Personal Protective Equipment & Standards:

A Compendium for Construction SMEs

DECEMBER 2025

FOREWORD

This publication has been developed in the framework of EU-supported activities for strengthening the role of small and medium-sized enterprises (SMEs) in standardisation. Within this context, Small Business Standards (SBS), in collaboration with DTV (Deutscher Textilreinigungs-Verband e.V.), EBC (European Builders Confederation) and SME Safety, created this PPE Compendium for the construction sector to provide accessible and practical information for SMEs faced with complex regulatory and technical requirements in selecting and managing Personal Protective Equipment.

The Compendium aims to bridge the gap between regulatory obligations, technical standards, and real-life workplace needs in the construction industry. It offers explanations of key concepts, requirements and standardisation principles related to PPE, helping SMEs make informed decisions while maintaining high levels of worker protection.

The development of this Compendium was coordinated and written by Daniel Dalkowski and Andreas Schumacher (DTV), Evangelia Tsiala (EBC) and Gabriele Casalini (SME Safety). Substantial input to this work has also been provided by involved and contributing experts: Hilario Castresana (3L INTERNACIONAL), Piotr Pietrowski (Dream Consulting), and Andrea Rechtsteiner (A&R Textilproduktion GmbH), whose technical insights and sector-specific experience have enriched the content of the document.

Further support or specific contributions were also offered by external experts in specialised areas, notably: Dr. Jürgen Winterlik (Deutsche Gesetzliche Unfallversicherung e.V.), Attorney Thomas Lange (GermanFashion/IVPS e.V) and Prof. Dr. Arno Weber (Hochschule Furtwangen – Faculty III: Health, Medical and Life Sciences, Security & Safety Engineering). The authors would also like to acknowledge the valuable expert input provided by Marion Schiller (3M – Personal Safety Division – Fall Protection), EMEA Regulatory Engagement Specialist, which contributed to the development of the relevant section of this Compendium. A special thanks is also again extended to EBC and 3L International for providing pictures included in this document.

This publication reflects the commitment of these organisations and experts to supporting SMEs in their efforts to choose and manage PPE responsibly, in line with both safety requirements and evolving market and sustainability considerations. It is intended as an informative guide, empowering SMEs to protect workers effectively while navigating standards and regulatory frameworks.

Disclaimer: This compendium is intended solely as an informative resource to support understanding of Personal Protective Equipment in the construction sector. It is not a compliance document, nor should it be used as a substitute for applicable legislation, standards, certification processes, or professional safety assessments. The information provided does not ensure any legal conformity or technical compliance, and it only reflects the views of SBS, DTV, EBC and SME Safety, who cannot assume responsibility for its use or for the accuracy, completeness or interpretation of the information contained herein. The European Commission and the EFTA Member States are not responsible for any use that may be made of the information it contains.

EBC (European Builders Confederation) is the European professional organisation representing Micro, Small and Medium-sized Enterprises (SMEs) and crafts in the construction sector. Recognised as a European sectoral social partner, EBC is part of the employers' delegation in the EU sectoral social dialogue for construction.

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Transp. Register 09256701147-51

The German Textile Cleaning Association (DTV) represents companies of varying sizes and business models, from traditional dry cleaners to industrial textile service providers, as an employers' and trade association. Approximately 800 craft, commercial, and industrial businesses are members of the DTV.

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SME Safety is the European association of small and medium enterprises (SMEs) that manufacture safety products. SME Safety is an interest group active in the EU policy and standardization debate

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enterprises' (SMEs) interests in the standardisation process at both European and international level.

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Co-financed by the European Union and EFTA

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GLOSSARY

To better understand this document, here are definitions of the most common and specific terms:

Accident Prevention: Measures used to eliminate or reduce workplace incidents through planning, risk control and correct use of PPE.

Accredited Test Laboratory: A recognised facility authorised to perform PPE testing and conformity assessments according to standards.

Assigned Protection Factor (APF): The expected level of respiratory protection achieved when a device is properly selected, fitted and worn.

Body Protection: A PPE category covering garments that protect the torso and limbs from hazards such as flame, chemicals, weather, or low visibility.

Category I / II / III PPE: Legal PPE categories under Regulation (EU) 2016/425. Category I covers minimal risks, Category II covers non-minimal risks, and Category III covers life-threatening or irreversible risks requiring continuous surveillance.

CE Marking: A marking indicating that PPE meets EU regulatory requirements. For Category III PPE it must be accompanied by the four-digit number of the notified body.

Certification: Formal confirmation that PPE meets regulatory requirements following testing by an accredited body or laboratory.

Cleaning Cycle: Washing or maintenance process carried out according to manufacturer instructions to maintain PPE performance and validity.

Compatibility of PPE: The requirement that multiple PPE items worn together must not reduce each other's protective performance.

Conformity Assessment: The process by which PPE is tested, evaluated and certified against EU regulations and standards.

Construction Risk: Hazards arising from construction activities, including falls, noise, dust, cutting, vibration, vehicle movement or molten metal exposure.

Construction SME: A small or medium-sized enterprise operating in the construction sector, often relying heavily on PPE due to limited engineering controls.

Control Measure: Any action used to reduce risk, including technical solutions, organisational planning, training, or PPE.

Degradation (PPE Material): Physical deterioration of materials due to mechanical, chemical or environmental exposure resulting in reduced performance.

Declaration of Conformity (DoC): Mandatory document issued by manufacturers confirming compliance with Regulation (EU) 2016/425 and applicable standards.

Durability (PPE): Ability of PPE to maintain protection and functionality over time, influenced by design, use and maintenance.

Ergonomics (PPE): Design considerations ensuring PPE fits comfortably and supports movement without creating additional risk.

Essential Health and Safety Requirements (EHSR): Mandatory safety requirements that all PPE must meet to be marketed in the EU.

Hazard Identification: Initial stage of risk assessment in which potential sources of harm are recognised.

Inspection (PPE): Checks carried out to verify equipment condition, functionality and markings before and during use.

Lifecycle of PPE: The complete span of a PPE product from design to procurement, use, maintenance and disposal.

Maintenance (PPE): Actions taken to preserve protective performance, including cleaning, repair and correct storage.

Manufacturer Responsibilities: Obligations to design, test, certify and provide compliant documentation for PPE placed on the EU market.

Mechanical Hazard: Risk of injury from cutting, abrasion, impact, crushing or vibration, commonly encountered in construction work.

Multinorm Garment: A protective garment certified under multiple standards to address multiple hazards simultaneously.

Notified Body: An independent organisation designated to assess PPE conformity, certify products and perform ongoing surveillance for Category III PPE.

Performance Level: A graded measure indicating the degree of protection provided by PPE under defined test conditions.

Protective Clothing System: A combination of garments and accessories designed to work together as a complete protection ensemble.

Protection Factor: A numerical indication of how effectively PPE reduces exposure to a hazard.

Presumption of Conformity: Legal assumption that PPE meets the Regulation when it complies with harmonised standards.

Reusable PPE: Equipment designed to be safely used multiple times if maintained according to manufacturer instructions.

Risk: Combination of the severity of potential harm and the likelihood of its occurrence.

Risk Assessment: Legally required process for identifying hazards, evaluating risks and determining appropriate risk controls, including PPE use.

Standard: A technical specification that defines protective performance, testing and marking requirements for PPE.

Standards Development Organisation (SDO): A body responsible for drafting technical standards, such as CEN, CENELEC or ISO.

SUCAM (Selection, Use, Care and Maintenance): Framework used to assess PPE suitability, ensure correct use, and preserve performance through proper maintenance.

Technical Committee (TC): A group within an SDO that drafts and updates standards for specific PPE categories or hazards.

Textile Service Provider: A professional organisation that supplies, cleans, repairs and manages PPE while preserving certified performance.

Traceability: Ability to verify the origin, certification status and maintenance history of PPE through documentation or digital systems.

User Instructions: Mandatory documentation supplied with PPE explaining use, limitations, care, storage and maintenance requirements.

Work Equipment: Tools or machinery used by workers. PPE must be compatible with work equipment to ensure effective protection.

1. EXECUTIVE SUMMARY

Personal Protective Equipment (PPE) serves as the last line of defence in the European construction sector, where workers face disproportionately high accident and fatality rates. While engineering and organisational controls remain the priority, PPE is often one of the most practical and effective solutions available to small and medium-sized enterprises (SMEs), which make up the majority of construction companies and frequently operate with limited safety resources. This compendium offers a structured, accessible guide to support correct PPE selection, use and maintenance in construction environments, bridging the frequent knowledge gap between compliance and actual workplace practice.

The document provides an overview of the legal requirements under the PPE Regulation (EU) 2016/425, employer duties from national occupational safety legislation, and the role of harmonised European standards. It emphasises that employers must carry out a risk assessment before selecting PPE and ensure that equipment supplied is certified, CE-marked, correctly maintained, and accompanied by manufacturer instructions. CE certification is only one part of compliance; employers must also select appropriate protection levels, ensure compatibility between elements (e.g. helmets, footwear, gloves) and consider worker acceptance, comfort and usability to guarantee that PPE is worn properly and consistently.

A major section of the compendium explains key standards for protective clothing, gloves, footwear, helmets, eye and hearing protection, and respiratory protective equipment. These summaries provide practical insight into the various relevant harmonised standards.

The compendium also addresses current industry trends, including multinorm garments, digitalisation of compliance documentation, smart PPE, and sustainability. While PPE offers essential protection, its environmental footprint is complex due to multilayer materials, standards-driven durability requirements and strict certification rules. Professional textile service providers are therefore increasingly important actors, ensuring validated maintenance, repair, reprocessing and end-of-life strategies that preserve certification and extend product life cycles without compromising safety.

Ultimately, this document aims to support construction SMEs in making informed PPE decisions that reinforce a proactive safety culture. By connecting regulatory obligations, standardisation requirements and practical selection guidance, it contributes to safer workplaces, reduced economic loss from accidents, and a more sustainable approach to PPE management.

2 INTRODUCTION

This chapter outlines the broader context in which Personal Protective Equipment (PPE) is used in the construction sector, highlighting why PPE remains indispensable despite being the last resort in the hierarchy of risk control. It explains the current state of safety in construction, the regulatory and market developments influencing PPE selection, and the evolving expectations placed on employers. By presenting the economic, legal and practical drivers shaping PPE use, the chapter provides a foundation for understanding why careful selection, proper management and standard-based decision-making are essential for effective worker protection, especially for SMEs operating in complex and high-risk environments.

2.1 Why is PPE Important?

Construction sites are among the most hazardous workplaces, with risks ranging from falling objects and sharp materials to chemical exposure, extreme temperatures, and electrical hazards. Personal Protective Equipment (PPE) serves as the last line of defence when engineering and organizational controls cannot fully eliminate these dangers. Under the European **PPE Regulation (EU) 2016/425**[1] and the relevant safety provisions[2], employers are legally required to provide certified PPE based on a thorough risk assessment. For construction workers, PPE such as helmets, high-visibility clothing, safety footwear, gloves, and respiratory protection are essential to prevent injuries and fatalities. Beyond compliance, PPE ensures operational continuity, reduces downtime caused by accidents, and supports a **culture of safety that protects both workers and company reputation**.

2.2 What is the current state of play?

Since April 2018, the **PPE Regulation (EU) 2016/425** has standardized requirements across Europe, replacing the previous directive. PPE is classified into three categories based on risk severity:

- **Category I**: Minimal risks (e.g., basic weather protection).
- **Category II**: Intermediate risks (e.g., high-visibility clothing for roadwork).
- **Category III**: Life-threatening or irreversible risks (e.g., fall protection, arc-flash-resistant garments).

