

## Protective Gloves Selection

Protective gloves are used in many situations. They shall protect human skin during wet work, against mechanical and thermal injury, against infections, or against chemicals and drugs. Or they shall protect sensitive material against contamination by hands

**Various types of skin diseases are among the most frequently occurring work related diseases. In Germany 25% of all registered occupational diseases are skin diseases. In Great Britain 660,000 workdays are annually called off due to occupational skin diseases. For prevention of these serious problems it is imperative to avoid too much humidity on hands, direct skin contact with chemical products, and exposure to hazards from glove itself.**

Protective gloves may reduce the risk to human health significantly. However, it is essential to find the appropriate glove for each specific purpose. A wrong glove provides the user with a false sense of safety and may prove even more dangerous than no glove at all. And employees may refuse stiff and non-flexible gloves for bad comfort, resulting in bad protection and increased health risk.

Inappropriate gloves as well as hazardous glove ingredients may cause considerable health risks. Some glove ingredients may cause allergies, such as Chromium(VI) in leather gloves, or certain proteins in latex gloves. Textile gloves and plastic gloves may contain carcinogens and other substances of concern if they migrate into skin or into products (such as food).

### Selection of gloves

The all purpose glove does not exist. CE mark indicates certain basic tests have been performed but these are not specific enough in many cases.



Gloves shall be safe in use:

- Any gloves shall be safe and comfortable to wear.
- General working gloves shall be robust and protect against some more mechanical challenges.
- Food handling gloves shall not show migration of plasticisers and other substances into food.
- Medical gloves shall not deteriorate dexterity and be tight against infectious liquids, and against certain drugs.
- Chemical protective gloves shall protect against the chemical challenges in use - this challenge may differ widely between different applications, resulting in very different gloves to be selected.

Eurofins can help selecting the right glove for each particular need by searching existing knowledge and by testing. The network of Eurofins laboratories provides high expertise on different fields, making Eurofins Group a unique place for designing and performing glove testing tailored to many specific needs.

## Mechanical stability

The stability under mechanical stress is tested at Eurofins for any type of gloves, following international standards (ISO 1817, ISO 37 and similar, tensile strength and more). A glove is stretched, and necessary force is measured at certain length, and at break.

## Gloves and health

The glove itself may constitute a hazard. If allergens are released from the glove material they will be transferred to the body immediately due to tight skin contact with the glove, and the humid atmosphere inside the glove supports health effects.

Latex allergy from surgical or household gloves is an important issue. Residual proteins originating from the natural latex milk are among the main triggers. Eurofins is ready to analyse glove contents of sensitising proteins (EN 455-3), but also to determine biological tolerance such as skin irritation. Leather gloves may cause allergy

by exposure to chromium(VI) compounds originating from tanning agents. Eurofins is ready to analyse glove contents of chromium(VI) (EN 420 and ISO 17075).

Other hazardous ingredients such as N-nitrosamines, azo dyes, aromatic amines, PCP and more may be determined in case of doubt.

## Food contact gloves

Plasticisers and other substances may migrate into food, deteriorating its quality. Migration testing (EN 1186) uses different food simulants. Overall migration may be determined, as well as specific migration of certain substances. Similar issues may be relevant in electronic industry.

