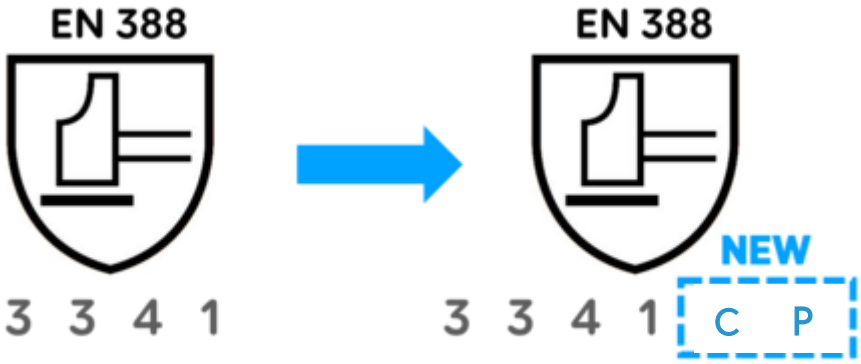
OnSite Support Research Team

OnSite Support White Paper EN388:2016 +A1:2018

Hand Protection Standard Explained



This and other White Papers have been developed by the OnSite Support Research Team
in collaboration with leading independent bodies and other partners

Introduction

The UK, in common with the rest of the Europe, adopted the new glove standards in 2016 as a means of more closely defining real world protection of gloves.

However there has been a long transition period but manufacturer's have now adopted and applied the new standards.

Here we cover the main updates from the EN 388:2003 to EN 388:2016 standards and the latest version A1 2018.

EN 388 IS A EUROPEAN SAFETY STANDARD FOR PROTECTIVE GLOVES

What is EN 388?

- **Purpose:**

EN 388 is used to test and rate the performance of protective gloves against mechanical risks.

- **How it works:**

Gloves are tested for their resistance to abrasion, cut, tear, and puncture. In the most recent version, impact resistance is also included.

IT PROVIDES A NUMERICAL RATING SYSTEM TO ASSESS A GLOVE'S RESISTANCE AGAINST VARIOUS MECHANICAL HAZARDS, INCLUDING ABRASION, CUT, TEAR, PUNCTURE, AND, IN SOME CASES, IMPACT.

- **Rating System:**

The standard uses a rating system (numbers and letters) to indicate the level of protection offered by a glove against each hazard.

THE STANDARD HAS BEEN UPDATED OVER TIME, WITH THE LATEST VERSION BEING EN 388:2016+A1:2018.

Background

Hazards to the hands and arms include abrasion, temperature, cuts, impact, chemicals, electric shock, radiation, biological agents or prolonged immersion in water.

PPE options are gloves (including gloves with a cuff), gauntlets and sleeving that covers part or all of the arm.

Avoid gloves when operating machines such as bench drills where they might get caught.

Barrier creams are not a substitute for proper PPE. Using separate cotton inner gloves can help prevent skin problems from wearing gloves for long periods. Choose gloves made from materials that are not quickly penetrated by chemicals. There is more guidance on skin at work from the HSE found here.

- The main differences between the EN 388:2003 and EN 388:2016 standards
- Each test undertaken and its criteria for each rating
- A focus on the new Cut (TDM-100 Test) and its updated A-F cut ratings

The EN 388:2016+A1:2018 standard is intended to be used in conjunction with EN ISO 21420:2020 – 'Protective gloves. General requirements and test methods'

EN 388:2016+A1:2018 specifies requirements, test methods, marking and information to be supplied for protective gloves against the mechanical risks of abrasion, blade cut (cut resistance method (EN ISO 13997:1999)), tear, puncture and, if applicable, impact. The test procedures include a separate test for each of these properties. A performance level is determined according to each test result – the higher the number or ascending letter, the higher the level of protection.

Guidance on Gloves: Choosing the right gloves to protect skin

Taken form the HSE advice on gloves
www.hse.gov.uk/mvr/topics/gloves.htm

Protecting against substances in the workplace

The most effective and reliable way to prevent skin problems is to design and operate processes to avoid contact with harmful substances. So take all the steps you can to achieve this before resorting to the use of protective gloves. Gloves differ in design, material and thickness. No glove material will protect against all substances and no gloves will protect against a specific substance forever.

