Safe at work with Kramp Work gloves - EN standards

If a protective glove is deemed to meet the safety requirements and is given a CE mark in an EU country, it can be exported and sold throughout the EU zone. To meet the requirements, the manufacturer has to comply with a number of EN standards. An EN standard includes demands, testing methods and requirements as to how the product is to be labelled in addition to the CE mark, and also sets out what the manufacturer's instructions for use must contain.

EXPLANATION OF THE RISK CATEGORIES

EU Regulation 2016/425 divides personal protective equipment into three categories, depending on the level of risk involved. The greater the risk to which the user is exposed, the tougher the test requirements are concerning the gloves protective ability and certification. Since the EU regulations are framed in general terms, European standards have been developed that specify requirements, test methods and marking instructions. One such standard is EN 420, which lists general requirements for protective gloves. **CATEGORY I / SIMPLE DESIGN**

This category covers gloves used for work with minimum risks that can be identified in good time. This includes for instance gloves with less stringent requirements as to mechanical durability and gloves that are required to protect against hot objects. Gloves of a more basic type such as gardening gloves and assembly gloves belong in this category. The manufacturer must be able to show that the product meets the basic requirements for protective gloves (in accordance with EN 420), and is responsible for guaranteeing the CE marking. This applies to all protective gloves.

CATEGORY II / INTERMEDIATE DESIGN

Many protective gloves belong in this category, such as gloves where the requirements include mechanical durability to protect against, for example blade cuts. If gloves are to be given a CE mark, the manufacturer must be able to show that the product meets both the basic requirements and further standards that may apply to specific areas of use, such as welding gloves. The gloves must be tested by an approved laboratory and be type-approved by a notified body that issues certificates. Gloves in Category II must be marked with a pictogram, i.e., a symbol showing what the glove has been tested against and at what performance level. If the glove is intended to protect against mechanical risks (in accordance with EN 388), a six-figure code is shown beside or beneath the pictogram. These figures denote performance levels from tests against abrasion, blade cuts, tearing and puncture.

CATEGORY III / COMPLEX DESIGN

These gloves can offer protection against things like highly hazardous substances. They are required to protect against permanent damage in situations where the user may have difficulty detecting the risks in time. This includes for instance gloves that protect against heat (above +100°) and extreme cold (below -50°) and gloves used for handling most chemicals. The gloves must be tested by an approved laboratory and be type-approved by a notified body. A further requirement is a yearly inspection of the production process and the gloves will be properly checked to ensure the right quality. Not until this is done may the gloves be given a CE mark. The notified body's identity code (four figures) is to be placed directly after the CE mark, i.e. CE 0123.

Protective gloves – general requirements and test methods EN 420:2003 + a1:2009

Summary of the requirements:

- The gloves must have been made so as to provide the protection they are intended for.
- The seams and edges must not cause harm to the user.
- The gloves must be easy to put on and take off.
- The material must not harm the user.
- The pH of the gloves should be between 3.5 and 9.5.
- Chromium (VI) content should be below 3 mg/kg in leather gloves.
- The manufacturer must state whether the glove contains substances that may cause allergies.
- The protective quality of the glove must not be affected if the washing instructions are followed.
- The gloves must allow maximum finger mobility (dexterity), given the need for protection.

Size	Circumference of hand (mm)	Length (mm)	Minimum length of glove (mm)
6	152	160	220
7	178	171	230
8	203	182	240
9	229	192	250
10	254	204	260
11	279	215	270

It is important to choose the right glove size (see table above). Using gloves that are too large may increase the risk of accident. The sizing system in the above table is based on hand size, i.e., circumference and length. The standard also specifies requirements for resistance to water penetration, which is measured where necessary.

Marking requirements:

Each glove is to be marked with:
- The name of the manufacturer.
- The designation, e.g., Kramp Protect 1.001
- The size.
- The CE mark.

Gloves belonging to Category II and Category III must also be marked with the following:

- A pictogram denoting the type of risk that the glove has been tested for.
- The performance level and the reference to the relevant EN standard, e.g. 388, next to the pictogram.

Protective gloves against mechanical risks EN 388:2016

This pictogram shows that the glove is intended to protect against mechanical risks. The change in the name refers to the year. At the end of 2016 the new version of EN 388 was completed.

Changes have been made but much remains the same. Testing of resistance to wear, tear and puncture is carried out as before. The obtained test results are divided into levels of protection in the same way as in the 2003 version, which for these three tests is 0–4, with 4 being the highest. For details, see table below.
The major differences in the new edition compared with the previous is related to cut resistance and impact protection. There are now two methods available for testing the cut resistance and the standard clearly states that there is no correlation between them.