## Degradation of gloves

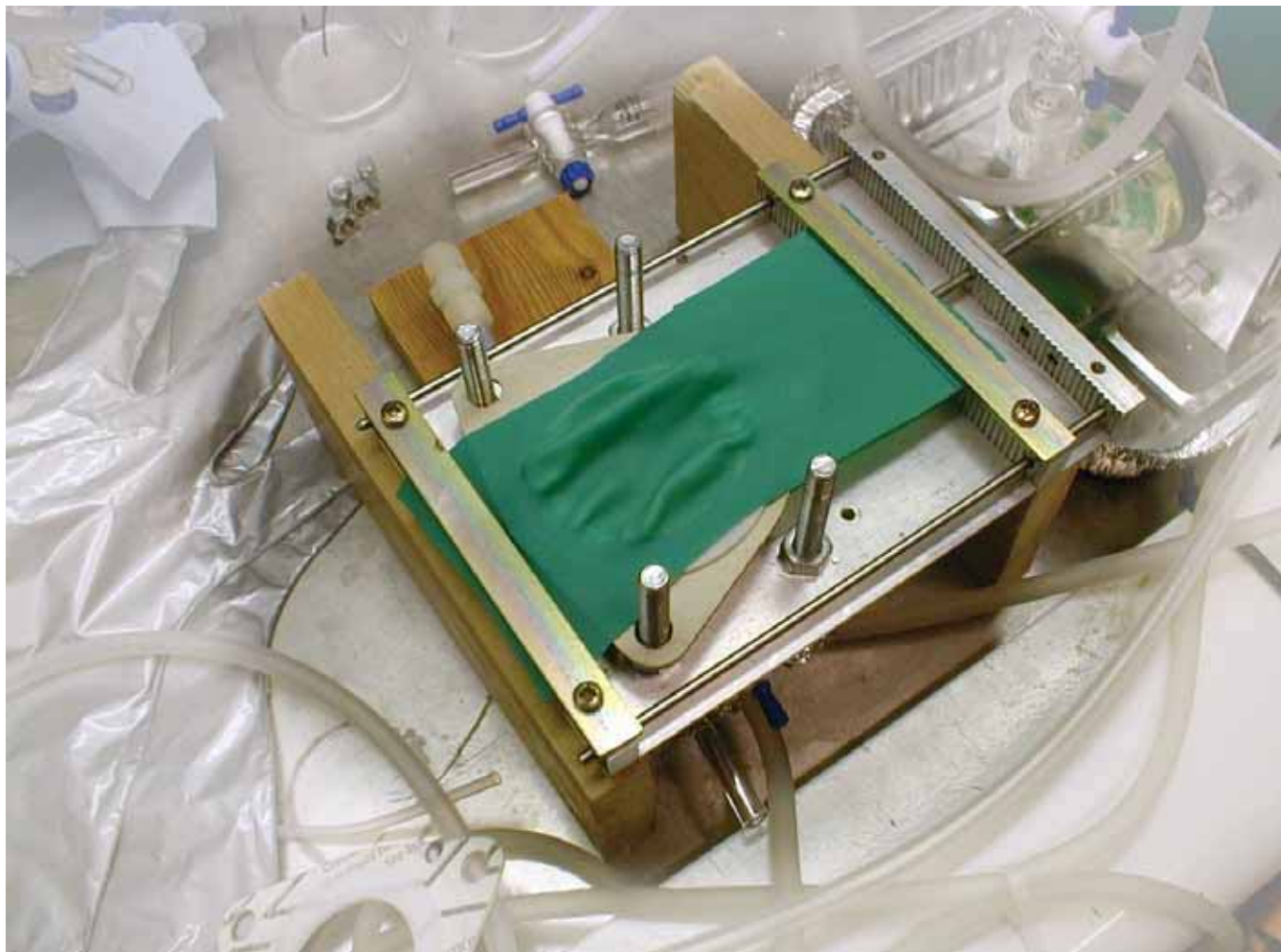
Glove mechanical stability may be deteriorated by chemical challenges, or just by hot dish washing water and other detergents. The impact of such exposures on mechanical stability (degradation) is

tested at Eurofins, following international standards (ISO 1817, ASTM D471): Before and after exposure, glove dimensions (length/width, thickness, density), or glove stability under mechanical stress (tensile strength), are compared.

## Tightness of gloves

Chemical protective gloves are made from elastomers or from thermoplastics. When wearing such gloves body heat and sweat will form warm and humid interior, in which the skin will soften. Under such conditions a hazardous substance entering inside the glove may prove extremely harmful.