Construction sites often require **PPE from all three categories**. Compliance involves CE marking, conformity declarations, and adherence to harmonized standards such as: EN ISO 20471 for high-visibility clothing, EN 343 for weather protection, EN 397 for industrial safety helmets.

[1] https://eur-lex.europa.eu/eli/reg/2016/425/oj/eng
[2] https://osha.europa.eu/en/safety-and-health-legislation

Employers must not only select PPE that meets these standards but also ensure proper training, fitness, and maintenance. Increasingly, professional textile service providers are critical partners, offering validated cleaning, inspection, and repair processes to maintain PPE performance throughout its lifecycle. This is particularly relevant for garments exposed to concrete dust, oils, and chemicals on construction sites.

Sustainability is becoming an increasingly critical aspect of PPE management in the construction sector. Companies are under growing pressure to **reduce environmental impact** through extended product lifecycles, recycling, and circular economy strategies. However, implementing these measures is far from straightforward. PPE involves complex material compositions, multiple safety standards, and strict regulatory requirements, making sustainable solutions technically challenging. Many decision-makers lack the specialized knowledge needed to evaluate eco-friendly options without compromising safety and compliance. As a result, sustainability often remains an aspirational goal rather than an integrated practice, highlighting the need for expert guidance and industry-wide collaboration.

2.3 How is the market evolving?

The construction PPE market is experiencing rapid evolution driven by regulatory compliance, technological innovation, and sustainability goals:

Digitalization: The upcoming EU initiative allowing electronic manufacturer information simplifies compliance and documentation.

Comfort and Ergonomics: Workers demand PPE that combines protection with mobility and breathability, reducing heat stress and fatigue during long shifts.

Multinorm Garments: Integrated protection against multiple hazards such as flame, arc flash, and chemical exposure. It is becoming standard for complex construction environments.

Smart PPE: Wearables with sensors for fall detection, temperature monitoring, and location tracking are emerging, enhancing safety and productivity.

Service-Based Models: Leasing and full-service textile management are gaining traction, offering companies predictable costs, compliance assurance, and sustainability through extended product lifecycles and recycling strategies.

Sustainability: Circular economy principles are increasingly embedded in PPE supply chains, aligning with corporate ESG objectives.

These trends underscore a shift from PPE as a static product to PPE as a managed safety solution. For construction companies, this means partnering with suppliers and service providers who can deliver not only certified products but also lifecycle management, digital compliance tools, and sustainability reporting.

2.4 How is safety in the construction industry today?

Safety in construction across Europe remains a serious concern. Even though progress has been made, the sector continues to report alarmingly high rates of injuries and fatalities. Construction workers in the EU are nearly three times more likely to be killed and twice as likely to be injured than workers in other sectors, with over **1,300 fatal accidents each year** attributed to construction alone[3]. This makes construction the most hazardous sector across the EU, while SMEs, which represent over 99% of firms, bear the brunt of these incidents.

Despite improvements in accident trends between 2010 and 2019, including a substantial decrease in non-fatal injuries (e.g. over 100,000 fewer in construction[4]), the pace of change remains slow, and **serious risks persist**, especially for SMEs with limited resources for safety management.

Although **regulatory progress and risk reduction** have yielded a modest decline in serious incidents over the past decade, construction safety remains precarious, especially within SMEs which often lack dedicated safety resources and expertise. These firms frequently operate

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[3] https://osha.europa.eu/sites/default/files/Factsheet_15_-_Accident_Prevention_in_the_Construction_Sector.pdf
[4] https://oshwiki.osha.europa.eu/en/themes/sectors-and-occupations"/

reactively when it comes to health and safety, relying on "common sense" rather than structured risk management approaches. In this context, PPE becomes not just the final barrier of protection under the hierarchy of controls, but often one of the few proactive measures realistically implementable for SMEs on busy, resource constrained sites.

2.5 Proper & relevant selection of each type of PPE

Selecting the right PPE for each task in construction is not just about compliance, it is about matching **protection to real-world risks**. Every workplace hazard requires a specific solution: high-visibility garments for traffic zones, helmets for impact protection, gloves for handling sharp materials, and specialized clothing for heat or chemical exposure. **Proper selection** starts with a thorough risk assessment, identifying which body parts need protection and under what conditions. Factors such as durability, comfort, and compatibility with other equipment are equally important, as poorly chosen PPE can lead to non-compliance or reduced safety. Decision-makers must also consider standards and performance classes to ensure that garments meet the required protection level without compromising mobility or usability. In short, **PPE selection is a strategic process** that balances safety, functionality, and worker acceptance; because the best protection is only effective when it is worn consistently and correctly.

Knowledge gaps in PPE selection are common, especially among small and medium-sized enterprises (SMEs). The process is highly complex: it requires understanding risk assessments, harmonized standards, performance classes, and compatibility between different protective elements. Many companies struggle to navigate these requirements, which often leads to **inadequate or non-compliant solutions**. This compendium aims to close that gap by providing clear, structured guidance on legal obligations, technical standards, and practical decision-making tools. Its goal is to make PPE selection and management more transparent and achievable even for organizations without specialized safety expertise.

3 LEGAL BASIS

This chapter provides a clear overview of the legal framework governing the use and selection of PPE in the European construction sector. It explains how Regulation (EU) 2016/425 interacts with national occupational safety laws, clarifies employer responsibilities, and describes the role of CE marking, harmonised standards and certification bodies. By outlining in general how PPE must be assessed, purchased, documented and managed, the chapter translates regulatory obligations into practical guidance for construction companies. The focus is not only on compliance, but on ensuring that legal requirements are understood as essential tools for protecting workers and preventing accidents, particularly within SMEs where safety resources may be limited.

This overview shows it is necessary and sensible for users to understand the **PPE Regulation**. Regardless of whether they work with manufacturers, retailers, or textile service providers, users should ensure their partners understand and comply with the Regulation. This is essential for upholding high **health and safety standards**. Experience shows that trust-based collaboration within the PPE supply chain improves overall quality and compliance.

3.1 Employer Responsibilities: Occupational Health and Safety - An Overview from the User's Perspective

3.1.1 Scope of the PPE Regulation

Every potential user of PPE must first determine whether the PPE they are seeking even falls within the scope of the PPE Regulation[5]. Not every garment designed to protect against hazards must comply with the PPE Regulation.

The scope is defined in **Article 2** in combination with **Article 3** of the PPE Regulation. According to these, it is primarily up to the manufacturer to determine whether their product falls within the scope—namely, if they manufacture products intended to be worn or held by a person to protect against one or more risks to their health or safety. This so-called "**intended use**" is thus determined by the manufacturer. The user can recognize it especially through the product's presentation, marketing, and accompanying information. Before each use of PPE, users should carefully review the **manufacturer's instructions** to understand the intended use and limitations of protection to avoid misuse and reduce potential contributory negligence in the event of injury.

However, Article 2 Paragraph 2 of the PPE Regulation explicitly **excludes certain PPE products from its scope**: notably some items for private use (e.g., weather clothing not intended for extreme conditions and dishwashing textiles). These exclusions reflect a balance between the need for protection and the administrative burden. However, if these products are sold or distributed for commercial use, they are subject to the Regulation. **Other exclusions apply**, for example, when

[5] https://eur-lex.europa.eu/eli/reg/2016/425/oj/eng

government authorities define their own protection standards (e.g., for military or law enforcement PPE), or where other safety standards already exist (e.g., PPE for use on ships or aircraft, or motorcycle helmets and visors).

3.1.2 National occupational health and safety requirements

Employers across Europe must comply with the EU PPE Regulation (Regulation (EU) 2016/425), as they are responsible for selecting and **providing the correct PPE to their employees**. National occupational health and safety laws in all Member States require employers to take necessary measures to protect workers from risks. As part of their mandatory risk assessment, employers must determine whether protective clothing or other PPE is required. If risks cannot be eliminated by general preventive measures, employers must select and provide appropriate PPE free of charge.

Importantly, employers cannot freely choose any type of PPE—they may only provide equipment that complies with Regulation (EU) 2016/425. This means **PPE must be tested and certified under the Regulation** before being placed on the market and supplied to employees. This legal framework underlines how crucial it is for employers to be familiar with the requirements of the EU PPE Regulation when selecting protective equipment.

3.1.3 Formal Requirements for PPE under the Regulation

Users should verify whether the **formal requirements for marketability** are met: manufacturer's identification (Art. 8(6)), CE marking (Art. 16), user instructions (Annex II, 1.4), and a declaration of conformity (Art. 15). If these requirements are not met, the product may not be sold and should not be purchased.

PPE must be labelled with the manufacturer's contact address (postal address required as web or email alone is not sufficient; Art. 8(6)). If the manufacturer is not EU-based, the importer's address must also appear (dual labelling; Art. 10(2) and (3)). If the importer markets the product under their own name (private label), they are considered the manufacturer (Art. 12).

The most visible sign that PPE meets the Regulation is the **CE mark**, which must be clearly visible, legible, and permanent, usually found on a sewn-in label. This mark confirms compliance with the PPE Regulation and EU marketability. If a number appears next to the CE mark, the PPE is Category III. The number identifies the notified body conducting annual inspections.

The manufacturer must provide **instructions and information with the PPE** (Annex II, 1.4), covering storage, use, cleaning, and maintenance. It must also specify the risk the PPE protects against and when the protective effect may expire. Users should read and follow this information carefully. Employees must be instructed using the manufacturer's information on proper and safe PPE use (§3(1) PSA-BV).

A **declaration of conformity** must also be included—either integrated into the user manual or accessible online via a link. It confirms compliance with the PPE Regulation.

For **Category II and III PPE**, this includes reference to an EC type-examination certificate. This is not required for Category I PPE (self-certification). For Category III, the declaration must also indicate the notified body conducting the ongoing product or system audits. The declaration tells the user not only who the manufacturer is, but also who issued the certificate and performs surveillance. The certificate itself need not be enclosed.

3.1.4 Technical Requirements for PPE

More important than formalities are the health and safety requirements set out in the PPE Regulation. These are often equated with compliance with **European standards** (e.g., EN ISO 20471 for high-visibility clothing). Standards help interpret legal requirements but are not mandatory. The actual requirements are found in the PPE Regulation itself—standards merely support compliance.

Minimum requirements for placing high-visibility clothing on the market are defined in Annex II, 2.13 of the PPE Regulation, clarified by EN ISO 20471. If a standard has been published in the **EU Official Journal (harmonized standard)**, compliance is presumed (Art. 14 PPE Regulation). Harmonized standards make it easier for manufacturers and notified bodies to prove conformity—but they are voluntary. Compliance can also be demonstrated through non-harmonized standards or solely based on the Regulation, though this is more complex. The user can see how conformity was proven in the declaration of conformity.

3.1.5 PPE Risk Categories

PPE is assigned to one of three categories based on the severity of the risk it protects against. The higher the category, the higher the level of risk and the stricter the requirements and testing.

- **Category I**: For minimal risks. Manufacturer self-certifies.
- **Category III**: For life-threatening or irreversible risks. Requires type-examination and ongoing annual surveillance.
- **Category II**: Covers all other risks. Requires type-examination, but no ongoing surveillance.

Only after a product passes type-examination and receives certification can it be mass-produced and sold.

3.1.6 PPE as a Commercial Product

Though PPE is subject to stricter requirements than ordinary textiles, it remains freely tradable like any other product. Users can buy directly from manufacturers or through retailers.

In B2B transactions, PPE may be bought by a textile service provider and lent to clients along with laundering services. The user is free to choose their supplier and whether to include services.

The Regulation imposes obligations on all actors in the PPE value chain:

- **Manufacturers** (Art. 8): Most obligations.
- **Importers** (Art. 10): Nearly identical obligations.
- **Private-label distributors** (Art. 12): Treated as manufacturers.
- **Retailers** (Art. 11): Must check for proper labelling, CE marking, and documentation.