Changes related to cut protection in EN 388:2016
Another test method is added to the EN 388:2016. The method is described in the standard EN ISO 13997, commonly called 'TDM' which is an abbreviation for the equipment used: tomodynamometer. EN ISO 13997 describes exactly how the test works. The requirements and levels of protection are included in EN 388:2016, and for this method they are rated A to F, where F represents the maximum performance level. The test method for the previous version, the so-called Coup method, remains but is now only to be used for materials that do not affect the sharpness of the blade. This is because certain cut-resistant materials such as fiberglass diminishes the blade sharpness at the beginning of the test, which reduces the relevance of the test results.

Changes related to impact protection in EN 388:2016
Impact protection verification has been added to the EN 388:2016. The test method is taken from the motorcycle standard EN 13594:2015. The area with the protection is tested, which can vary per intended use, but due to technical reasons, the area around the fingers cannot be tested.

Here follows a brief description of each test method and the levels of protection:

A. Abrasion resistance
The glove material is subjected to abrasion with sandpaper under pressure. The number of turns required to wear a hole in the material is measured. The highest level of protection is 4, which corresponds to 8,000 revolutions.

B. Cut resistance**, Coup method**
This measures the number of turns required for a rotating circular knife at a constant rate to cut through the glove. The result is compared with a reference material to get an index. The highest level of protection is 5, which corresponds to an index of 20.

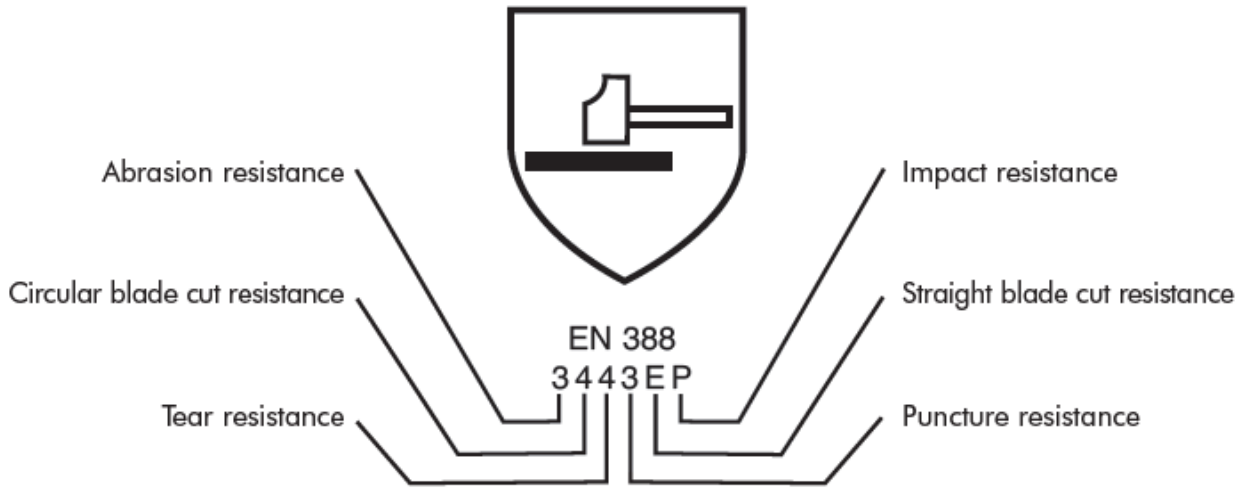
C. Tear resistance
The glove material is cut, after which the force needed to tear the material is measured. The maximum protection level is 4, which corresponds to a force of 75 newton.

D. Puncture resistance
The force needed to pierce the glove with a nail having a predetermined dimensions and certain speed (10 cm/min) is measured. The highest protection level is 4, which corresponds to a force of 150 newton.

E. Cut resistance, TDM, EN ISO 13997
The basic principle is to measure how the cut resistance is affected by the amount of force applied during the test. A new sharp blade is used for each part of the test, and the resulting measurement is how far the blade can move before it cuts through. The unit is millimeters (mm). Several incisions are made and for each cut there's a new blade, new test area and specific force (in the form of weights). Different weights result in different forces, causing the blade to move different lengths before it cuts through. Several tests are carried out and specific weights are correlated to a measurement in millimeters. A chart is created based on the different forces in the form of newton

values (x) and length in mm where the glove breaks (y). The test result is the newton value needed to penetrate the glove material at 20 mm. The highest cut protection level is F, which corresponds to 30 newton.

