Testing and Certification for PPE Gloves & the EU Regulations

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The Procedure for Testing and CE Marking Gloves

PPE Glove products are divided into types dependent upon the intended end use. Each of these types is equivalent to the different levels of protection they provide to the wearer. There are many types of PPE gloves. Those detailed in this article are protective gloves against mechanical use, protective gloves against chemicals and micro-organisms, protective gloves against thermal risks (heat and/or flame), welders’ gloves, protection against cold gloves, handheld chainsaw gloves, fire fighter gloves, ionizing radiation gloves, motorcycle gloves and sports gloves. The testing required for PPE gloves is also dictated by these different types of gloves and their corresponding standards.

Glove Testing by Type and Corresponding Standards

Protective Gloves General Requirements - EN 420
Protective Gloves against Mechanical Risk – EN 388
Protective Gloves for Chemical and Micro-Organisms – EN 374
Protective Gloves for Thermal Risks - Heat and/or Flame – EN 407
Protective Gloves for Welders – EN 12477
Protective Gloves for Cold – EN 511
Protective Gloves for Handheld Chainsaws – EN 381
Protective Gloves for Fire Fighters – EN 659
Protective Gloves for Ionizing Radiation – EN 421
Protective Gloves for Professional Motorcycle riders – BS EN 13594
Protective Gloves for Sport – Various standards dependent upon the sport

EN 420 Protective Gloves – General Requirements

EN 420 Protective Gloves General Requirements specifies all the basic requirements for PPE gloves and the following testing including:

1. General requirements for glove design - The glove must give the end user the highest levels of protection and be designed to minimise the time required for putting on and removing.

2. Resistance to water penetration (if required) - Provides an indication of how water resistant the materials used to manufacture the gloves are.

3. Innocuousness – Innocuousness is the restriction of banned substances which cannot be used in components making up the gloves, for example: pH value of leather to a minimum requirement and the presence of chromium VI.

4. Cleaning - Cleaning instructions including how to take care of the gloves during their wear life.

5. Electrostatic properties (if required) - Electrostatic properties denotes the gloves will provide protection against static shocks so sensitive electrical components or explosives can be handled reducing the risk of a static discharge.

6. Sizing - Sizing gives minimum dimensions for measuring the glove from the tip of the middle finger to the bottom of the cuff which then determines the end size of the glove to fit the appropriate hand.

7. Dexterity - Dexterity gives the wearer an indication of tactile feeling through the gloves and indicates an increased or decreased ability to pick up objects.
8. Water vapour transmission and absorption (if required) – Water vapour transmission and absorption gives an indication of how well the materials used in the gloves allow the skin to breath during wear.

9. Marking and information supplied by the manufacturer – These should include details of the levels achieved for the properties tested against for the gloves, including the relevant pictogram from the standard, and should inform the end user of how to take care of the gloves during their working life.

This standard cannot be used alone, but only in combination with another standard containing requirements for specific performance of a product in providing protection. This standard must be used in conjunction with further testing for all gloves which are to be submitted for certification.

**EN 388 Protective Gloves against Mechanical Use**

Gloves tested to this standard are used in industries like construction or manufacturing. If the end use is known to have contact with rough surfaces, then a high level of abrasion is required. If sharp objects will be handled; a higher level of cut and puncture resistance will be required. The standard specifies the requirements for gloves to protect the user against mechanical risks and defines the terms to be used. This method is the most common standard which gloves are tested against and contains four tests. For abrasion resistance, tear resistance and puncture resistance, four samples are taken from the palm area of the gloves. For blade cut resistance, two samples are taken on the bias from the palm area. Once tested, the results are compared to the levels detailed within EN 388. At the point which failure occurs, the preceding level is assigned to the gloves.

1. Abrasion resistance - There are four levels of abrasion resistance. Each denoted by the number of cycles including 100, 500, 2000 & 8,000 cycles. They are tested using 100 grit glass paper until the sample develops a hole. The test is then finished and the relevant level assigned.

2. Blade cut resistance - There are five levels of blade cut resistance. The sample has a steel blade rolled over it using standardized, calibrated equipment until it cuts through the sample. The number of cycles achieved is put through an equation given by the standard and a cut index is assigned.

3. Tear resistance - A trouser tear test is performed in both directions (warp and weft of the fabric) on a Universal Testing Machine. The lowest load achieved is reported.
4. Puncture resistance - A standard pin is mounted on a Universal Testing Machine. The sample is securely fastened in a clamp. The pin is driven through the sample until breakthrough has occurred, and the maximum force required to do this is recorded. However, the lowest of the four results is reported.