Protective gloves tend to be less effective than other control measures but if avoiding contact is impractical or is not enough to protect employees then gloves may be needed. When you select protective gloves, base your choice on the work, the wearer and the environment they work in.

Identify the substances handled

Water/'wet work'

- Prolonged or frequent contact with water, particularly in combination with soaps and detergents, can cause dermatitis. In MVR this might include vehicle washing, valeting work and also wet sanding techniques in bodyshops. 'Wet work' is the term used to describe tasks in the workplace that can cause this.
- To protect the hands from 'wet work' choose a glove that meets the European Standard EN374-2. This shows that the gloves are waterproof.

Substances in products and created by work processes

- Substances in products.
  Some products contain substances that can harm the skin or enter the body through skin contact (e.g .degreasing solvents, paints, cleaning chemicals). The product label or material safety data sheet should tell you if this is the case. These may also give information on what protective gloves to use. If this is missing then try contacting the product supplier or manufacturer for help.
- Substances created by work processes.
  Not all harmful substances come in labelled containers. Substances can be generated during work activities (e.g. body filler dust from sanding, welding fumes). If you are unsure if a substance produced by a work process you are handling is harmful, you can get help from a variety of sources, e.g. your trade association or this website.
- To protect hands from substances/chemicals choose a glove that meets the European Standard EN374-3. But make sure the glove material you choose protects against the substances being handled.
- Glove manufacturers usually produce charts to show how well their gloves perform against different substances. Manufacturers use three key terms, breakthrough time, permeation rate and degradation:
  a. Breakthrough time is the time a chemical takes to permeate through the glove material and reach the inside. Permeation is a process by which a chemical can pass through a material without going through pinholes or pores or other visible openings. This tells you how long you can use a glove for.
  b. The permeation rate is the amount that then permeates through. The higher the rate the more of the chemical will move through the glove. Choose a low rate.
  c. Some chemicals can destroy the glove material. It may get harder, softer or may swell. Degradation indicates the deterioration of the glove material on contact with a specific chemical. Choose gloves with an excellent or good degradation rating.
- You can use manufacturers' charts to identify the best gloves for the chemicals being handled or glove manufacturers can help with this step.
- The performance of glove materials can vary slightly from manufacturer to manufacturer, so base your selection on the correct manufacturers' data.
- Keep in mind that the manufacturers' data is for pure chemicals, not mixtures. When you mix chemicals, their properties can change. As a rule of thumb, base your glove selection on the component in the mixture with the shortest breakthrough time. However, the only way to be absolutely sure that a glove performs well against the mixture is to have it tested.
- Some people develop an allergy to gloves made of natural rubber latex. Choose non-latex gloves unless there are no alternatives that give the protection needed. If you must use latex, choose low-protein, powder-free gloves.

Identify all other hazards for hands

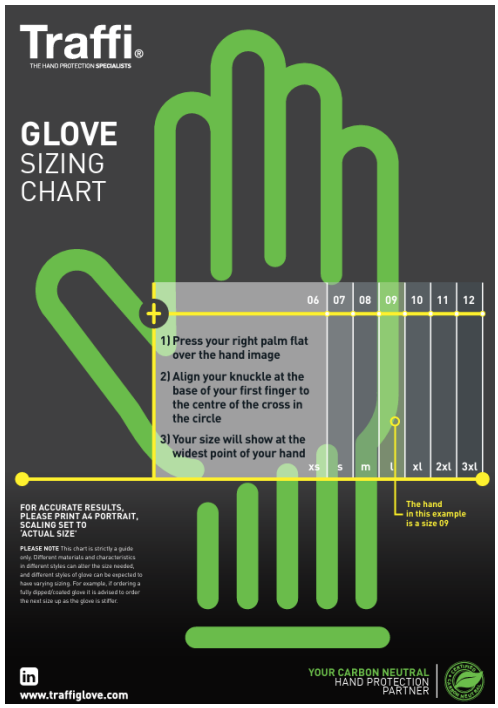
Identify any other hazards present. For example, is there a risk of, abrasion, cuts, puncture or high temperature? There are chemical protective gloves that also give protection against mechanical hazards (those marked EN388) and thermal hazards (those marked EN407).

