	Cycles to failure		Distance of blade travel	
Test Result	Calculated Cut Index (Unitless Ratio)		Calculated Rating Force (grams-force or Newtons)	

Please keep in mind that test results can be impacted by a number of factors, including material construction, number of components, how the components are combined, fabric weight, thickness, quality, the “tester” and other environmental issues.

ANSI-approved performance levels

As mentioned earlier, ISEA developed performance levels that are derived directly from the CPPT results as illustrated in the following chart. These levels help provide guidance when selecting cut resistant hand protection.

Level	Rating Force (gf)
0	< 200
1	≥ 200
2	≥ 500
3	≥ 1000
4	≥ 1500
5	≥ 3500

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ISEA and ASTM both worked to develop this standard. ASTM defined the method. ISEA has specified the levels of performance based on results from ASTM 1790-97.

Below are examples of the types of materials that may fall within the various levels. Due to inherent variation as discussed above, the ANSI ratings provide only a general indication of the cut resistance of any protective material. These values also reflect laboratory measurements, and may vary depending on the specific work environment, materials, sharpness of the blade or edge, and the force applied.

Level 0: Disposable Rubber

Level 1: Cotton, Leather, Light-Weight Synthetics

Level 2: Light-Weight Aramid or HPPE

Level 3: Heavy-Weight Aramid or HPPE

Level 4: Reinforced Products

Level 5: Heavy-Weight Reinforced Products

No matter what the level of cut resistance, most glove manufacturers do not recommend using cut-resistant gloves for protection against powered devices, especially those that exert rotational force such as saws and drills. Gloves are usually tested for use with non-powered blades and tools only.

Other considerations

Although any glove material will provide some level of cut resistance, finding the right glove often requires consideration of factors such as grip, abrasion and puncture resistance, size & overall fit. Safety managers and purchasing personnel who consider only cut resistance when selecting hand protection products are missing part of the equation.

Abrasion resistance and durability are both important factors when choosing products that protect against cut. Most gloves are used for extended periods of time and should provide the same level of protection at the end of the shift as they do at the beginning.

Dexterity and comfort are essential in workplaces where workers handle small sharp objects or wear gloves for extended periods of time. A Frost and Sullivan survey showed 85 percent of respondents indicated comfort as the leading feature influencing their hand protection selection decision.

Individuals may require gloves that enhance their grip if they work with sharp-edged objects that pose a much greater threat when they are in motion. A secure grip combined with the proper level of cut resistance can significantly reduce the chance of cut injury by preventing slipping and slicing and providing the worker better control.

Summary

While the ISEA performance levels and general recommendations detailed above can help provide guidance when selecting hand protection products, the responsibility for testing products for specific end user applications still rests with the end user.

We can indicate, for example, that a medium-weight, uncoated Kevlar glove will typically have an ISEA cut rating of 3, but we cannot say the glove will provide the level of protection needed for the range of jobs on an automobile assembly line. Another Level 3 glove might be better suited to an application that requires the worker to have an oil grip.

As glove manufacturers, we know gloves. We do not know the details about every workplace. We therefore, must look to our customers to provide us the properties they need for hand protection products that will sufficiently protect their workers on the job.

Cutline

Safety managers and purchasing personnel who consider only cut resistance when selecting hand protection products are missing part of the equation.

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