

Glove Selection Guidance for Handling Chemicals

Occupational Health & Safety
Service
HSD168C (rev 3)



Introduction:

Gloves are important as Personal Protective Equipment (PPE) for handling toxic, corrosive and hazardous chemicals.

The correct gloves for the task should be identified in the COSHH risk assessment.

However, it must be remembered that:

- gloves only protect the wearer and they do not remove or reduce the risk to others.
- If gloves fail, they will always **'fail to danger'** exposing the wearer to the hazard.
- selecting the wrong glove may leave the wearer effectively unprotected.
- over extensive use of gloves can cause irritation, dermatitis and allergic reactions.

Incidental or Intentional contact:

In the majority of cases gloves worn as PPE in the laboratory are to protect the hands from **small incidental splashes**. In these cases good quality **disposable nitrile gloves** will usually suffice. However, nitrile is not suitable for direct contact with ketones (acetone), DMF, benzene, oxidising acids, organic compounds containing nitrogen, aniline, chloroform, ethyl acetate or phenol amongst others. Gloves worn as PPE for intentional contact or as protection against large splashes with hazardous chemicals will usually be of the thicker re-usable type, but will be subject to similar chemical limitations (see below).

Chemical Degradation of Gloves:

Degradation occurs when the action of a chemical causes the loss of one or more of the original physical qualities of the glove material allowing chemicals to pass through it. Signs may include loss of flexibility, softening, swelling, brittleness, weakness, tackiness, disintegration, colour and failure.

Chemical Permeation:

Permeation occurs where a chemical passes through an intact glove by diffusion, this can occur even if the glove is 'undamaged'. The rate of permeation varies depending on the glove material and the chemical in question. Some chemicals can continue to permeate through the glove material after use.

Chemical Breakthrough Times:

A chemical breakthrough time is the time it takes for a chemical to pass through a glove and be detected on the inside. It is derived from '*static tests*' at room temperature carried out on a specimen cut from a glove and is measured in minutes from 0 (**zero**) to 480.

Breakthrough times are:

- proportional to glove thickness.
- specific to the glove type tested
- published for some but not all chemicals
 - o limited data on chemical mixtures
- reduced by
 - o synergistic effects of some mixtures
 - o elevated temperatures ie: 37°C !
 - o pressure ie: gripping
 - o flexing / abrasion ie: moving fingers
 - o stretching ie: gloves too small
 - o age related degradation

See manufacturer's websites and catalogues for lists of chemical breakthrough times and chemical compatibilities with glove materials.

Acceptable Quality Level ' AQL '

Some manufacturers test disposable gloves for pinholes and assign the gloves an AQL of 0.65, 1.5 or 4.0. The AQL is the percentage of gloves that 'could' have pinholes from new! **Therefore, remember, the lower the AQL the better the quality of the gloves.**

Guide to Glove Materials:

GLOVE MATERIAL	GENERALLY GOOD: (check manufacturer's data)
NITRILE	For a variety of solvents, oils, greases, some acids and bases.
NATURAL LATEX RUBBER *	For incidental contact with phenol, dilute aqueous acids / bases, inorganic chemicals.
NEOPRENE / CHLOROPRENE	For acids and bases, peroxides, fuels, alcohols hydrocarbons, phenols.
BUTYL RUBBER	For many organics, acids, ketones, esters, vapours/gases, oxidising chemicals. Remain flexible at low temperature
POLYVINYL CHLORIDE (PVC) – 'Vinyl'	For acids and bases, some organics, oils, fats, amines, and peroxides
POLYVINYL ALCOHOL (PVA)	For aromatic and chlorinated solvents
VITON™ Synthetic rubber - fluoroelastomer	For chlorinated and aromatic solvents, aniline, benzene, chloroform Resistance to cuts and abrasions.
Silver Shield™ (Norfoil)	For a wide variety of toxic and hazardous chemicals; provides high level of chemical resistance. Flexible laminate glove
Ansell Barrier LLDPE (Polyethylene)	For resistance to many chemicals; better dexterity than Silver Shield™.but may be delicate.

* Natural Rubber Latex can cause a very serious allergic reaction; see University Policy for the use of disposable latex gloves: HSD034C.

Some Simple Guidelines for Using Gloves:

- Select gloves which are **resistant to the chemical hazards** you may be exposed to.
- Select gloves of the correct size, fitting and length (a standard disposable is only 24-26cm long, however the longer 30cm glove also covers the wrist).
- **Only use disposable gloves for small incidental splash protection** (re-usable gloves are best for immersion if unavoidable).
- Before use, check gloves for physical damage such as tears or pin holes; this is especially important for very dangerous materials such as hydrofluoric acid (HF).
- Double glove (using two pairs) for added protection from very toxic chemicals, mixing glove types where it increases protection.
- If disposable gloves are contaminated with a toxic chemical immediately change them.
- Do **not** attempt to re-use disposable gloves
- Do not use disposable gloves of unknown AQL, they may not have been tested.
- When working, it may be advisable to wash the external surface of gloves regularly.
- Most gloves are combustible, keep gloves away from naked flames or other high temperature heat sources.
- When removing gloves, do so in a way that avoids the contaminated exterior contacting the skin i.e. use the 'surgical technique' of glove removal.
- Wash hands after removing gloves.
- Dispose of contaminated gloves properly.
- **Never** wear contaminated gloves outside of the laboratory or to handle telephones, computer keyboards, door handles, etc.

For further information on choosing and using gloves see the University's 'Glove Selection Guidance': HSD059 on the HSD website.

Gloves do Exactly What it Says on the Box?



BSEN374* 'Chemical resistance'
NB: See University Guidance.**



BSEN374* – Resistance to micro-organisms (moulds and bacteria).



a b c d

BSEN 388* – Resistance to abrasion. NB: if abcd scores 0000 it means the gloves failed the tests!



Single use disposable gloves;
do not re-use !

* The 2016 British Standard and European Norms*

** The Standards changed in 2016 with the introduction of more test chemicals and 3 levels of chemical resistance. See HSD034C.

PPE category I - for 'minimal risk' where the effects of not wearing a glove are easily reversible or superficial. Self-certified.

PPE category III - for areas/applications that can seriously or irreversibly harm the health. Tested by approved notified body.

Note: Examination / Exam / Medical gloves are 'medical devices' as per BSEN455 and NOT Personal Protective Equipment (PPE).

Gloves tested to ASTM F1671 are resistant to penetration by viruses and thereby particles down to at least 27nm.

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