Consider the type and duration of contact

- Will gloves be worn for a short time intermittently or for long periods? Comfort is more important for longer wear. Generally, thicker, robust gloves offer greater protection than thinner gloves but thinner gloves offer better dexterity.
- Will contact be from occasional splashes or by total immersion? Short gloves are fine to protect against splashes. If hands are immersed (and you can justify that this is unavoidable), choose a length greater than the depth of immersion.

Consider the user - size and comfort

- Gloves should fit the wearer. Tight gloves can make hands feel tired and loose their grip. Too large gloves can create folds; these can impair work and be uncomfortable. It can help to use sizing charts.
- Comfortable gloves are more likely to be worn. Involve employees in the selection process and give them a reasonable choice to pick from. This can sometimes promote buy-in to wearing them.
- Hands can sweat inside gloves making them uncomfortable to wear. Getting staff to take glove breaks, removing gloves for a minute or so before hands get too hot and sweaty, can help air the hands. You could also consider supplying separate cotton gloves to wear under protective gloves. These can increase comfort by absorbing sweat. They can be laundered and reused.



Example of sizing chart

Consider the task

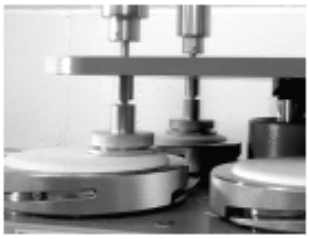
Gloves should not hamper the task. If wet/oily objects are handled, choose gloves with a roughened/textured surface for good grip. Select gloves that balance protection with dexterity.

Latex Gloves

- Dermatitis can be caused by direct contact with natural latex rubber in latex gloves. Powdered latex gloves can also cause asthma. This posed a risk, not only to the user but also to sensitised people in the area. Proteins in the latex glove leach into the powder which becomes airborne when they are removed. Inhaling the powder may lead to sensitisation.
- If you need to use latex gloves, ensure you specify 'low protein powder-free'. Alternatives such as soft nitrile, vinyl or plastic gloves may provide better chemical resistance or durability.

ABRASION TEST

ABRASION RESISTANCE (CYCLES)	PERFORMANCE LEVEL RATING
100	1
500	2
2000	3
8000	4



UPDATED: ABRASION PAPER

This test is carried out through the Martindale Abrasion Machine. A sample material is cut from the palm of the glove and fitted to a rubbing head of fixed size and weight. This is moved in an elliptical motion over a table covered with abrasion paper. The performance level of the glove is measured by the number of abrasion cycles required to 'hole' the material. Four samples are tested in this way, with the overall performance level decided by the lowest result.

TEAR TEST

TEAR RESISTANCE (NEWTONS)	PERFORMANCE LEVEL RATING
10	1
25	2
50	3
70	4

TEAR RESISTANCE

In this test, four samples from the palm of the glove are clamped in a standard tensile strength testing machine. The jaws move apart at a speed of 100mm per minute and from this the force required to tear the sample is measured. Performance levels range from 1 (resistance of peak force between 10N and 25N) to 4 (tear strength is at least 70N). For single materials, the level is decided by the lowest result of the four tests. For multiple, unbonded layers, each layer must be tested individually and the level is based on the lowest individual result of the most tear resistant material.

COUPE TEST

CUT INDEX	PERFORMANCE LEVEL RATING
1.2	1
2.5	2
5	3
10	4
20	5

COUPE TEST

Up until now, the 'Coupe Blade Cut Test' has been the standard test method for cut protection. A rotating circular blade moves horizontally to-and-fro across a fabric sample with a fixed force of 5 Newton's (N) applied from above. The test ends when the blade breaks through the sample material and the result is specified as an index value. This result is determined by the cycle count needed to cut through the sample and additionally by calculating the degree of wear and tear on the blade. This represents an exposure type cut risk in the workplace.

