

Appendix E: Chemical Glove Performance Standards

The **EN 374:2003 (2013)** standard specifies the capability of gloves to protect the user against chemicals and/or microorganisms. The standard should be used in conjunction with EN 420 and is superseded by **EN ISO 374-1:2016**.

EN 374:2003 (2013)

1. Definitions

- (a) **Length of life:** degradation is rated according to the change in the integrity of a material following chemical exposure. The rate of degradation depends on which chemical the glove has or will come in contact with.
- (b) **Penetration:** is the flow of chemicals and microorganisms through the porous material, seams, small holes or other small defects in the material.
- (c) **Permeation:** passage through the glove material at a molecular level. Absorption is the flow of molecules in contact with the outer surface of the glove. Diffusion is the movement of molecules through the material. Desorption is the outward flow of molecules from inside the glove.
- (d) **Breakthrough time:** the time taken for a chemical or hazardous substance to pass through a glove and be detected on the inside surface of the material.

2. Requirements

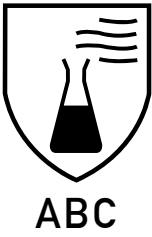
- (a) The size of the minimum liquid proof section of the glove must equal the minimum length of the gloves specified in EN 420. In essence, this is to ensure, for example, that a glove designed to cover the wrist provides the same protection to the wrist as the main part of the glove.
- (b) **Penetration:** glove performance during an air and/or water leak test, tested and inspected in compliance with the Acceptable Quality Level (AQL). AQL refers to an internationally used quality standard for measuring the percentage of pinhole defects in disposable gloves (*i.e.* lower = fewer defects). Gloves assigned a protection rating of 1 are waterproof while gloves with ratings of 2 and 3 provide protection against microorganisms

| Performance level | Acceptable quality level unit | Inspection levels |
|-------------------|-------------------------------|-------------------|
| Level 3 | ≤ 0.65 | G1 |
| Level 2 | ≤ 1.5 | G1 |
| Level 1 | ≤ 4.0 | S4 |

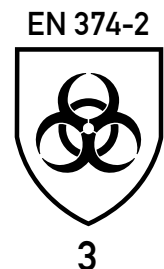
- (c) **Permeation:** Each chemical tested is classified in terms of breakthrough time (reported as Class or Level 1 to 6).

| Measured breakthrough time | Protection Index | Measured breakthrough time | Protection Index |
|----------------------------|------------------|----------------------------|------------------|
| > 10 min | class 1 | > 120 min | class 4 |
| > 30 min | class 2 | > 240 min | class 5 |
| > 60 min | class 3 | > 480 min | class 6 |

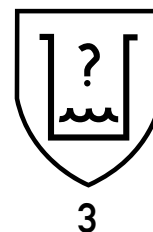
- (d) Gloves that provide performance level 2 protection against water penetration and microorganisms and attain a level 2 protection score (breakthrough time of at least 30 minutes) against any 3 of the 12 standard defined chemicals in the table below meet the EN 374-3 standard for chemical resistance. Gloves meeting this standard have the 'Chemical Resistant' glove pictogram, which must be accompanied by a 3-digit code that refers to the code letters of the 3 chemicals for which the breakthrough time ≥ 30 min was obtained:

|  EN 374-3 ABC | 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 paraffin | |
| E | Carbon disulphide | 75-15-0 | Sulphur-containing organic compound | |
| F | Toluene | 108-88-3 | Aromatic hydrocarbon | |
| G | Diethylamine | 109-89-7 | Amine | |
| H | Tetrahydrofuran | 109-99-9 | Heterocyclic and ether compound | |
| I | Ethyl acetate | 141-78-6 | Ester | |
| J | n-Heptane | 142-85-5 | Saturated hydrocarbon | |
| K | Sodium hydroxide 40% | 1310-73-2 | Inorganic base | |
| L | Sulfuric acid 96% | 7664-93-9 | Inorganic mineral acid | |

- (e) EN 374-2: the 'Microorganism' pictogram is used when the glove conforms to at least performance level 2 for water penetration and protection against microorganisms.