Retailers must also ensure all information is available in the correct language—German in Germany (§7(1)– (2) PPE-DG). Textile service providers have the same obligations as retailers.

3.2 Duty of the employer: Occupational safety and health

"The prevention of accidents is not a question of legal regulations, but of corporate responsibility and, moreover, an imperative of economic sense"[6].

Werner von Siemens

If one were to take the sentiment from this sentence to heart, everything would actually be fine. There is a **moral, legal and economic justification** for employers/entrepreneurs to take care of the safety and health of employees. With these simple words, we know that something has to be done, but we know less about what concretely enables the implementation.

First and foremost, the is European law in the form of directly applicable regulations or directives that must be transposed into national law. The directives, in turn, are divided into internal market directives, i.e. everything that concerns product requirements and market regulation - they must be adopted one-to-one in national law - and **directives that set minimum requirements**. The latter also includes the Health and Safety at Work Directive[7].

> *Example: The product requirements for safety goggles must be the same throughout Europe, when they must be worn can be regulated differently "strictly" at national level, the minimum aim is to protect the eyes.*

Additionally, there might be **national specifics** in the form of laws, ordinances and technical regulations. And in some cases (e.g. Germany) there might be autonomous statute law of the statutory accident insurance institutions (employers' liability insurance associations, accident insurance funds, accident insurance associations, social insurance for agriculture, forestry and horticulture).

Private regulations of standardisation bodies are **not legally binding** but are often considered to be the **state of the art** - and must therefore be considered. **Harmonised European standards** (EN) play a special role in product manufacture, as they can have a presumption of conformity for the product in question (*e.g. you can be more confident that you have done everything right if you observe them*).

The overriding framework for occupational health and safety is based on the EC **Occupational Health and Safety Framework Directive** (Council Directive 89/391/EEC). In particular, **Articles 3 to 5** set out the most important obligations of the prioritising hazard prevention over technical

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[6] The quote can be found in various safety and industrial contexts, often attributed to a statement made by Werner von Siemens in 1880.
[7] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A31989L0391

measures over organisational measures over Personal Protective Equipment over behavioural measures.

Behavioural measures *must*, PPE *will* often, complement the technical and organisational measures. In a chemical laboratory, an approved fume cupboard should protect against pollutants and splashes/chips. This only works if the front window is closed as often as possible (behaviour) and the residual risk is compensated for by safety goggles and lab coats (protective equipment) for the short moment of access to the fume cupboard.

Under the Occupational Health and Safety Act there are legal ordinances, e.g. the Workplace Ordinance and the PPE Use Ordinance, and under these there are technical regulations that trigger presumption of conformity (e.g. Technical Rules for Hazardous Substances (TRGS), Technical Rules for Industrial Safety and Health (TRBS)). The Occupational Safety Act (ASiG)[8] requires every company to have the support of an occupational safety specialist (safety engineer, safety foreman, safety technician) and a company doctor (specialist in occupational medicine or doctor with additional qualification in occupational medicine).

In addition to the external supervisory authorities (labour inspectorate and technical supervisory service of the statutory accident insurance), each company has two fully qualified professionals at its disposal for support. Overall, the model is successful, and in recent decades the number of accidents has been reduced.

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[8] https://www.gesetze-im-internet.de/englisch_asig/index.html

3.2.1 CE Marking and Harmonized Standards

Since 1 July 1995, the placement of PPE on the European single market has been subject to **CE marking requirements**. The “CE” abbreviation stands for “Communauté Européenne” (European Community) and serves as a kind of "passport" for goods, facilitating their free movement across the EU without national trade barriers. This mark indicates that the product complies with the relevant EU legislation—in this case, the PPE Directive 89/686/EEC.

This directive was **repealed and replaced by Regulation (EU) 2016/425** of the European Parliament and Council, which came into force on 9 March 2016. The regulation modernizes and expands the previous requirements, drawing on more than two decades of practical experience. Unlike the directive, the regulation is directly applicable in all EU Member States, without requiring national transposition. It emphasizes the need for harmonized safety standards across the EU.

To monitor compliance, the EU designates so-called "**Notified Bodies**" based on proposals by Member States. These institutions must prove their competence and are granted a unique identification number. They are authorized to **assess and monitor products** and quality assurance systems according to standardized procedures.

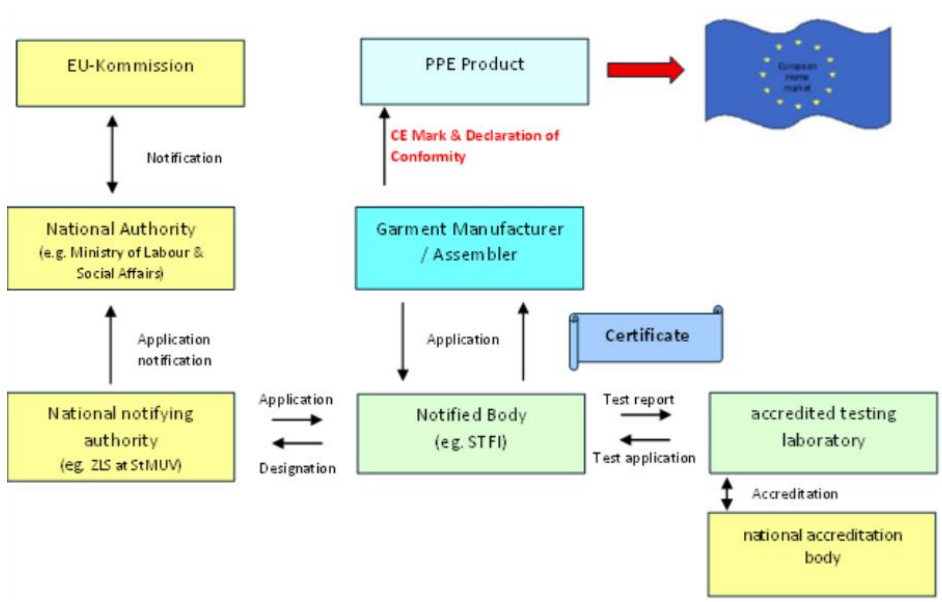

Fig.: *Illustration of the certification processes; Source: Saxon Textile Research Institute (STFI)*[9]

3.2.2 Certification of PPE

The technical requirements for PPE depend on the type of risk the equipment is designed to protect against. PPE is categorized into **three risk levels**—low, medium, and high—each requiring different levels of testing and certification.

[9] https://www.stfi.de/en/

- **Category I** includes PPE for low-level risks, where the user can assess effectiveness independently. No third-party testing is required.
- **Category II** covers intermediate risks and requires an EU type-examination by a Notified Body.
- **Category III** involves complex PPE designed to protect against life-threatening hazards. In addition to type-examination, ongoing surveillance of the manufacturer's quality system by a Notified Body is mandatory.

Based on test results, the manufacturer must issue an **EU Declaration of Conformity**, affirming that the product meets all legal and technical requirements.

PPE models also carry pictograms and performance levels in addition to the CE mark. These symbols identify the specific protective function (e.g., fire resistance, visibility, chemical protection) and indicate compliance with relevant product standards.

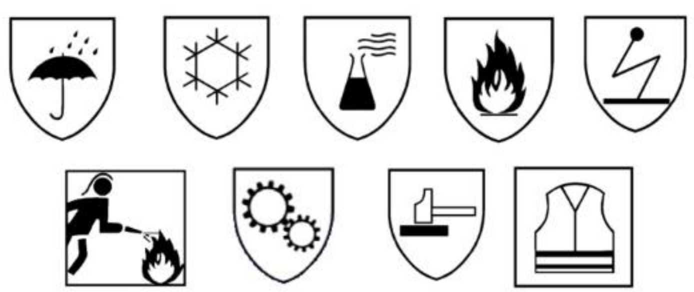

Fig.: Examples of pictograms for labelling the PPE model; Source: OSH Wiki[10]

These pictograms are part of the product standards and - supplemented by performance levels or classes - serve to characterise the product or its properties.

3.2.3 Roles of Testing and Certification Bodies

Authorized testing and certification bodies assess the following:

- **Basic requirements**: These include the highest possible level of protection, ergonomic design, minimal thermal and physical stress, and the absence of safety hazards.
- **Specialized performance criteria**: These relate to flammability, mechanical strength, visibility (colour location and luminance), and design elements.
- **Technical documentation**: Manufacturers must provide complete technical files, including detailed product descriptions, test results, applicable standards, and draft user manuals.

[10] https://oshwiki.osha.europa.eu/en/themes/ppe

3.2.4 Harmonized Standards

In addition to the PPE Regulation, various **harmonized product standards** support its implementation. These standards provide clear technical criteria for compliance and are recognized as conferring a "presumption of conformity" with the regulation.

That said, there can be tension between the expectations of end users, manufacturers, and certifiers. Their views do not always align, especially when it comes to functional performance, customization, or branding.

Examples of Standardization Challenges

High-visibility clothing (EN ISO 20471:2013). The classification of the garment (e.g., Class 2 or Class 3 visibility) depends on the surface area of fluorescent and reflective materials. For small sizes, the minimum area may not be met—especially if additional logos or contrasting panels are added. If modifications are made after certification (e.g., applying emblems or badges), these changes may reduce the garment's effective surface area and compromise its compliance.

Multifunctional protective clothing. Such garments are designed to protect against a range of hazards—thermal, chemical, or electrical—and must meet multiple standards (e.g., EN ISO 11611, EN ISO 11612, EN 13034, EN 1149-5, IEC 61482-2). Not only must the fabric and accessories comply, but so must any design modifications, including company logos or name tags.

Customization is increasingly important in practice. A visually appealing design that reflects the user's corporate identity has become a key selling point. However, in regulated environments, customization must be assessed and approved as part of the certification process.

3.2.5 User Instructions and Manufacturer Obligations

For each PPE model, the manufacturer must provide a clear and comprehensive **information brochure**, which must accompany the product. This brochure must be written in at least the **official language(s) of the country** where the product is sold.

The information **must include**:

- Manufacturer’s name and contact details
- Instructions for proper use
- Storage conditions
- Cleaning, care, and maintenance guidelines
- Warnings and limitations of use

This documentation ensures that the PPE is used correctly and that its protective function is preserved throughout its service life.

4 RISK ASSESSMENT

This chapter highlights the central role of risk assessment as the foundation of any PPE strategy in construction. Before selecting or supplying PPE, employers must first identify and evaluate workplace hazards, assess their likelihood and severity, and determine whether risks can be eliminated or reduced through technical or organisational measures. Only when those measures are insufficient should PPE be considered. The chapter explains how risks should be systematically analysed, how inappropriate or excessive PPE can undermine safety, and why correct selection depends on understanding exposure conditions, compatibility between items, and certified protection levels. By linking risk assessment to practical decision-making, this chapter emphasises that PPE is effective only when its use directly reflects real, task-specific hazards.

4.1 Proper risk assessment

PPE should never be the first response to workplace risks. According to Regulation (EU) 2016/425 on PPE, employers must first carry out a thorough risk assessment. **Only after identifying the risks and determining that they cannot be removed by other means should PPE be selected.**

In small construction companies, many employers either skip this step or are unsure how to carry it out. This often results in overprotection, with PPE provided without a clear understanding of what is needed. The result is equipment that is too heavy, uncomfortable or not adapted to the job. Workers are then less likely to use it properly. The risk remains and costs increase unnecessarily.

The assessment starts with **identifying possible hazards** in each task or work area. Employers then evaluate how likely an incident is to occur and how severe the consequences would be. Based on this, they define specific safety measures—such as using personal protective equipment, installing barriers, or adapting work processes.

