Performance standards for PPE

Due to globalization, products from different continents are sold in all parts of the world. Although you might expect the existence of a global standard for performances, such as the cut resistance of PPE, the contrary is true. Globally, there are two different performance standards for cut resistance: the European standard EN388, used in Europe, APAC, South America, Mexico and parts of Canada and the US; and the ANSI/ISEA 105 standard mainly used in North America.

These different standards are not identical and do not correlate, potentially causing confusion for end-users in their specification process of selecting the right glove for their application. It is important to understand the differences between these standards and the test methodologies specified in these standards in order to set the right expectations for the performances and specifications. This document will explain these differences.

Methods for measuring cut resistance

Globally, three different Standards accepted by industry exist to measure the cut-resistant properties with three different methods.

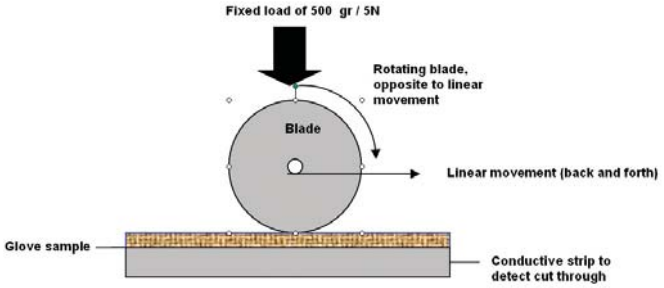
Standard	Test method	Region
ASTM F1790 '97	CPP (old version)	North America / Canada
ASTM F1790 '05	CPP /TDM 100	North America / Canada
ISO 13997	TDM 100*	North America/Canada/Europe
EN388	Couptest	All regions except North America

* The TDM tester can be used as alternative test method for the CPP test.

CPP and TDM test method:

Both the ASTM F1790 '05 and ISO 13997 standard describe the same test methods for cut resistance: TDM and updated CPP test, while the ASTM F1790'97 only describes the 'old' CPP test to measure the cut performance. From a principle point of view, the functionality of both the CPP and TDM method are identical:

Simply said, both methods measure the amount of pressure one can apply on a rectangular blade, while moving the blade over the fabric without cutting through the fabric for at least 0.8 inch (20 mm). See picture 1 for a schematic drawing. These two methods simulate an accidental cut or slash with a sharp object.



The higher the load (expressed in grams or Newton) one can apply on the blade without cutting through for at least 0.8 inch, the better the cut resistance of the fabric.

ANSI / ISEA 105 defined cut-resistance levels for this, but are only valid for the old ASTM F1790 '97 standard and are shown in below table 1.1. It is important to realize that these performance levels are NOT valid for the updated version of the ASTM F1790 '05 and ISO 13997 test standard. It is known that the results using the ASTM F1790 '97 method are slightly higher than the '05 and TDM method.

Table 1.1: ANSI / ISEA 105 performance levels

Couptest:

The EN388 standard describes the Couptest method for cut resistance, which is based on a totally different principle than the CPP/TDM method. In the Couptest, a circular blade is moving back and forth across the sample under a fixed load of 5N/500 gr, while rotating in the opposite direction of the linear movement.(see figure 2).

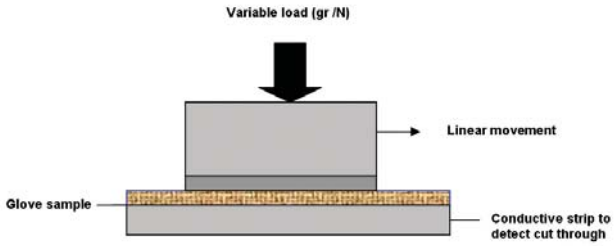


Figure 2 : Schematic drawing of Couptest method

Simply said, this method simulates the number of repetitive cuts needed to cut through the fabric on the same position in the glove with a constant load.

This is compared to the resistance of a reference cotton fabric. The result of this test, the so called Cut Index, tells you how much better the sample is compared to the reference cotton fabric. For example, a cut index of 5 means the sample has five-times better cut resistance than the reference cotton.

The higher the number of cycles needed to cut through, the better cut resistance of the fabric. EN388 has defined cut-resistance levels for this (see table 1.2), but are only valid for the Couptest method.

Performance Level	Average Cut Index (10 measurements)
0	< 1.2
1	1.2 - 2.4
2	2.5 - 4.9
3	5.0 - 9.9
4	10.0 - 19.9
5	> 20

Table 1.2: EN388 cut performance levels

Picture 3: EN388 Pictogram

Due to dulling of the blade during the test, especially valid for high cut-resistant materials (e.g. steel), this method is not very suitable to test steel-wire-containing gloves. For those type of gloves, the EN388 standard recommends testing according to the ISO 13997 (TDM) standard. However, since there is no correlation between the 2 standards level, certification is only allowed using the Couptest.

Also important to understand is that the EN388 standard describes more than just the cut resistance of a glove. The norm also describes the abrasion, puncture and tear resistance of a fabric/glove. If all tests have been performed by a notified lab institute, the glove can carry the CE certificate, together with the EN388 logo (see picture 3), that informs you about the total performance of the glove.

All four individual performances are linked to each other: Low abrasion resistance of a glove will not only have a negative effect on the consistency of cut protection during wear, but tear resistance will also be affected. For low puncture-resistant materials (typical for gloves), it is important to have a high tear resistance to guarantee the longevity of the glove.

Comparing cut-resistant values

In your decision making process for selecting the most suitable glove for your application, it is important to understand the differences between the different standards and methods above described.

It is important to understand that:

- EN388 cut level X (Couptest) does NOT necessarily correspond to the same ANSI/ISEA105 level X (ASTMF1790'97).
- CPP/TDM indicates how much force/load is need to slash/cut through a fabric.
- Couptest indicates how many repetitive cuts on the same position are needed to cut through.
- CPP values measured with ASTMF1790 '97 give higher results than the 'ASTMF1790'05 and TDM test on the same glove, and this is purely due to an improvement of the standard.