- (f) EN 374-1: the 'Low Chemical Resistant' or 'Waterproof' glove pictogram is used for gloves that do not achieve a breakthrough time of at least 30 minutes against at least three chemicals from the defined list, but which comply with EN 374-2. The following example is for a glove that has passed performance level 3 for water penetration and protection against microorganisms



EN ISO 374-1:2016

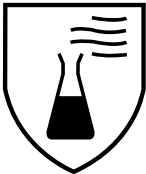
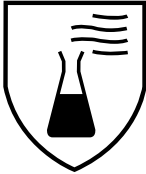
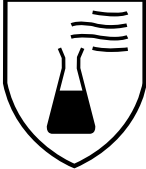
3. This is a revised version of EN 374:2003 (2013), with new tests for penetration, permeation and degradation. Key points:

- (a) New test chemicals. There are now 18 listed chemicals in total, as opposed to 12. The 6 additional chemicals are as follows:

| CODE Letter | Chemical | CAS NUMBER | CLASS |
|--------------------|------------------------|-------------------|--|
| M | 65% Nitric Acid | 7697-37-2 | Inorganic mineral acid, oxidising |
| N | 99% Acetic acid | 64-19-7 | Organic acid |
| O | 25% Ammonium hydroxide | 1336-21-6 | Organic base |
| P | 30% Hydrogen peroxide | 7722-84-1 | Peroxide |
| S | 40% Hydrofluoric acid | 7664-39-3 | Inorganic mineral acid, contact poison |
| T | 37% Formaldehyde | 50-00-0 | Aldehyde |

- (b) Degradation. A new degradation test has been introduced which measures the change in physical properties of the glove after exposure to a chemical for a period of time. Degradation may appear as swelling, disintegration, flaking, colour change, embrittlement, hardening, softening or dimensional change. To claim protection against a chemical on the defined list, permeation and also degradation tests must be carried out. The results of the degradation test should be outlined in the information leaflet.
- (c) Biological hazards. If the glove is intended to protect wearers against biological hazards, the manufacturer will need to decide whether they are going to claim protection against viruses, fungi and bacteria. If this is the case, the glove will require further testing to ISO 16604: 'Clothing for protection against contact with blood and body fluids'.

(d) Specifications

| Type of Glove | Requirement | Marking |
|---------------|---|---|
| Type A | Penetration resistance (EN 374-2). Breakthrough time \geq 30 min for at least 6 chemicals in the new list. | EN ISO 374-1 / Type A  A J K L P R |
| Type B | Penetration resistance (EN 374-2). Breakthrough time \geq 30 min for at least 3 chemicals in the new list. | EN ISO 374-1 / Type B  J K L |
| Type C | Penetration resistance (EN 374-2). Breakthrough time \geq 30 min for at least 1 chemical in the new list. | EN ISO 374-1 / Type C  |

4. Selection of Materials

The chart below is **for guidance only** to assist with the choice of an appropriate glove material. Before any given material is used, the specifications provided by the manufacturer should be checked against the intended use.

| Chemical group | Nitrile | Butyl rubber | Neoprene | Viton | PVC | PVA | Latex |
|------------------------|---------|--------------|----------|-------|-----|-----|-------|
| Halogenated solvents | x | x | x | Y | x | Y | x |
| Ketones | x | Y | x | x | x | (Y) | x |
| Aldehydes | x | Y | x | (Y) | x | x | x |
| Alcohols | Y | Y | (Y) | Y | x | x | x |
| Esters | x | Y | x | x | x | (Y) | x |
| Ethers | (Y) | (Y) | (Y) | x | x | (Y) | x |
| Amines | (Y) | Y | (Y) | (Y) | x | x | x |
| Aliphatic hydrocarbons | Y | x | x | Y | Y | Y | x |
| Aromatic hydrocarbons | x | x | x | Y | x | Y | x |
| Organic acids | (Y) | Y | Y | Y | Y | x | (Y) |
| Inorganic acids | (Y) | Y | (Y) | Y | Y | x | Y |
| Alkalis | (Y) | Y | Y | Y | Y | x | Y |

Key: x, not suitable for immersion use (breakthrough times generally < 1 h); Y, suitable (breakthrough times generally > 4 h); (Y), suitable in some cases.