It should consider all **typical risks in construction**, such as[11]:

- falls from height
- slips, trips and moving machinery
- electrical hazards
- chemical exposure and dust
- physical strain and poor posture

[11] https://osha.europa.eu/sites/default/files/Magazine_7_-_Actions_to_improve_safety_and_health_in_construction.pdf

- heat, cold and adverse weather
- noise and vibration
- vehicle movement and tool use in public areas
- stress, time pressure and poor communication

The goal is to **reduce risks at source**, using the STOP hierarchy:

- **Substitution**: Can the process or substance be replaced?
- **Technical measures**: Can the danger be removed by design?
- **Organizational measures**: Can access be limited or procedures improved?
- **Personal protection**: Use PPE only if the above steps are not sufficient.

Once the need for PPE is confirmed, it must be chosen carefully. This includes **checking the category of PPE (I, II or III)**, understanding the protection it offers, and ensuring it is CE marked and correctly certified. For example, PPE that protects against serious or irreversible harm (e.g. chemical burns, electric shock, falling from height) is classed as Category III and must meet stricter requirements, including annual inspections.

This process must involve safety officers, supervisors and the workers themselves. It should be updated when conditions change, for example, when new tools are used, when legal requirements are revised, or after an incident.

In addition, employers can make use of visuals, for example pictures of typical risks and standard procedures, to support training and awareness. Sources in different countries, such as DGUV or the Federal Institute for Occupational Safety and Health provide **practical tools and templates** for documentation.

PPE must always follow risk. When this is not the case, there is a real danger of poor decisions, worker resistance and legal non-compliance. Risk assessment is therefore not a bureaucratic task, but a practical and necessary step to protect workers and ensure that PPE is used where it is truly needed.

4.2 Limitations of the use of PPEs

Personal protective equipment is always the *last* line of defence. Even when correctly selected and certified under Regulation (EU) 2016/425 and used in line with employer obligations under Directive 89/656/EEC, PPE has inherent limitations and **can never fully eliminate risk**.

In the context of respiratory protection for construction activities, it is essential that companies understand these limitations clearly, especially when combining different standards and when working in atmospheres where oxygen levels may be reduced.

4.2.1 Limitation of the use of PPEs – focus on respiratory protection

Respiratory protective devices (RPDs) must be selected, used and maintained according to the manufacturer's instructions and the relevant European standards (e.g. EN 136, EN 140, EN 143, EN 14387, EN 149), as well as guidance documents.

They are designed and tested as complete systems, under defined conditions. Misuse or use outside these conditions can create a *false sense of security* and expose workers to serious harm.

In practice, construction workers and safety managers could be tempted to "mix and match" respiratory components (e.g. filters from one manufacturer with a facepiece from another, or combining devices certified to different standards) in order to improve comfort, reduce cost or respond quickly to site needs. This approach carries significant risks.

For the purposes of this compendium, it should be clear that companies should **only use respiratory protective devices or combinations that are:**

- CE-marked and certified for the specific configuration in which they are used; and
- recommended by the manufacturer in the instruction manual for that device.

Any deviation from this principle must be treated as non-compliant and unsafe.

4.2.2 Use of respiratory protection in oxygen-deficient atmospheres

A critical limitation of many respiratory devices used in construction (such as filtering half masks and cartridge respirators) is that **they do not supply oxygen**. They only filter the ambient air and therefore they are *not* suitable for atmospheres where oxygen may be reduced.

In such conditions, air-purifying respirators (filtering facepieces, half masks, full-face masks with filters) must not be used. These devices rely on the surrounding air and offer no protection against oxygen deficiency.

For construction companies, this has practical consequences:

- Work in **confined spaces** may result in oxygen deficiency due to displacement by other gases, corrosion processes, or decomposition of organic matter[12];
- Before assigning respiratory PPE, employers must **measure and evaluate the atmosphere**. If there is any indication that oxygen levels may be below safe limits, the area must be treated as a high-risk environment and managed under specific confined-space procedures[13].

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[12] https://sampling-manual-customs-taxation.ec.europa.eu/health-and-safety/hazardous-substances/dangerous-atmospheres-fumes-and-mists_en
[13] https://www.eiga.eu/uploads/documents/DOC044.pdf

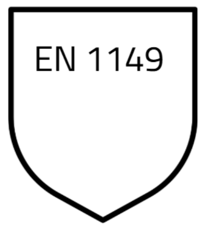
5 STANDARDS COMPENDIUM

5.1 Textiles

Protective textiles form the foundation of many PPE garments used in construction, providing barrier properties against risks such as heat, flame, weather, chemicals, or reduced visibility. Their performance depends on specialised fibres, multilayer constructions and functional finishes that must continue to meet the requirements of the relevant harmonised standards throughout the garment's service life. Because protective textiles can degrade through wear, laundering or exposure to contaminants, proper care and professional maintenance are essential to preserving certified protection. Comfort, breathability and ergonomic design also play a key role in ensuring that protective garments are worn consistently and effectively on the worksite.

EN 1149

Protective Clothing – Electrostatic Properties



PURPOSE OF THE STANDARD

This standard is part of a series of testing methods and requirements for the determination of the electrostatic properties of protective clothing.

This standard specifies the testing methods for the determination of electrostatic charge decay on the surface of clothing materials. These testing methods apply to all the materials

General Requirements

Protective clothing under EN 1149 must:

- Be made from materials with **electrostatic properties**
- Be tested according to relevant parts of the standard (see below)
- Be used in combination with **proper grounding**, antistatic footwear, and controlled environmental conditions
- Be marked clearly with performance information and intended use

Special Features

EN 1149 does **not provide protection against mains voltage** and is **only effective** when used in environments where:

- The **humidity is sufficient** to allow charge dissipation
- The wearer is **properly grounded**
- The **complete protective system** (clothing, footwear, gloves, etc.) is antistatic

The standard is often applied in the **chemical, pharmaceutical, oil & gas, electronics**, and **explosive processing** industries.

Classification (Levels / Classes / Performances)

EN 1149 does not use a traditional class or level system. Instead, it refers to **compliance with specific test methods**:

- **EN 1149-1:** Surface resistivity measurement. For fabrics with conductive fibres woven in a grid
- **EN 1149-2:** Vertical resistance testing (through the fabric)
- **EN 1149-3:** Charge decay testing (measures how quickly charge dissipates)
- **EN 1149-4:** *(Withdrawn)* Garment-level testing (replaced by other parts)
- **EN 1149-5:**
- **Performance requirements** and design guidance
- Requires materials to pass at least one of the methods (1, 2, or 3)
- Specifies **design requirements** such as avoiding non-dissipative components on outer surfaces

EN ISO 11611:2015

Protective clothing for use in welding and allied processes

PURPOSE OF THE STANDARD

This European Standard specifies the essential requirements that the clothes for welding protection must accomplish. These clothes are meant to protect against molten splashes, short term contact with flames and accidental electric shock by electric arc.

Depending on the protection level offered, these clothes can be classified as Class 1 and Class 2, with ascendant level of protection and depending on the welding techniques used and the danger of the situation.

General Requirements:

Clothing covered under this standard must meet several essential safety and quality characteristics:

- **Design Requirements:**
  - No exposed metal parts
  - Limited openings through which sparks or molten metal could enter
  - Must cover the full body (e.g. jackets and trousers, or coveralls)
- **Material Performance:**
  - Resistance to **flame propagation**
  - Resistance to **molten metal splash**
  - **Tensile strength** and **tear resistance**
  - **Dimensional stability** after cleaning
  - **Seam strength**

- **Electrical Resistance:**
  - Materials must have a minimum electrical resistance to avoid shock from low-voltage sources.
- **Comfort and Fit:**
  - Garments must be designed to allow for safe movement and practical use during welding activities.

Classification (Levels / Classes / Performances):

Protective clothing under EN ISO 11611 is classified into **two performance classes**, based on the **level of risk** during welding or related tasks:

Class 1:

- For **less hazardous** welding techniques and situations
- Offers protection against **lower levels** of spatter and radiant heat (e.g. manual metal arc welding, MIG welding, gas welding, brazing)

Class 2:

- For **riskier techniques** or conditions with **higher exposure** to spatter and radiant heat (e.g. heavy-duty welding, gouging, plasma cutting)

EN ISO 11612:2015

Protective clothing — Clothing to protect against heat and flame — Minimum performance requirements

PURPOSE OF THE STANDARD

This European standard specifies the minimum requirements that clothes for protection against heat and flames must accomplish.

Depending on the protection level offered, these clothes can be classified as Level 1, Level 2 or Level 3 with ascendant protection level and depending on the low, medium or high risk (with an additional level for high features materials).

For its certification, the clothes must show a series of features, defined in the marking by codes that show the feature level. They are limited flame propagation (A), convective heat (B), radiant heat (C), molten aluminium splashes (D), molten iron splashes (E) and contact heat (F).

General Requirements

The standard sets out basic safety and construction rules, including:

- Garments must **cover the torso, arms, and legs** completely.
- Optional items (hoods, gaiters, aprons) must also comply when used together with main garments.
- Fasteners, pockets, and seams must be **designed to minimize heat or flame ingress**.
- Garments must pass basic **thermal resistance** and **flame spread** tests before and after cleaning.
- Tests also cover **mechanical durability** (tear, tensile and seam strength, dimensional stability).

Special Features

- Full garment fire exposure test using a **thermally instrumented manikin** (ISO 13506)
- Optional 260°C heat resistance test
- Molten metal protection (D and E) requires specific design features (e.g. no cuffs, covered pockets)

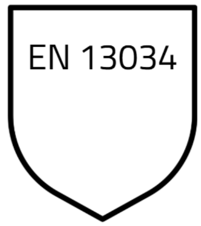
Classification (Levels / Classes / Performances):

Garments are tested and labelled using **code letters** with corresponding **performance levels**. A compliant garment must always meet the basic flame spread requirement (Code A1 or A1+A2) **plus at least one of the following** thermal protection types:

Protective garments for heat and flame hazards are identified by specific letter codes, each corresponding to a particular type of protection and associated test method. Code **A1/A2** refers to limited flame spread, assessed according to ISO 15025, and is evaluated on a pass/fail basis. Code **B** covers protection against convective heat and is tested under ISO 9151, with performance levels ranging from B1 to B3. Code **C** concerns resistance to radiant heat, measured through ISO 6942 and classified from C1 to C4. Protection from molten aluminium (**D**) and molten iron (**E**) is tested according to ISO 9185, with levels D1 to D3 and E1 to E3 respectively. Finally, code **F** relates to resistance to contact heat at 250°C, evaluated using ISO 12127-1 and graded from F1 to F3.

EN 13034:2005+A1:2009

Protective clothing against liquid chemicals (Type 6 and PB [6])



PURPOSE OF THE STANDARD

Test methods and performance classification of chemical protective clothing materials, seams, joints and assemblages.

This standard determines performance requirements and test methods for chemical protective clothing materials, seams, joints and assemblages.

General requirements:

The standard defines **two types of protective clothing**:

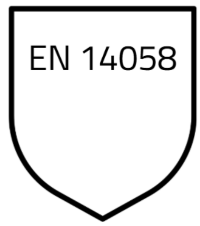
1. **Type 6**:
    - Full body protection (e.g. coveralls)
    - Must protect against **light liquid chemical splashes** and **fine sprays**
2. **PB [6] (Partial Body Protection)**:
    - Protection for specific body parts (e.g. jackets, trousers, aprons, sleeves)
    - Same materials and tests as Type 6, but for **partial coverage**

Garments must:

- Section Be made from materials that resist **chemical penetration** and **repel liquids**
- Feature **secure seams and closures**
- Be **ergonomically designed** for movement and comfort
- Withstand exposure during testing to **specific test chemicals** (e.g. sulfuric acid, sodium hydroxide)

EN 14058:2017+A1:2023

Protective garments against cold environments



PURPOSE OF THE STANDARD

This standard determines test methods as well as the requirements individual garments (individual garment part of an ensemble of clothing that provides protection to the part covered) must meet.