The results obtained from these tests are used to determine the levels of protection offered by the glove, when compared against the values in the following table. At least one of the four tests must achieve level 1 and the glove must conform to EN 420 to be certified against EN 388.

### Levels of Protection for EN 388

<table>
<thead>
<tr>
<th>Test</th>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion Resistance (number of cycles)</td>
<td>&lt;100</td>
<td>100</td>
<td>500</td>
<td>2,000</td>
<td>8,000</td>
<td></td>
</tr>
<tr>
<td>Blade Cut Resistance (cut index)</td>
<td>&lt;1.2</td>
<td>1.2</td>
<td>2.5</td>
<td>5.0</td>
<td>10.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Tear Resistance (in newtons [N])</td>
<td>&lt;10</td>
<td>10</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Puncture Resistance (in newtons [N])</td>
<td>&lt;20</td>
<td>20</td>
<td>60</td>
<td>100</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

### EN 374 Protective Gloves against Chemicals and Micro-organisms

These types of gloves are used in industries where oils, grease, chemicals and pharmaceutical biology are conducted (e.g. laboratories, oil and gas, engineering, etc.) This standard specifies the requirements for gloves to protect the user against chemicals and/or micro-organisms and defines the terms to be used. The standard has three parts.

Part 1 specifies the performance requirements, markings and user information to be provided.

Part 2 specifies two test methods for the penetration resistance of the gloves:

- A water leak test during which the glove is filled with water and inspected for leaks.
• An air leak test during which the glove is filled with compressed air to also be checked for leaks.

Part 3 specifies the determination of the resistance of protective glove materials to permeation by potentially hazardous non-gaseous chemicals under the condition of continuous contact. A glove shall be tested using a minimum of three chemicals listed in EN 374-1 and reach at least level 2.

**EN 407 Protective Gloves against Thermal Risks (Heat and/or Flame)**

The standard specifies requirements, test methods, information to be supplied to end users and marking for protective gloves against heat and/or flame.

This standard should be used for all gloves which protect the hands against heat and/or flames in one or more of the following forms:

• Fire – Burning behaviour is assessed by placing a flame at the tip on the middle finger of a glove. After a given time of 3 and 15 seconds, the after flame and after glow times are measured and recorded.

• Contact Heat- The glove is placed on a hot surface and the time taken for the temperature of the glove to rise by 10°C is recorded.

• Convective Heat – The glove is placed over a flame and the time taken for the temperature of the glove to rise by 24°C is recorded.

• Radiant Heat – The glove is placed on a hot surface. The amount of heat radiating through the glove is measured as a relative heat transfer index.

• Small Splashes of Molten Metal – A steel rod is heated until it melts. The resulting metal droplets are allowed to fall onto the glove. The number of droplets which cause a temperature rise of 40°C are recorded.

• Large Quantities of Molten Metal – Different quantities of molten iron are heated in a crucible, and then tipped over the glove. The droplets should roll off the surface. Any droplets remaining stuck to the glove, mean the gloves fail the test.

The defined performance level for each test depends upon the intended field of application of the glove. Only the tests that are relevant to the risks in the intended end-use application need to be carried out. The level of the gloves’ protection will be determined by the test results obtained and must be labelled
accordingly. The performance levels for each test range from 1 to 4 - the higher the figure, the increased level of performance of the gloves.

**EN 12477 Welders Gloves**

This standard specifies requirements, test methods, information to be supplied to the end user and marking for protective gloves against welding. There are two types of glove specified in the standard, Type A or Type B.

Type A gloves are associated more with gas welding with a blow torch and has higher performance requirements but a lower dexterity requirement.

Type B gloves are associated more with TIG (tungsten inert gas) welding and have lower performance requirements but higher dexterity requirements.

Gloves must offer protection against the following:

- Abrasion Resistance
- Blade Cut
- Tear Strength
- Puncture Resistance
- Burning Behaviour
- Contact Heat
- Small Splashes of Molten Metal
- Dexterity Requirements
- Convective Heat – only applicable for Type A gloves

**Additional Types of PPE Gloves and Standards**

There are many other types of PPE gloves on the market which have their own corresponding standards and requirements:

- **Cold Hazard** - EN 511 – These gloves provide protection down to -50°C with protection against convective cold, contact cold and water penetration likened to industry or climate.

- **Handheld Chainsaw Protection** - EN 381 for gloves to be worn while using handheld chainsaws.

- **Fire Fighters Protection Against Heat and Flame** - EN 659 – This standard differs from EN 407 with different design and test level
requirements to make them fit for fire fighters to wear and receive a competent level of protection.