## Penetration of gases and liquids through glove

A glove may be leaky to liquids and gases because of pores and holes through which the challenge product passes into glove. Tests are performed with model liquids (water) and gases (nitrogen) and visual inspection of bubbles or droplets appearing inside. Several standards are available, the most appropriate one preferred by Eurofins is ISO 13994.

## Molecular diffusion (Permeation) through glove

A glove may be free of leaks but still allow passage of substances into glove. Normally this is restricted to smaller organic molecules, if not e.g. a solvent is performing as carrier for larger molecules by chemical degradation of the membrane.

No glove will protect against all chemicals. A glove forming an effective barrier against two solvents as pure compounds may be a bad barrier against a mixture of these, and form a still worse barrier against inorganic acids. And - if at all effective, most gloves form a barrier only for a limited time. Few gloves are sold as being almost universal, but these are expensive and show bad comfort in use.

Identifying the right glove for the specific purpose is no easy task. The deficiency of a specific glove is not always evident. Information taken from relevant tables and databases is of very low value because the data rely on a test situation not representing actual working situation at all. Many Safety Data Sheets, tables and databases focus on gloves of specific materials, not specific brands. This type of information is highly misleading, as there are huge differences in the barrier effect between gloves of same polymer type, but from dif-

ferent manufacturers. "Latex" is not necessarily the same as "Latex", and the same applies to "Chloroprene" and "Nitrile" elastomers.

According to ASTM and EN standards, most testing is performed at a temperature of 23°C. In real life, the inside glove temperature will be around or above 33°C. In a research project, Eurofins delivered evidence that protection time at 35°C is much shorter (possibly only one half or one third) than breakthrough time at 23°C.

After having been in contact with the chemical, the interior structure of the glove material may be deteriorated - on the following day the protection time may be considerably shorter than on first day, and in some cases next day there is no more barrier effect left at all. Consequently, a glove test must be performed over more than one day, if reuse of the glove is planned.

## Permeation testing

Permeation testing under real use patterns is used for identifying safe gloves. In many cases, testing allows using cheaper gloves than those that are recommended in tables or by consultants without specific testing.

Eurofins performs reliable testing of the barrier effect of protective gloves in accordance with EN 374-3, ASTM F739 and ISO 6529, offering tests alternatively at room temperature or at 33°C. Duration of the test may vary between 1 hour and 1 month, depending on use patterns. The test gives the breakthrough time - the point of time when the total permeation flow of all substances, through each cm<sup>2</sup> of the glove, reaches 1 µg (microgram) per minute (EN 374-3) or 0.1 µg (ASTM F739). Additionally, the permeation rate may be determined. Permeation of volatile organic compounds (VOC) such as solvents, and water-soluble substances such as acids, is subject to standard testing: The glove is placed in a test cell with the challenge product on the outer side of the membrane. Synthetic air or water passes along the inner side, flushing any chemical to a detector after breakthrough.

Some very reactive VOC's such as formaldehyde, and non water-soluble low volatile organic compounds, can-

not be determined in that manner. Eurofins developed adaptations of standard test method with solid sampling discs tightly pressed at inside of glove, some of these discs even chemically impregnated, for collecting such difficult to monitor substances. Some examples are:

- Epoxy resins
- Isocyanates
- Amines
- Acrylates
- PAH, PCB
- Pesticides
- Additives for plastics
- Latex and other polymers
- Cytostatic drugs

## Glove test design

Eurofins is your expert in designing and initiating impartial and reliable glove testing. We perform testing for distributors and for users of chemicals, for industry, for trade associations, and within research programmes.

## Further information

For further information please contact your national contact points or our specialists [ReinhardOppl@eurofins.com](mailto:ReinhardOppl@eurofins.com) or [JohnHansen@eurofins.dk](mailto:JohnHansen@eurofins.dk).



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