PUNCTURE TEST

PUNCTURE RESISTANCE (NEWTONS)	PERFORMANCE LEVEL RATING
20	1
60	2
100	3
150	4

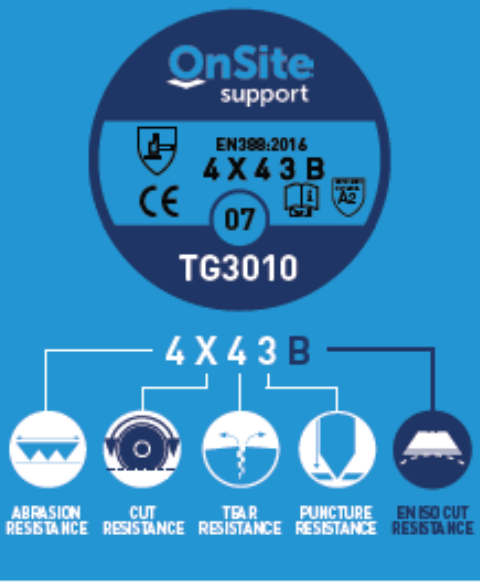
PUNCTURE RESISTANCE

This test consists of a compression test machine which pushes a rounded stylus 50mm (the size of a standard roofing nail) into the sample cut from the palm of the glove at a speed of 100mm per minute. From this, the maximum resistance force is recorded. Performance levels range from 1 (puncture resistance force of between 20N and 60N) to 4 (measured resistance of at least 150N). These levels are decided by the lowest of four test results.

EN ISO 13997 CUT TEST

For safety gloves created with materials designed to have a blunting effect on blades, additional cut protection tests must now be carried out and verified. Any sample fabric testing for cut resistance using the 'Coupe Blade Cut Test', which blunts the blade during the test, will be marked with an X and tested using the new EN ISO test. This is to ensure the degree of protection provided by the glove is as accurate as possible.

The objective of this new EN ISO 13997 cut test is to determine the resistance of the safety glove by applying the sample fabric with great force in a single movement, a better representation to the pressure type cut risk experienced in the workplace. To this end, a sharp-edged blade is dragged over the sample fabric once. This allows the accurate calculation of the minimum force required to cut the sample material at a stoke length of 20mm. The result is displayed in Newton's. There are 6 cut levels identified in the new EN ISO cut method.



Summary of A-F Rating

The new EN ISO13997 Cut TDM-100 Test improves the accuracy of cut performance data.

When buying gloves the new 'A-F' rating should be referenced but a direct comparisons to the old 1-5 cut levels can be difficult. For example under the new ISO13997 test, gloves previously rated as cut level 5 from EN 388:2003, could now be classified as a level 'C/D' or in some cases even a 'B'. However as glove manufacturers apply the new standards remember that if a type of glove met your needs before, its performance hasn't changed, but only the method of testing.

	Performance Level Rating	Cut Resistance (Newton)	Suggested Applications
Low Cut Protection Level	A	>2	Light material handling, small parts assembly, light duty general purpose
Medium Cut Protection Level	B	>5	Packaging, white goods manufacturing, warehousing / logistics
High Cut Level Protection	C	>10	Metal handling, light assembly, maintenance works
High Cut Level Protection	D	>15	Electrical installation & assembly, automotive assembly, engineering, utilities
Extra High Cut Level Protection	E	>22	Metal stamping & fabrication, glass manufacturing, automotive assembly, food processing, waste management
Extra High Cut Level Protection	F	>30	Heavy metal handling & stamping, pulp & paper, waste management, recycling, glass handling

Your Responsibilities

What you need to do

Once you have selected your gloves tell your employees how to use them properly to protect themselves. Tell them when they should be replaced, and if they are reusable gloves ask them to rinse them before removal (if practical) and tell them how they should be stored.

Review their use periodically and get employee feedback, this can help check that the gloves are performing properly.

Conclusion

User Safety:

Understanding EN 388 markings helps users choose the correct gloves for the hazards they face.

Position on Glove	Test Undertaken	Possible Rating
1.	Abrasion	0-4
2.	Cut (Coup Test)	0-5
3.	Tear	0-4
4.	Puncture	0-4
5.	Cut (TDM-100 Test)	A-F
6.	Impact Protection	P

If a test isn't applicable then a X may be displayed instead.

In essence, EN 388 is a crucial safety standard for various mechanical risks.

As such it should be used in conjunction with the other relevant standards that help ensure people select the appropriate hand protection for all the various risks they may encounter in their work or other activities.

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