General requirements:

A key feature of EN 14058 is its focus on protection in moderately cold environments, such as those found in food processing, storage facilities, or unheated indoor workplaces. Unlike EN 342 (which covers protection in extreme cold), EN 14058 applies to conditions above –5 °C and allows for flexible garment designs and material combinations. Optional testing for water penetration resistance is also possible.

Classification (Levels / Classes / Performances):

Thermal resistance is classified into several performance classes, with higher classes indicating increased insulation capacity. In addition to thermal resistance, garments may also be assigned an optional air permeability rating, which is divided into different classes reflecting how easily air can pass through the material. Another optional property is resistance to water penetration, which is likewise categorised into classes based on the material's ability to withstand water pressure.

Insulation requirements for protective clothing depend on both the wearer's activity level and the duration of exposure to cold. Lower levels of physical activity, demand higher insulation to maintain thermal comfort, while movement provides additional body heat and therefore allows for lower insulation values. Exposure time has a similar influence: shorter periods can be tolerated at lower temperatures, whereas longer exposure requires greater insulation to ensure safety and comfort.

EN 14605:2005+A1:2009

Protective clothing against liquid chemicals

EN 14605

PURPOSE OF THE STANDARD

The standard EN 14605:2005+A1:2009 specifies requirements for protective clothing against liquid chemicals, particularly chemical protective clothing with liquid-tight (Type 3) or spray-tight (Type 4) connections between different parts of the garment and between the garment and other items (like gloves or boots).

General requirements

To ensure that protective clothing **provides adequate protection** for workers who may be **exposed to hazardous liquid chemicals**, in the form of **liquid jets (Type 3)** or **liquid sprays (Type 4)**.

It covers:

- **Performance requirements** for materials and seams.
- **Design features** to prevent liquid penetration.
- **Testing methods** to verify tightness and protective ability.
- **Marking and user information** to ensure correct usage.

Classification (Levels / Classes / Performances)

Materials used in protective clothing must meet a set of minimum performance requirements to ensure they provide adequate durability and safety in use. These requirements cover resistance to abrasion, flexing—including at low temperatures—tearing, tensile forces, puncture and permeation by liquids. In addition to the properties of the materials themselves, seams, joins and assemblages must also comply with defined performance criteria. They are required to resist liquid penetration or permeation according to the relevant test methods, and they must demonstrate sufficient seam strength to maintain integrity during use. Together, these specifications ensure that both the fabric and its construction can withstand the mechanical and liquid-related stresses encountered in protective applications.

In addition, complete garments must pass a practical test in which the tester has to perform the “seven movements” sequence, including crawling, climbing ladders, arm movements, torso twists and several moves to check the garment does not prevent such movements and is not damaged while performing them. Finally, the standard also specifies the marking of the garments and the information that must be provided to users.

EN ISO 20471:2013

High visibility clothing — Test methods and requirements

PURPOSE OF THE STANDARD

This Standard is applied to determine the water penetration of the materials used in the manufacturing of clothing and extends to the permeability of the seams. The water resistance is the most important property.

General requirements

High visibility clothing must:

- Include **fluorescent background material** (for daylight visibility)
- Include **retroreflective material** (for nighttime visibility)
- Ensure **360° visibility** through proper material placement
- Be tested **before and after washing and wear simulation**
- Fulfil specific requirements regarding:
    - **Colour and luminance** (brightness)
    - **Colour fastness**
    - **Mechanical strength**
    - **Dimensional stability**
    - **Thermal and moisture resistance**
    - **Photometric performance of retroreflective material**

Design Requirements

- Garments must cover the **torso** and optionally the **arms and/or legs**.
- Garments must be designed so that **logos or accessories** do not reduce the visible area.
- **Retroreflective bands** must be at least **50 mm wide** and arranged for maximum visibility.

- Materials must meet minimum performance in **realistic conditions**, including rain and repeated washing.

Classification (Visibility Classes)

High-visibility clothing is divided into different classes that reflect the amount of fluorescent and retroreflective material incorporated into the garment. Higher classes correspond to greater visibility and are intended for use in environments with increased traffic speed or higher visibility demands. The appropriate class depends on the level of risk posed by the surroundings: workers exposed to fast-moving traffic require the highest visibility; those in urban or moderately trafficked areas need an intermediate level; and activities carried out indoors or in low-speed environments typically require only the basic class. These classifications help ensure that workers are equipped with the visibility level suited to their specific working conditions.

EN 342:2017

Ensembles and garments for protection against cold

PURPOSE OF THE STANDARD

This standard determines test methods as well as the requirements individual garments (individual garment part of an ensemble of clothing that provides protection to the part covered) must meet. The tables indicate the values required for each of the different aspects considered.

General requirements

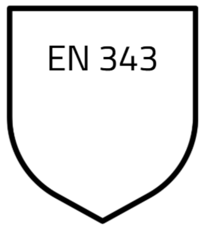
Applied to individual garments and ensembles used for protection against temperatures below -5°C. The Standard defines other concepts to be considered such as Thermal Resistance, effective and actual Thermal Insulation, etc. Thermal insulation is the most important property. To ensure adequate protection against the cold the minimum value of the resulting effective thermal insulation (Icler) must be 0.310 m2 K/W. The standard also specifies air permeability (AP) and the resistance to water penetration (WP) (Optional) (See Tables below) and also sets the values for Water Vapour Resistance (less than 55 m2 Pa/W).

Special features:

A distinct feature of EN 342 is that it evaluates both complete clothing ensembles and single garments for their protective capabilities in extremely cold environments (e.g., arctic outdoor work, cold storage logistics). The standard allows for testing with or without base layers and considers environmental wind effects. Optionally, it can include water resistance testing if moisture exposure is relevant for the application.

EN 343:2019

Protective clothing — Protection against rain



PURPOSE OF THE STANDARD

This Standard is applied to determine the water penetration of the materials used in the manufacturing of clothing and extends to the permeability of the seams. The water resistance is the most important property.

EN 343:2019 specifies the requirements and test methods for clothing materials and finished garments that are designed to provide protection against precipitation (such as rain and snowflakes).

General requirements

This standard **does not** cover protection against:

- Water spray from high pressure (e.g. waves)
- Other types of protective clothing (e.g. for chemical exposure)
- Footwear, gloves, or separate headwear

EN 343:2019 introduces and updates several key requirements:

1. **Water Penetration Resistance (WP):**
    - Measured in Pascals (Pa); classifies how waterproof the material is.
    - A new **Class 4** has been introduced for garments with WP ≥ 20,000 Pa.
2. **Water Vapor Resistance (Ret):**
    - Indicates breathability: lower Ret = better moisture evaporation, which reduces heat stress.
    - A new **Class 4** is defined for Ret < 10 m²·Pa/W (very breathable).

3. **Material Durability Requirements:**
    - Tear resistance, bursting strength, and seam strength are specified.
    - Some new requirements now match those in related cold protection standards (EN 342, EN 14058).
4. **Innocuousness (Harmlessness):**
    - Garments must not pose a health risk (e.g. no harmful substances).
5. **Optional Garment Testing (Rain Tower Test):**
    - Finished garments may be tested after cleaning cycles to ensure continued protection.
6. **Separate Testing Procedures for Pre-treatment and Performance:**
    - Ensures clear and reliable classification after washing or wear simulation.

Classification (Levels / Classes / Performances):

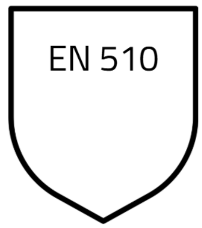
Garments are labelled using a **two- or three-digit code**, typically shown as:

EN 343 :2019 Class X Y [Z]

- **X = Waterproofness (WP Class):**
    - Class 1 = lowest resistance (≥ 8000 Pa)
    - Class 4 = highest resistance (≥ 20,000 Pa)
- **Y = Breathability (Ret Class):**
    - Class 1 = least breathable (Ret > 40)
    - Class 4 = most breathable (Ret < 10)
- **Z = (optional) Rain Tower Test:**
    - "R" may be added if tested as a finished garment

EN 510: 1993

Protective clothing against entanglement in moving part



PURPOSE OF THE STANDARD

This standard specifies the requirements for protective clothing designed to minimize the risk of entanglement in moving machine parts, such as rotating shafts, drills, or conveyors. It is particularly intended for workers who are required to work in close proximity to machinery with moving parts where snagging or entrapment could cause injury.

General requirements

The standard focuses on **garment design and construction**, rather than material performance. Key requirements include:

- **Smooth and close-fitting design** to reduce the chance of snagging
    - **No loose components**, such as dangling cords or belts, wide sleeves, open pockets, untied zippers or flaps
- **Secured fastenings** (e.g. zippers, Velcro, or snaps) that remain closed during work
- Reinforced or covered **closures and seams**
- Garments should allow **sufficient mobility** while staying close to the body

Restrictions and Considerations

- No **openings or gaps** that could catch on moving parts
- No **protruding accessories** (e.g., external badges or tags)
- Special attention to **cuffs, hems, and collars**, which must be secure
- If worn over other garments, outerwear must **still meet EN 510 design principles**

Classification (Levels / Classes / Performances):

EN 510 does **not** include performance classes like other PPE standards

EN 61482-1-2:2020

Test Method 2: Box Test Method

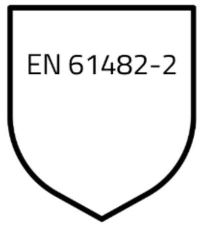
PURPOSE OF THE STANDARD
To test clothing and materials under a directed and constrained arc (box arc) to simulate realistic short-circuit conditions in low-voltage installations.

General requirements:

- **ATPV (cal/cm²):** The energy level at which there is a 50% probability that the wearer would receive a second-degree burn.
- **EBT (cal/cm²):** The energy level at which the material **breaks open**, exposing skin, which is another critical risk.

EN 61482-2:2020

Protective clothing against the thermal hazards of an electric arc



PURPOSE OF THE STANDARD

Protective clothing against the thermal hazards of an electric arc. Part 1-2: Test methods. Method 2: Determination of arc protection class of material and clothing by using a constrained and directed arc (box test).

General requirements

This standard specifies the test methods that determine if the thermal protection against the arc is achieved. The protection classes 1 and 2 are safety requirements that cover real potential hazards due to electric arcs. It must be considered that in practice it might be higher hazards and a hazard analysis must be performed for classifying the real hazards.

Classification (Levels / Classes / Performances):

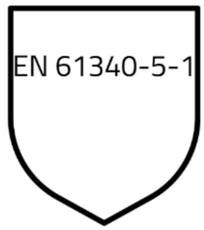
Depending on the shortcut current expected the classes are fixed as:

- Class 1 4kA
- Class 2 7kA

With an arc duration of 500ms in both test classes (similar conditions to those of a low-tension environment during an electric failure). The tests refer to the thermal effects of the arc, other effects such as noise, light emissions, pressure rising, hot oil, electric shocks, consequences of physical and metal shocks and toxic influences are not applied.

EN 61340-5-1:2016

Protection of electronic devices from electrostatic phenomena – Part 5-1: General requirements



PURPOSE OF THE STANDARD

To define the requirements for an Electrostatic Discharge (ESD) control program aimed at protecting electronic components and assemblies that are sensitive to electrostatic discharge.

It ensures that electronic devices, especially Electrostatic Discharge Sensitive Devices (ESDS), are handled in a way that prevents damage from static electricity—common in electronics manufacturing, assembly, and repair.