F. Impact protection
The test for protection against impact is carried out per a standard for protective gloves for bikers, EN 13594:2015. The area with protection is tested, but because of its limited surface, the area around the fingers cannot be tested using this method. The impact force is 5 J and the transmitted force must be in accordance with the highest level, in this case level 1, with an individual result of ≤ 9.0 kN and mean force ≤ 7.0 kN.



EN 388 – Testing (specifies the requirements that apply for each safety level)

Level of performance	**1**	**2**	**3**	**4**	**5**	
A. Abrasion resistance (No. of cycles)	100	500	2000	8000		
B. Circular blade cut resistance (index)	1,2	2,5	5,0	10,0	20,0	
C. Tear resistance (N)	10	25	50	75		
D. Puncture resistance (N)	20	25	50	75		
Level of protection	**A**	**B**	**C**	**D**	**E**	**F**
E. Cut resistance (N)	2	5	10	15	22	30
Level of protection	**P**					
F. Impact protection, EN 13594: 2015	Pass (Level 1 ≤ 9kN)					

Protective gloves against thermal risks (heat and/or fire) EN 407:2004

This standard specifies thermal performance for protective gloves in relation to heat and/ or fire. These risks mainly involve contact with strong heat generated as a result of combustion, radiation or molten metal. Gloves marked with this pictogram show that they give protection against one or more of the thermal risks. What the glove protects against (A-F in the right-hand column) and up to what performance level (1-4) must be stated next to the pictogram. The gloves are required to attain at least Level 1 for abrasion resistance and tear resistance in accordance with EN 388.

THE TEST COVERS:

A. Resistance to burning behavior

Here, the test involves measuring the time it takes for the glove material to stop burning and glowing after being exposed to a gas flame for 15 seconds. The highest performance level is 4, which represents an after-burn time of no more than two seconds and an afterglow time of no more than five seconds. If the glove risks coming into contact with fire, it must attain at least Level 3.

B. Contact heat resistance

The test involves measuring the temperature range (100°C–500°C) at which the glove gives protection for 15 seconds without the inside of the glove becoming ten degrees hotter. The highest performance level is 4, which means the glove can withstand +500°C.

C. Convective heat resistance

(= gradually penetrating heat) This is based on the length of time the glove is able to delay the transfer of heat from a flame to the extent that the temperature on the inside increases by 24 degrees. The highest performance level is 4.

D. Radiant heat resistance

The glove is exposed to heat radiation. The test involves measuring the time it takes for a given amount of heat to penetrate the glove. The highest performance level is 4, which means that the glove gives protection for at least 95 seconds.

E. Resistance to small splashes of molten metal

Here, the test involves measuring how many drops of molten metal are needed to increase the temperature between the glove material and the skin by 40°C. The highest performance level is 4, which corresponds to 35 drops or more.

F. Resistance to large quantities of molten metal

This test shows how many grams of molten iron are required to damage synthetic skin (PVC) attached to the inside of the glove material. The highest performance level is 4, which corresponds to 200 grams of liquid metal.

EN 407 - Testing				
Level of protection	**1**	**2**	**3**	**4**
A. Burning behavior (s) After flame time After glow time	 ≤20 No requirement	 ≤10 ≤120	 ≤3 ≤25	 ≤2 ≤5
B. Contact heat (s)	100˚C ≥15	250˚C ≥15	350˚C ≥15	500˚C ≥15
C. Convective heat (s)	≥4	≥7	≥10	≥18
D. Radiant heat (s)	≥7	≥20	≥50	≥95
E. Small splashes of molten metal (no.)	≥10	≥15	≥25	≥35
F. Large quantities of molten metal (g)	30	60	120	200

WARNING The glove must not come into contact with fire if it does not attain performance level 3 when tested for resistance to flammability.

Protective gloves against cold EN 511:2005

Gloves carrying this pictogram meet the requirements for protection against cold. The performance level attained by the glove is stated next to the pictogram. Gloves giving protection against cold are tested for two different cold situations: penetrating or convective cold (a) and contact cold (b), i.e., direct contact with cold objects. In both cases, the highest performance level is 4. Testing resistance to permeability by water (c) is done when relevant. There are two ratings here: 0 and 1. If no water has penetrated after 5 minutes the glove is marked with a 1 as the last number in the code beside the pictogram. Otherwise the rating is 0.

