

Ansell



THERMAL PROTECTION

HOT AND COLD

The role and requirements of hand protection for thermal and cold risks

There are many applications that require the use of protective gloves to combat either hot or cold conditions. Beyond ambient temperature, additional environmental influences, dexterity requirement, and glove construction qualities will help identify selection of the most suitable protection.

Low temperature risks

Workers in the transport, food handling, agriculture, oil and gas, warehousing and construction sectors are frequently exposed to low temperatures. They may be required to carry out tasks in dangerously cold conditions — either indoors or out — and often for extended periods of time. Handling liquids, foods and frozen items, transporting oils or working in the open-air leaves employees susceptible to the risks associated with cold exposure. Cold is either;

- a. convective – transferred via air temperature
- b. contact – direct touch with a cold object or surface

Physical effects of lower temperatures

Exposing hands to cold can have serious local and systemic health ramifications.

Localised (generally short-term) effects include;

- Frostbite – the freezing of skin and other tissues when exposed to low temperatures. This typically starts as numbness, followed by an inability to adequately use or move the fingers. The skin will take on a blue or white tinge and this condition can lead to hypothermia if left unchecked.
- Chilblains – though sometimes confused with frostbite, chilblains presents as redness, itching, or blisters. The condition occurs when individuals with a predisposition are exposed to cold.
- Sticking – the skin of the hands will stick to frozen surfaces at temperatures $< -7^{\circ}\text{C}$.
- Decreased capability – it becomes difficult to effectively use the hands in low temperatures, as dexterity, tactile sensitivity, and grip are all compromised.



Systemic effects include;

- Hypothermia – a condition when the body's core temperature is lower than normal. Classified hypothermia ranges include; Mild (35 to 32°C), Moderate (< 32 to 28°C), Severe (28 to 20°C) and Profound $< 20^{\circ}\text{C}$. Even mild hypothermia can significantly reduce decision-making capability.
- Blood circulation – cold temperatures slow blood circulation, leading to potential problems including rheumatic issues or Raynaud Syndrome, a condition in which blood vessels narrow blood flow to the extremities decreases.
- Musculoskeletal disorders – extreme cold can leave workers susceptible to development of a range of musculoskeletal disorders (MD). An umbrella term, MD encompasses a range of conditions and syndromes that inflame or otherwise degenerate muscles, tendons, ligaments, joints, nerves or supporting blood vessels. Cold temperatures exacerbate the likelihood due to muscle and joint stiffness or reduced peripheral circulation.

COMBATTING COLD

Using suitable hand protection will minimise the damaging effects of cold environments. Aptness is determined by ambient temperature, other atmospheric conditions (including humidity and wind speed), exposure times, and the dexterity requirement for the task being carried out.

Selected gloves need to maintain a level of thermal comfort, while still giving the worker functional capability. Wearers must choose the protection based on their risks, because the wrong glove can be just as dangerous as no glove at all. When looking at options, the two key glove characteristics are insulation capacity and design.

Gloves designed to offer protection from cold are governed by the EN511:2006 standard. EN511 outlines the requirement and test methods for gloves against convective or contact cold to -50°C with varying levels of protection. Gloves are tested and designated a numeric performance level rating, which ranges from 0 to 4. The higher the number, the better the insulating capability (the longer it takes to transfer cold to the wearer's hand).

Results are displayed as a pictogram with three digits.

- A. The first digit indicates performance in resistance to convective cold
- B. The second is resistance to contact cold
- C. The third denotes water impermeability after 30 minutes as a fail/pass result. A zero in this position indicates water penetration and a 1 indicates no water penetration. An "X" means the gloves were not tested and is therefore not applicable.



It is important to note that EN511 marking indicates performance level testing results and not the degree of protection each solution offers. A common query is the minimum temperature at which cold protection gloves can be utilized.

Temperature use recommendations should be viewed as a guideline rather than a strict rule. As "feeling cold" is a subjective measure, the most appropriate solution will ensure suitable levels of wearer comfort while still maintaining adequate defence against known risk.



High temperature risks

Heat and fire are daily exposures present in many industries such as manufacturing, engineering, maintenance, food preparation and processing, medical, and mining. Handling hot glass, castings or wooden plates, demoulding rubber tyres or thermoplastics, using autoclaves, welding, or working close to liquid metal are all activities that put workers at risk.

Heat exposure can be;

- convective – transferred via air temperature
- contact – direct touch on a hot object or surface
- radiant – dispersed by an infrared radiation source and absorbed



Physical effects of higher temperatures

Heat exposure presents risks of both short-term and long-term effects.

Short-term effects;

- Skin dryness
- Thermal burn – from contact with a hot object, boiling water, oil, steam or fire

Long-term effects;

- Cancer – via infra-red radiation

HANDLING HEAT

As when working in cool temperatures, hand protection used to minimise the effects of heat must also permit the wearer to carry out required tasks.

Under EN407:2004 Gloves giving protection against thermal hazards, thermal protective gloves are given a performance level rating across six key areas;

- Resistance to flammability
- Contact heat resistance
- Convective heat resistance
- Radiant heat resistance
- Resistance to small splashes of molten metal
- Resistance to large splashes of molten metal



EN 407



abcdef

EN407 pictogram

The contact and radiant heat characteristics are most often referenced and describe the delay before heat transfers through the glove wall — either by contact with a hot object or by radiant heat. Tested gloves achieve a rating of 1-4, with 4 indicating the highest level of protection. They must also achieve at least a Level 1 rating for abrasion and tear.

The maximum temperature at which a glove can be used also depends on the following characteristics;

- Glove construction material
- Contact or radiant heat
- Exposure time
- Exposure temperature
- Nature of molten material

Heat transfer threatens effective thermal protection, because removing the source of heat will not deliver immediate relief. For example, a gloved hand immersed in 65°C liquid will eventually be burned as heat is transferred to the hand. Even when removed, the hand will continue to burn as the glove wall is heated to the liquid temperature and the coating will not allow for fast dissipation. Glove construction materials and fibres melt at different rates, so it is important to ensure the chosen solution is designed to offer heat protection at the specific temperature risks present in an application.



THE ADVANTAGE OF ASSISTANCE

To best determine hand protection solutions that offer the best defence, consult a vendor that offers customised analysis of your specific conditions. Ansell's Guardian is an integrated approach delivering personalised risk management solutions that improve worker safety, increase compliance and reduce injury through identification and provision of optimal PPE solutions.

For more information, or to discuss your specific requirements contact Ansell Customer Service on 1800 513 276 or protectionau@ansell.com.

Caution: Gloves exposed to toxic or hazardous contaminants may require special handling or disposal. For food handling gloves, always follow the manufacturer's guidelines to ensure compliance with regulatory guidelines for food safety.

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