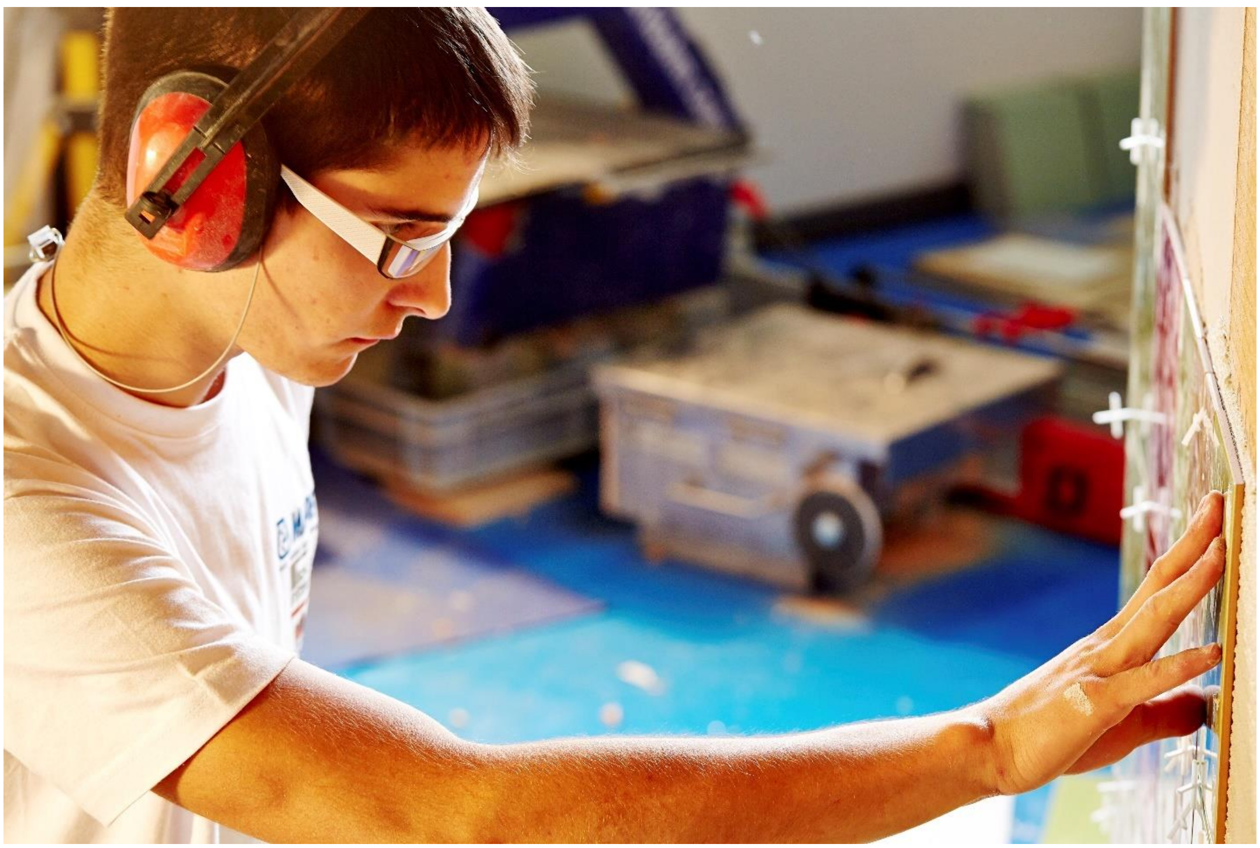
General requirements

EN 61340-5-1 specifies:

- Requirements for **ESD control programs**
- **Protective equipment** (e.g., wrist straps, ESD garments, footwear)
- **ESD-protected areas (EPAs)**
- Requirements for **grounding systems**
- **Handling and packaging** of ESD-sensitive devices
- **Training and auditing** of personnel and systems

5.2 Ear Protection

Hearing protection is essential on construction sites, where workers are frequently exposed to high noise levels from machinery, tools and heavy equipment that can cause irreversible hearing damage. Selecting the correct hearing protector—such as earplugs or earmuffs—requires assessing the noise exposure and matching it with the appropriate attenuation level defined in harmonised standards, avoiding both under- and over-protection. Comfort, fit and compatibility with helmets or other PPE strongly influence whether equipment is worn correctly and consistently. Regular inspection, proper hygiene and timely replacement are necessary to ensure that hearing protectors maintain their certified performance and continue to safeguard workers' long-term health.



EN 352

Hearing Protector

PURPOSE OF THE STANDARD
Establish the requirements for hearing PPE in relation to Regulation (EU) 2016/425 regarding Personal Protection Equipment. **The requirements of this Standard mainly refer to the physical and acoustic performance of both hearing protectors. Acoustic Attenuation is specified in particular by the Standards in each case. Both the ear plugs and the earmuffs are classified in Category III (Complex design). They protect against risks which are fatal or which could cause serious or very serious injuries.**

General requirements

Acoustic Attenuation is defined as the average difference in dB between the hearing threshold with and without the hearing protector from a panel of test subjects. Acoustic attenuation indicates the effective protection level.

Mf: represents the average attenuation values and **sf** the typical deviations measured in accordance with the Standard EN 13819- 2:2020.

The following concepts must also be taken into account:

- **APV:** Protection provided (Difference between the average attenuation and the standard deviation).
- **H:** Attenuation at high frequencies.
- **M:** Attenuation at medium frequencies.
- **L:** Attenuation at low frequencies.

- **SNR:**(Overall attenuation of the protector) average level of protection offered by the protector considering all frequency bands between 63 and 8000 Hz

Classification (Levels / Classes / Performances):

- Name, commercial brand or other identification of the manufacturer or its authorized representative.
- Denomination of the model.
- CE logo plus the 4-digit number of the Notified Body in charge of the control procedure (Module C2 or D).

5.3 Eye Protection

Eye protection is a critical safeguard in construction, where workers are routinely exposed to risks such as flying particles, dust, chemical splashes, radiant energy and UV or infrared emissions from welding and cutting operations. Selecting appropriate eye protection requires matching the identified hazard with the correct type of protector—such as safety spectacles, goggles or face shields—and ensuring compliance with the relevant harmonised standards. Comfort, field of vision, anti-fog and anti-scratch performance, and compatibility with helmets and respiratory protection all influence effective use. Proper maintenance, cleaning and timely replacement are essential to preserving protection and ensuring that eye protectors continue to perform as certified.

EN 166:2001

Personal eye-protection - Specifications

EN 166

PURPOSE OF THE STANDARD

This is the basic standard that defines general functional requirements for all types of personal eye protection, including protection from mechanical, chemical, thermal, and optical risks.

General requirements

Requires optical clarity (classes 1–3), resistance to aging, corrosion, ignition, and mechanical strength. Markings must indicate protection class and manufacturer.

Special features

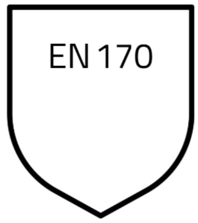
This is the foundation standard; all other filter or specialized standards refer to EN 166. Includes marking codes for resistance to droplets (3), dust (4), gas (5), fine particles (9), and anti-fog (N).

Classification (Levels / Classes / Performances):

Mechanical strength levels: S (low), F (medium, 45 m/s), B (high, 120 m/s), A (very high, for face shields). Optical classes: 1 (best) to 3 (limited use).

EN 170:2002

Personal eye protection - Ultraviolet filters - Transmittance requirements and recommended use



PURPOSE OF THE STANDARD

It specifies the requirements for UV filters used in eye protection devices. Filters protect against non-ionizing ultraviolet radiation (e.g., from UV lamps in laboratories or industrial curing systems).

General requirements

Must reduce UV radiation without significantly impairing visible light transmission. Filters are marked with code 2 followed by protection level (e.g., 2-1.2).

Special features

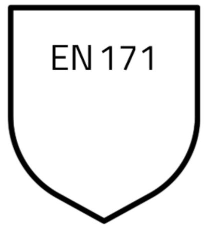
Designed for UV radiation up to ~400 nm. Not suitable for welding or intense optical radiation. Often colourless or only lightly tinted.

Classification (Levels / Classes / Performances):

Protection levels: 2-1.2 to 2-5. The second number refers to how dark the filter is – higher numbers mean stronger filtering.

EN 171:2002

Personal eye protection - Infrared filters - Transmittance requirements and recommended use



PURPOSE OF THE STANDARD

Defines the requirements for infrared radiation filters, used in tasks like glass manufacturing, foundries, or metal processing, where strong thermal radiation is emitted.

General requirements:

Filters must block IR radiation while maintaining adequate visible light transmission. Marked with code 4 followed by the protection level (e.g., 4-2).

Special features:

Designed for wavelengths above 780 nm. Often green-tinted to help reduce IR exposure. Must not distort colour perception

Classification (Levels / Classes / Performances):

Filter levels range from 4-1.2 to 4-5, where the second number indicates increasing IR attenuation.

EN 172:1994 + A1:2000 + A2:2001

Personal eye-protections - Sunglare filters for industrial use (includes Amendment A1:2000 and A2:2001)

EN 172

PURPOSE OF THE STANDARD

This standard applies to sunglare filters used in industrial environments. It ensures protection against bright sunlight but not for driving or direct observation of the sun.

General requirements

Filters must have consistent light absorption and provide sufficient glare protection without distorting colours. Not for driving or road use. Designed for outdoor industrial tasks (e.g., construction, agriculture). May include mirror coatings.

Special features:

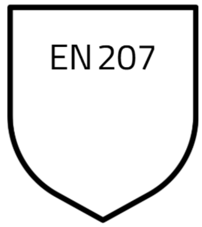
Not for driving or road use. Designed for outdoor industrial tasks (e.g., construction, agriculture). May include mirror coatings.

Classification (Levels / Classes / Performances):

Filter codes range from 5-1.1 to 5-4, depending on how dark the tint is. Marked with code 5- followed by light transmission grade.

EN 207:2017

Personal eye-protection equipment - Filters and eye-protectors against laser radiation (laser eye-protectors)



PURPOSE OF THE STANDARD

Specifies requirements for laser safety eyewear that protects against specific laser wavelengths and power levels. Mandatory in environments with laser classes 3B or 4.

General requirements

The eyewear must fully absorb or block laser radiation for the specified wavelength, mode (CW, pulsed), and exposure duration. Marked with "LB" and specific wavelength range (e.g., 800–900 nm LB6).

Special features

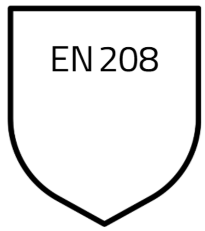
The protection is highly specific: goggles are tested against exact wavelength, power, and type of laser (continuous, pulsed, etc.). Each pair is only valid for certain settings.

Classification (Levels / Classes / Performances):

Marked with protection level LBn, where "n" is the tested level. Includes details like wavelength range and laser mode (D = CW, I = pulsed, R = modulated, M = giant pulse).

EN 208:2009 Personal eye-protection

Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors)



PURPOSE OF THE STANDARD
Designed for use during alignment or adjustment of low-power lasers, allowing the user to see the laser beam while still protecting the eyes.

General requirements

Must attenuate laser radiation to a safe level but still allow visibility of the beam spot for alignment. Tested for specific wavelengths and marked accordingly.

Special features

Only applicable to adjustment tasks with low-energy visible lasers (typically Class 2 or 3R). These are not suitable for laser processing tasks.

Classification (Levels / Classes / Performances):

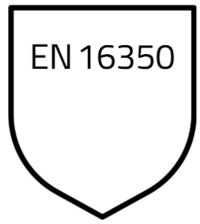
Classified with RBn values, where "RB" refers to "Reduced Beam" and "n" indicates the protection factor for a specific laser class/wavelength.