The pictogram may only be used for gloves that have attained performance level 1 for convective cold or contact cold. An X means that it is not relevant to test the glove for permeability by water. All gloves must attain at least performance level 1 for abrasion resistance and tear resistance under EN 388. In the case of extreme cold, the requirements concerning mechanical resistance are stricter. From Level 2 upwards, the gloves have to attain at least performance level 2 for abrasion resistance and tear resistance.

EN 511 - Testing					
Level of protection	**0**	**1**	**2**	**3**	**4**
A. Convective cold (isolation ITR/m²)	I<0,10	0,1< I <0,25	0,15< I <0,22	0,22< I <0,30	0,30< I
B. Contact cold (thermic resistance R/m²)	R<0,025	0,025<R <0,050	0,050<R <0,100	0,100<R <0,150	0,150<R
C. Water penetration 5 min.	Penetration	No penetration			

Protective gloves against dangerous chemicals and microorganisms EN ISO 374: 2016

Note that it is still important to consult the manufacturer regarding the application of the gloves. A risk assessment of the workplace activity must always be carried out, taking specific working conditions into account in order to identify the exact protection requirements.

- There are three levels of protection for gloves: Type A, B and C. Gloves will be labelled accordingly with pictograms.
- A further six chemicals have been added to the existing chemical list.
- If virus protection is claimed, an additional test is required: ISO 374-5:2016.
- The permeation method has changed from EN374-3:2004 to EN 16523-1:2015.
- Degradation testing (EN374-4:2013) is now required for each tested chemical in the permeation test.
- Gloves that do not provide mechanical protection are no longer required to be tested according to EN388.

Type of glove	**Marking**	**Requirement**

Type A	**EN374-1:2016/Type A**  UVWXYZ	Breakthrough time > 30 min for at least 6 chemicals in the new list
Type B	**EN374-1:2016/Type B**  UVW	Breakthrough time > 30 min for at least 3 chemicals in the new list
Type C	**EN374-1:2016/Type C** 	Breakthrough time > 10 min for at least 1 chemicals in the new list

Performance level	**1**	**2**	**3**	**4**	**5**	**6**
Breakthrough time (min)	>10	>30	>60	>120	>240	>480

List of chemicals on which the gloves are tested;

Code letter	Chemical	CAS Number	Class
A	Methanol	67-56-1	Primary alcohol
B	Acetone	67-64-1	Ketone
C	Acetonitrile	75-05-8	Nitrile compound
D	Dichloromethane	75-09-2	Chlorinated hydrocarbon
E	Carbon disulphide	75-15-0	Sulphur containing organic compound
F	Toluene	108-88-3	Aromatic hydrocarbon
G	Dimethylamine	109-89-7	Amine
H	Tetrahydrofuran	109-99-9	Heterocyclic and ether compound
I	Ethyl acetate	141-78-6	Ester
J	n-Heptane	142-82-5	Saturated hydrocarbon
K	Sodium hydroxide 40%	1310-73-2	Inorganic base
L	Sulphuric acid 96%	7664-93-9	Inorganic mineral acid, oxidizing
M	Nitric acid 65%	7697-37-2	Inorganic mineral acid, oxidizing
N	Acetic acid 99%	64-19-7	Organic acid
O	Ammonium hydroxide 25%	1336-21-6	Organic base
P	Hydrogen peroxide 30%	7722-84-1	Peroxide
S	Hydrofluoric acid 40%	7664-39-3	Inorganic mineral acid
T	Formaldehyde 37%	50-00-0	Aldehyde

PROTECTION AGAINST MICROORGANISMS: ISO 374-5:2016

Markings on packing will indicate whether gloves protect against bacteria and fungi only, or against bacteria, fungi and viruses. The biohazard pictogram is used to mark gloves protecting from bacteria and fungi. The pictogram will be accompanied by the word “VIRUS” if the glove meets the requirements of the virus test method.

For gloves protecting against bacteria, fungi and viruses.

For gloves protecting against bacteria and fungi.

DEGRADATION TESTING

Completely new for this standard are degradation requirements. Degradation is the change in puncture resistance after contact with the chemical in question*. During testing, the glove is perforated before and after contact with a specific chemical. Degradation will be tested for every chemical claimed in the marking.

*Reported as a percentage

CUFF SAMPLING FOR LONGER GLOVES

There have also been changes to the sampling requirements for gloves with protective cuffs. Three samples from the palm will be tested for all gloves. If the glove has a cuff that is 400mm or longer, then samples from the cuff will also be tested. The aim is to ensure that protective cuffs provide the same level of protection as the palm.