- **Ionizing Radiation and Radio Active Contamination** – EN 421
- **Motorcycle Gloves for Riders** – BS EN 13594
- **Gloves to be worn in violent situations and in associated training activities** – BS 7971 Parts 6 & 7
- **Sports Gloves** - There are many standards for gloves used in sport. The standards vary widely dependent upon which sport is played to reflect the wide variations between levels of protection and dexterity required. A few of the sports with specific glove requirements include cricket, football (for goalkeepers), martial arts, etc.

**PPE & the European Community Directive**

Since June 1995, products designed to protect the user from health and safety hazards must be CE marked before they can be sold in the European Community. Such products are called Personal Protective Equipment (PPE) and are covered by the Personal Protective Equipment Directive 89/686/EEC. This EC Directive defines the regulations and procedures required before a PPE product may be CE marked and placed on the market. It includes a set of health and safety requirements with which all PPE must comply. The responsibility for ensuring that the Directive is adhered to falls upon the manufacturer. The Directive is enforced in the UK by the local authority Trading Standards Service. Failure to comply can lead to up to 3 months in prison and/or a fine of up to £5000. Furthermore, manufacturers can be required to recall and replace any equipment found to be faulty. The CE mark is the manufacturer’s claim that their product meets the requirements of the directive. It is illegal to CE mark a product which does not comply with these requirements.

The PPE directive defines three categories of products:

- **Simple design** - products for protection against minimal risks (for example: sunglasses)
- **Intermediate design** - products which do not fall within either of the above classifications (for example: most PPE gloves)
**Complex design** - products for protection against dangers which may be fatal or cause serious irreversible injuries (for example: respiratory protection systems)

The CE marking process is different for each category. For all categories, conformance with the requirements of the Directive must be declared in writing, and a technical file must be compiled (technical files are explained below). For intermediate and complex design products, an independent assessment of the product is also necessary. This process is called an EC Type Examination, and usually involves testing against a harmonised European standard in order to prove conformance with the Basic Health and Safety Requirements of the Directive. For complex design products only, there is a further requirement that production is independently monitored to ensure that quality levels are maintained after the CE marking license had been granted. This is achieved through regular factory inspections, or approval of a recognised quality control system, by competent authorities.

The vast majority of glove PPE falls into the intermediate design category. But there are some exceptions, such as gloves for use in dangerous situations (for example, fire fighters) which fall into the complex design category.

**Technical Files**

Following successful completion of the relevant testing programme, a technical file must be compiled and assessed by a Notified Body appointed by the government of an EC member state. The Notified Body has the authority to issue an EC Type Examination Certificate, which is effectively a license to CE mark the product. The technical file is held by the Notified Body for at least 10 years after the last placement of the product(s) on the market.

A technical file is a collection of documents which includes:

* Details of compliance with the health and safety requirements
* Technical specifications of the product(s)
* Details of suppliers of all relevant components
* Test results
* Quality procedures

Upon successful assessment of the technical file, a document called an EC Declaration of Conformity must be submitted to the Notified Body. This is a legally binding document which states that the product is in conformance with the PPE directive. Changes to the product are not permitted without further testing and re-certification.
Other Regulations

Manufacturers located outside the European Community (EC) must have an authorised representative established within the EC. As well as the CE mark, various other markings must be present on the gloves, as defined by the relevant harmonised standard. An information notice to the user must be supplied with each pair of gloves sold. This is a document which explains the protection provided and other details such as care guidelines.

Certification

Products for which certificates are granted may be CE marked and sold freely throughout the European Community. However, under the 2014 draft version of the PPE directive, certificates are only valid for 5 years. This is expected to be made permanent when the new regulation is issued.

Who are Intertek?

Intertek is a global leader in Personal Protective Equipment (PPE) testing and certification of products, such as safety footwear, gloves, fire-fighting apparel, respiratory apparatus, and helmets. Intertek is accredited by the Standards Council of Canada (SCC), and is recognized by OSHA. We have performed evaluations in accordance with such standards as ANSI, ASTM, NFPA, CPSC, EN, CSA, SAE, AS and ISO.

We also offer testing and inspection services around the world. To better serve our international clients, we maintain an alliance with a U.K. based Notified Body that accepts Intertek data for the issuance of a notified CE Mark.

Intertek is a leading quality solutions provider to industries worldwide. From auditing and inspection, to testing, training, advisory, quality assurance and certification, Intertek adds value for its customers by helping improve the quality and safety of their products, assets and processes. With a network of more than 1,000 laboratories and offices and over 36,000 people in more than 100 countries, Intertek supports companies’ success in the global marketplace, by helping customers to meet end users’ expectations for safety, sustainability, performance, integrity and desirability in virtually any market worldwide.

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