5.4 Protective Gloves

Protective gloves are an essential component of hand safety in the construction sector, where workers face diverse risks ranging from mechanical cuts and abrasions to chemical exposure, vibration and thermal hazards. Selecting the correct glove requires a clear understanding of the task-specific risks identified in the company's risk assessment, as well as the performance levels defined in relevant harmonised standards. Comfort, dexterity, grip and compatibility with other PPE are critical to ensuring that gloves are worn consistently and correctly. As with all PPE, certified protective gloves must be used in accordance with manufacturer instructions, maintained properly, and replaced when damaged to guarantee that their protective performance is preserved throughout their service life.

EN 16350

Protective gloves - Electrostatic properties



PURPOSE OF THE STANDARD

This Standard provides additional requirements for protective gloves that are worn in areas where flammable or explosive areas exist or might be present (see IEC 60079-32-1). It specifies a test method and requirements for performance, marking and information for electrostatic dissipative protective gloves to minimize explosion risks.

General requirements

This European Standard does not cover:

- protection of electronic devices.
- protection against mains voltages.
- insulative protective gloves for live working (EN 60903).
- protective gloves for welders (EN 12477).

The requirements may not be sufficient in oxygen enriched flammable atmospheres.

Gloves must meet the requirements of EN ISO 21420 (Protective gloves. General requirements and test methods). This Standard should be used with the specific standards applicable to the risks for which the glove is designed.

NOTE The electrostatic dissipative protective gloves are effective only if the wearer is earthed through a resistance lower than10^8 Ω.

EN ISO 374:2016

Protective gloves against dangerous chemicals and microorganisms

PURPOSE OF THE STANDARD

The standard defines the marking of the gloves as well as the use of the appropriate pictogram. This standard is applied to determine the resistance of the materials of the gloves to permeation by non-gaseous, potentially hazardous chemicals under conditions of continuous contact. It should be noted that the test does not represent conditions that may be encountered during use and that the test data should be restricted to comparing materials, mainly, based on broad categories of penetration time. The resistance of the glove material to the permeation for a chemical, solid or liquid is determined by measuring the passage time of the chemical through the glove material. Each protective gloves / chemical combination is clarified in terms of passage time, according to each individual chemical for which the glove resists permeation.

General requirements:

The standard specifies, as minimum requirement, that the gloves must be airtight and watertight and minimum, they must meet the Type C performance.

Classification (Levels / Classes / Performances):

The levels in the are based on the permeation time determined during constant contact with the testing chemical under standard laboratory conditions. The protection time in the workplace can vary considerably in relation to this level.

EN 388

Protective gloves against mechanical risks

PURPOSE OF THE STANDARD

This standard applies to all types of protective gloves intended to protect against mechanical and physical risks caused by abrasion, blade cutting, tearing and perforation.

General requirements

Gloves must meet the requirements of EN ISO 21420 (Protective gloves. General requirements and test methods)

Classification (Levels / Classes / Performances):

Protective gloves are assessed against several mechanical performance criteria, including resistance to abrasion, cuts, tearing and perforation. Each of these properties is classified into different performance levels, with higher levels indicating stronger resistance and increased durability against mechanical hazards. These classifications help users select gloves that offer appropriate protection for the specific risks they face, ranging from general handling tasks to work involving sharper edges or more demanding mechanical stresses.

EN 407

Protective gloves and other hand-protective equipment against thermal risks (heat and/or fire)

PURPOSE OF THE STANDARD

This standard specifies requirements, test methods, marking and information for protective gloves, other hand protective equipment and arm protective equipment against thermal risks for professional use, consumer, domestic use.

It is used for all gloves and other hand protective equipment's which protects the hands or part of the hand against heat and/or fire in one or more of the following forms: flame, contact heat, convective heat, radiant heat, small splashes or large quantities of molten metal. This document does not apply to gloves for fire-fighters or welding that have their own standards.

General requirements:

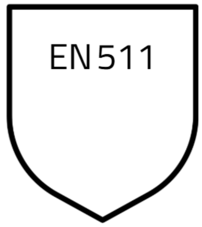
Gloves must meet the requirements of EN ISO 21420 (Protective gloves. General requirements and test methods). All the tests are performed on the palm area.

Classification (Levels / Classes / Performances):

Protective garments designed for heat and flame hazards are evaluated across several performance levels, each reflecting increasing resistance to different forms of thermal exposure. These assessments cover flame behaviour, contact heat, convective heat, radiant heat and molten metal exposure. Higher levels indicate better performance in withstanding ignition, delaying heat transfer and resisting both small and large quantities of molten metal. This classification system helps users identify the appropriate level of protection needed for tasks involving varying intensities of heat, flame or molten material.

EN 511

Protective gloves against cold



PURPOSE OF THE STANDARD

This European Standard specifies the requirements and test methods for gloves which protect against convective and conductive cold down to –50 °C. This cold can be linked to the climatic conditions or industrial activity. The specific values of the different performance levels are decided by the special requirements for each class of risk or the special areas of application. Product tests may only give performance levels and not levels of protection

General requirements:

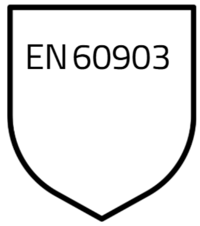
Gloves must meet the requirements of **EN 420** (Protective gloves. General requirements and test methods).

Classification (Levels / Classes / Performances):

Cold-protective garments are classified according to their ability to resist convective and contact cold, with higher levels indicating better thermal insulation and protection in low-temperature environments. These classifications reflect how effectively a material slows heat loss either through air movement or direct contact with cold surfaces. In addition to thermal performance, garments may also be assessed for resistance to water penetration, with a simple pass or fail outcome based on whether water is able to penetrate within a specified timeframe. Together, these properties help determine the suitability of clothing for work in cold and wet conditions.

EN 60903

Live working - Gloves of insulating material



PURPOSE OF THE STANDARD

This Standard is applicable to:

- **insulating gloves and mitts which should normally be used in conjunction with leather protector gloves worn over the insulating gloves to provide mechanical protection**
- **insulating gloves and mitts usable without over-gloves for mechanical protection.**

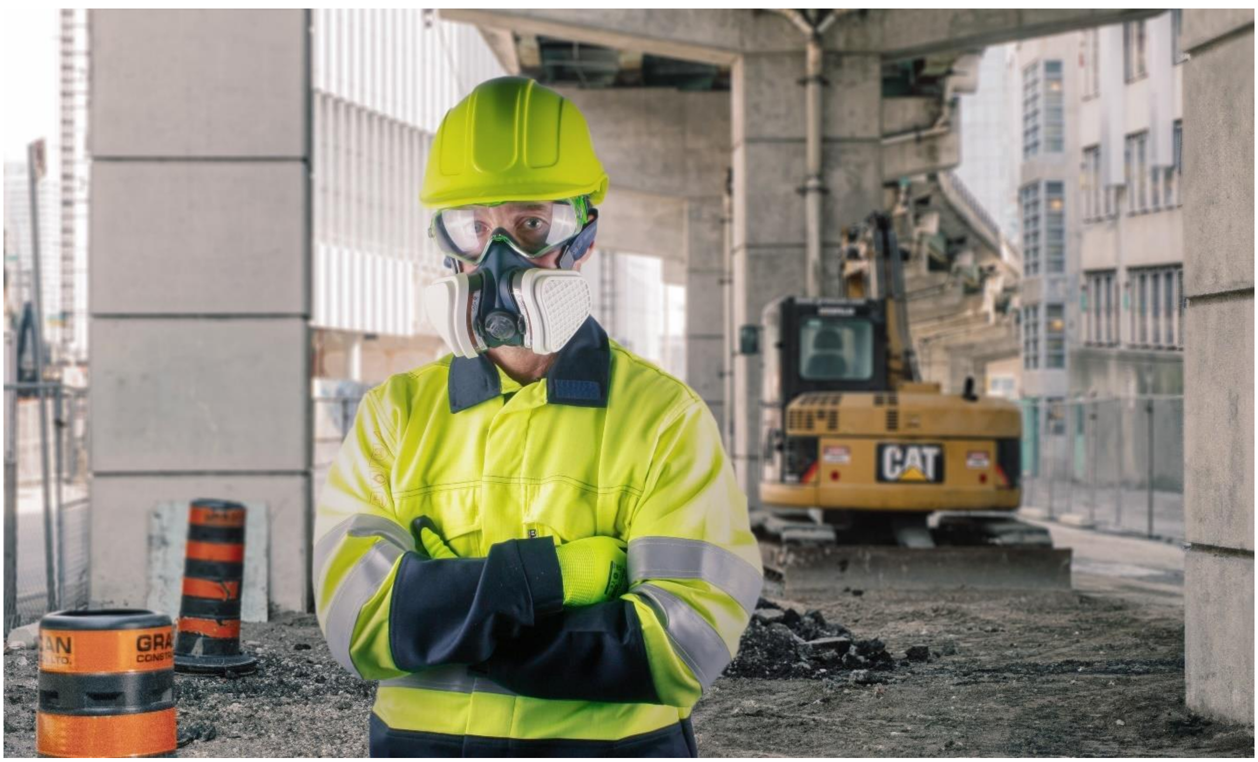
The use of the term insulating gloves designates gloves providing electrical protection only. The use of the term composite gloves designates gloves providing electrical and mechanical protection.

Classification (Levels / Classes / Performances):

Some protective gloves are classified according to special properties that indicate their resistance to specific environmental or chemical conditions. These categories include protection against acids, oils, ozone and very low temperatures, with a combined category available for gloves that meet multiple requirements simultaneously. In addition, electrically insulating gloves are grouped into classes that correspond to the maximum voltage levels they are designed to withstand in both AC and DC applications. These classifications help users select gloves that are suitable for specialised hazards and electrical work.

5.5 Respiratory Protective Equipment

Respiratory protective equipment is vital in construction environments where workers may be exposed to dust, fumes, vapours or hazardous particles that cannot be adequately controlled through technical or organisational measures. Choosing the correct device—whether filtering facepieces, reusable masks, powered respirators or atmosphere-supplying equipment—must be based on a detailed risk assessment and the limitations defined in harmonised standards. Critical considerations include the type and concentration of airborne contaminants, required protection factor, facial fit, compatibility with other PPE, and strict prohibitions on using filtering respirators in oxygen-deficient or immediately dangerous atmospheres. Proper training, fit testing, maintenance and timely replacement are essential to ensuring that respiratory equipment performs as certified and provides reliable protection throughout its service life.



EN 12941:2023

Respiratory protective devices – Powered filtering devices incorporating a loose-fitting respiratory interface - Requirements, testing, marking

PURPOSE OF THE STANDARD

The standard determines requirements and test methods the powered filtering devices incorporating a loose-fitting respiratory interface, to be used in respiratory protection, must meet.

General requirements

The standard specifies safety and usability requirements for the powered filtering devices incorporating a loose fitting respiratory interface (helmet, hood, visor) i.e. breathing resistance, comfort of use, strength of connections/connectors and head harness, mechanical strength, thermal resistance including flammability, fitting to the face/head, mass, breathable air supply including flow rate control, noise level, filtration efficiency and gas capacity.