DEFINITION OF TERMS

Penetration

When a chemical moves through pinholes and other imperfections in the glove material at a non-molecular level.

Permeation

The absorption of a chemical through the glove material at a molecular level. Breakthrough time is how long it takes for the chemical to move through the material and come into contact with the skin.

Degradation

A negative change in the glove material after contact with a chemical. Signs of degradation include flaking, swelling, disintegration, brittleness, color change, dimensional change, change in appearance, hardening, softening, etc.

TESTING DETAILS

- Penetration test: in accordance with EN 374-2: 2014
- Permeation test: in accordance with EN 16523-1: 2015, which replaces EN 374-3
- Degradation test: in accordance with EN 374-4: 2013
- Virus protection test: in accordance with ISO 16604: 2004 (method B)

Protective gloves with electrostatic properties EN 16350: 2014

The use of antistatic (dissipative) gloves is important in environments with hazards related to fire and/or explosion. The phenomenon to avoid is the electric potential difference between user and environment that is triggered during contact, what we colloquially call getting a 'shock'. The potential difference must be prevented in environments where it is judged that there is a risk of explosion and/or fire hazard. In these situations, there must be a holistic approach; it is important to consider the entire system in which the gloves are only one part. The required property is a low resistance so that electric charges do not accumulate. In EN 16350:2014 the requirement is that the vertical resistance of the gloves must be <108 7. The test method used is EN 1149-2:1997 and the conditions during the test is 25% relative humidity and a temperature of 23 °C. The method can also be used in other situations; it is therefore important to focus on the technical specification, in this case to be found in EN 16350:2014.

Gloves suitable for contact with foodstuffs

The EU's framework regulations for materials with contact with foodstuffs EC/1935/2004 establish general guidelines for all materials that may come into contact with food, including gloves. The materials used may not alter the food to such an extent that human health is at risk. Nor may the materials cause any unacceptable change in the composition of the food products or affect their taste and smell. The EU regulation on materials in contact with food Regulation 10/2011 replaced several previous directives but only applies to plastics. In the case of other materials, such as rubber, no regulations have been introduced as yet; instead, member states are referred to the recommendations of the German BfR, Das Bundesinstitut für Risikobewertung. All materials are analyzed in order to gauge the extent to which substances are transferred – migrate – from gloves to food of one kind or another. The food is divided into different groups, such as aqueous, acidic, alcoholic and fatty. Additional groups are listed in Regulation 10/2011. In the migration analysis, a simulant is used that resembles each food group. A glove material can be tested against one or more groups.

Food product group	Simulator	Examples of food
Aqueous	Distilled water	Vegetables, drinks, etc. with pH>4.5
Acidic	3% acetic acid	Juice, fruit pieces, sauces, dressings etc. with pH<4.5
Alcoholic	10% alcohol	Wine, vinegar
Fatty	Olive oil or another equivalent	Butter, cheese, meat, fish, chocolate etc.

Gloves that have been approved for handling foodstuffs are marked with the ‘fork and glass’ pictogram. It should be noted that the gloves may be suitable for some food groups but not for others. Contact your seller if you need further information. Tests for fatty foods use simulants equivalent to 100% fat, but the actual fatty content of foodstuffs may vary. For this reason, the migration test results are divided by a fat reduction factor (FRF) of 2-5, to reflect different foods. In the case of meat, for instance, the test result for fatty foods is divided by 4 (FRF 4). The figure thus obtained must be below the set limit of 10 mg/dm² for a glove to be approved. The test is conducted for a specific length of time and at a specific temperature. In the case of rubber materials this is 10 minutes at 40°C.

- Migration from the glove material to the food simulant may not exceed 10 mg/dm2 of material.
- Specific limits are enforced for certain special substances and additives in materials that come into contact

ESD

ESD stands for electrostatic discharge. All those engaged in the production or maintenance of sensitive electronic equipment need to protect it from the effects of discharging static electricity. This applies throughout both the manufacturing and maintenance processes. Both gloves and shoes make up an important part of this protection, and it is decisive that the whole system works together and is used properly. Products that are marked ESD meet current criteria and standards for ESD protection.

Test method

The international standard IEC 61340-5-1 is used to ensure that an ESD glove is capable of handling the resistance requirements of the system, which means that the resistance from operator to ground is less than 1097. The test is performed at 12% humidity. Shoes are tested in accordance with the standard IEC 61340-4-3 which ensures that the shoes have a resistance to ground of less than 1087.