Special features

The powered filtering devices incorporating a loose fitting respiratory interface are designed as complete and independent respiratory protective equipment incorporating respiratory interface (helmet, hood, visor), breathing tubes, body harness and filtered air blower to ensure effective protection against harmful airborne substances like particles (when completed with particle filters), gases and vapours (when completed with gas filters) and combination of gases/vapours and particles (when completed with combined filters), when total concentration of the harmful substances are below the specified value(s) of performance levels and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances):

EN 12941 defines three performance classes of powered filtering respiratory devices with loose-fitting facepieces. These classes differ primarily in their filtration efficiency and limits on inward leakage, with TH1 providing the basic level of performance, TH2 offering enhanced filtration and reduced leakage, and TH3 delivering the highest level of protection. Each class can be used with different types of gas or particle filters, depending on the hazard.

The standard also categorises gas filters according to the substances they protect against. These include filters for organic vapours, inorganic gases, acidic gases, ammonia, and low-boiling organic compounds, as well as special filters for specific substances such as nitrogen oxides or mercury. Some of these specialised filters are intended for single shift use, and certain combinations are restricted to ensure safe application.

Many gas filters can be combined to form multi-type filters that protect against several groups of substances simultaneously. Filters of types A, B, E and K are further divided into capacity classes, indicating how much contaminant each can safely adsorb; higher classes represent greater capacity for use in higher concentrations. Other filter types do not use capacity classes and may have specific limits on service life. All filters must be used within their intended capacity and according to the manufacturer’s instructions.

EN 12942:2023

Respiratory protective devices – Powered filtering devices incorporating full face masks, half masks or quarter masks - Requirements, testing, marking

EN 12942

PURPOSE OF THE STANDARD

The standard determines requirements and test methods the powered filtering devices incorporating full face masks, half masks or quarter masks, to be used in respiratory protection, must meet.

General requirements:

The standard specifies safety and usability requirements for the powered filtering devices incorporating full face masks, half masks or quarter masks i.e. breathing resistance, comfort of use, strength of connections/connectors and head harness, mechanical strength, thermal resistance including flammability, fitting to the face, mass, breathable air supply including flow rate control, noise level, filtration efficiency and gas capacity.

Special features:

The powered filtering devices incorporating full face masks, half masks or quarter masks are designed as complete and independent respiratory protective equipment incorporating facepiece, breathing tubes, body harness and filtered air blower to ensure effective protection against harmful airborne substances like particles (when completed with particle filters), gases and vapours (when completed with gas filters) and combination of gases/vapours and particles (when completed with combined filters), when total concentration of the harmful substances are below the specified value(s) of performance levels and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances):

EN 12942 defines three classes of powered filtering respiratory devices that use tight-fitting facepieces such as full-face, half-face or quarter masks. These classes differ in filtration performance and allowable inward leakage, with TM1 offering the basic level of protection, TM2 providing enhanced efficiency, and TM3 delivering the highest protection. All three classes can be paired with a range of gas or particle filters depending on the workplace hazard, including special combined filters for substances like mercury or nitrogen oxides. Device performance may vary depending on whether the power unit is operating, and each class specifies the corresponding limits. As with other powered respiratory systems, correct selection depends on the contaminants present and the type of filter required to ensure adequate protection.

EN 136:1998+AC 1999

Respiratory protective devices - Full face masks - Requirements, testing, marking

EN 136

PURPOSE OF THE STANDARD

The standard determines requirements and test methods full face masks (facepieces covering nose, mouth, eyes, chin and forehead) to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for 3 classes of full-face masks i.e. breathing resistance, leak tightness, comfort of use, strength of connections/connectors and head harness, thermal resistance including flammability and radiant heat, fitting to the face, field of vision.

Special features

Full face masks of Class 1 and Class 2 are designed to be connected with particle filters (acc. to EN 143) or gas filters and combined filters (acc. to EN 14387) or powered filtering devices (EN 12942) to ensure effective protection against harmful airborne substances like particles, gases and vapours or their mixtures when total concentration of the substances are below the specified value(s) and the concentration of oxygen is higher than 19,5%. Full face masks of Class 3 are designed to be connected with compressed air devices (acc. to EN 14593-1 or EN 14594) or breathing apparatus (acc. to EN 137 or EN 145), to deliver breathable air in case of high concentrations of harmful airborne substance(s) as well as when lack of oxygen occurs.

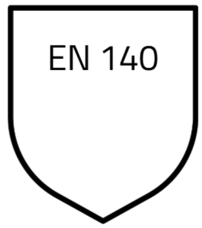
Classification (Levels / Classes / Performances):

EN 136 provides performance levels within 3 Classes:

- **Class 1** – Full face masks for light duty use - intended in the main respirators. Levels of protection depends on the type and the class of filter(s) i.e. particle filter, gas/combined filter used in connection with the facepiece.
- **Class 2** – Full face masks for general use - offer greater resistance to flammability. Levels of protection depends on the type and the class of filter(s) i.e. particle filter, gas/combined filter used in connection with the facepiece.
- **Class 3** – Full face masks for special use - offers greater protection against flame and radiant heat – suitable for firefighting, chemical rescue, mine rescue (usually used with various types of breathing apparatus). Levels of protection depends on the type and the class of filter(s) breathing apparatus used with the facepiece.

EN 140:1998+AC 1999

Respiratory protective devices – Half masks and quarter masks - Requirements, testing, marking



PURPOSE OF THE STANDARD

The standard determines requirements and test methods half masks (facepieces covering nose, mouth and chin) and quarter masks (facepieces covering nose and mouth) to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for half masks and quarter masks i.e. breathing resistance, comfort of use, strength of connections/connectors and head harness, thermal resistance including flammability, fitting to the face, field of vision.

Special features

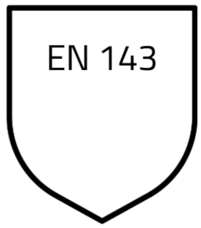
Half masks and quarter masks are designed to be connected with particle filters (acc. to EN 143) or gas filters and combined filters (acc. to EN 14387) or powered filtering devices (EN 12942) to ensure effective protection against harmful airborne substances like particles, gases and vapours or their mixtures when total concentration of the substances are below the specified value(s) and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances):

EN 140 does not provide classification related to the half masks nor quarter masks. Levels of protection depends on the type and the class of filter(s) i.e. particle filter, gas/combined filter used in connection with the facepiece.

EN 143:2021

Respiratory protective devices – Particle filters - Requirements, testing, marking



PURPOSE OF THE STANDARD

The standard determines requirements and test methods particle filters (to be connected with facepieces: acc. to EN 136 and EN 140 or powered filtering device acc. EN 12941 and EN 12942) to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for particle filters i.e. filtration efficiency, breathing resistance, mass and thermal resistance.

Special features

Particle filters are designed to be connected (completed) with facepieces (acc. to EN 136 and EN 140) or powered filtering devices (acc. to EN 12941 and EN 12942) to ensure effective protection against harmful particles when total concentration of the particles are below the specified value(s) of performance levels and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances):

EN 143 provides performance levels within 3 classes:

- **Class P1** – low filtering efficiency
- **Class P2** – medium filtering efficiency
- **Class P3** – high filtering efficiency

EN 14387:2021

Respiratory protective devices – Gas filters and combined filters - Requirements, testing, marking

PURPOSE OF THE STANDARD

The standard determines requirements and test methods gas filters and combined filters (to be connected with facepieces: acc. to EN 136 and EN 140 or powered filtering device acc. EN 12941 and EN 12942) to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for gas filter and combined filters i.e. gas capacity, breathing resistance, mass and thermal resistance and, additionally in case of combined filters, filtration efficiency.

Special features

Gas filters and combined filters are designed to be connected (completed) with facepieces (acc. to EN 136 and EN 140) or powered filtering devices (acc. to EN 12941 and EN 12942) to ensure effective protection against harmful airborne substances like gases and vapours (gas filters) and combination of gases/vapours and particles (combined filters) when total concentration of the substances are below the specified value(s) of performance levels and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances):

EN 14387 defines several types of gas and combined filters, each designed to protect against specific groups of hazardous gases or vapours. These include filters for organic compounds, inorganic gases, acidic gases, ammonia, low-boiling organic vapours and special filters for nitrogen oxides or mercury. Some of the specialised types have restricted service lives and are intended for single-shift or limited-duration use. Many gas filters can be combined to form multi-type filters that offer broader protection, except for combinations involving certain specialised types.

Filters for organic, inorganic, acidic and ammonia-based contaminants are further divided into capacity classes indicating how much contaminant they can absorb, with higher classes offering greater capacity and suitability for higher concentrations or longer use. Other filter types do not use capacity classes and may have specific limitations set by the manufacturer. Combined filters incorporate particle filtration as well. All filters must be used within their designed limits and service life to ensure safe and effective respiratory protection.

EN 14593-1:2018

Respiratory protective devices – Compressed air line breathing devices with demand valve – Part 1: Devices with full face mask - Requirements, testing, marking

EN 14593

PURPOSE OF THE STANDARD

The standard determines requirements and test methods the compressed air line breathing devices with demand valve - devices with full face mask, to be used in respiratory protection, must meet.

General requirements

The standard specifies safety and usability requirements for the compressed air line breathing devices with demand valve - devices with full face mask i.e. breathing resistance, comfort of use, strength of connections/connectors and head harness, mechanical strength, thermal resistance including flammability and heat, fitting to the face, breathable air supply including flow rate control, noise level.

Special features

The compressed air line breathing devices with demand valve - devices with full face mask are designed as complete and independent respiratory protective equipment incorporating full face mask, demand valve, breathing tubes, body harness, compressed air line tube, mobile compressed air supply system – if applicable, to ensure effective protection against harmful airborne substances like particles, gases and vapours and combination of gases/vapours and particles, when total concentration of the harmful substances are above the occupational and safety limits and the concentration of oxygen is lower than 19,5%. The devices supply the wearer with breathable air via pressure reducer, which during inhalation flows through a lung governed demand valve. The source of the breathable air is compressed air supply (mobile or stationary air supply system).

Classification (Levels / Classes / Performances)

EN 14593-1 does not provide classes of devices. In case the device and compressed air supply tube are heat resistant they should be marked with letter H.

In case the device and compressed air supply tube can be used in situations where exposure to flame can be a risk the device should be marked with letter F.

In case the compressed air supply tube is anti-static it should be marked with letter S.

EN 14594:2018

Respiratory protective devices – Continuous flow compressed air line breathing devices - Requirements, testing, marking

PURPOSE OF THE STANDARD

The standard determines requirements and test methods the continuous flow compressed air line breathing devices, to be used in respiratory protection, must meet.

General requirements:

The standard specifies safety and usability requirements for the continuous flow compressed air line breathing devices i.e. breathing resistance, comfort of use, strength of connections/connectors and head harness, mechanical strength, thermal resistance including flammability and heat, fitting to the face/head, breathable air supply including flow rate control, noise level.

Special features:

The continuous flow compressed air line breathing devices are designed as complete and independent respiratory protective equipment incorporating full face mask or half masks or hood, helmet, suit and breathing tubes, body harness, compressed air line tube, pressure reducer, mobile compressed air supply system – if applicable, to ensure effective protection against harmful airborne substances like particles, gases and vapours and combination of gases/vapours and particles, when total concentration of the harmful substances are above the occupational and safety limits and the concentration of oxygen is lower than 19,5%. The devices supply the wearer with breathable air via pressure reducer. The source of the breathable air is compressed air supply (mobile or stationary air supply system).

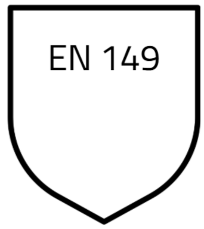
Classification (Levels / Classes / Performances):

EN 14594 classifies compressed-air line respiratory devices according to two main criteria: the maximum allowable inward leakage and the mechanical strength of the system. Strength-related requirements are grouped into Class A, with basic performance, and Class B, which includes higher demands, particularly for the air supply tube and its resistance to flammability. Devices are further divided into performance levels based on inward leakage, with progressively tighter limits from the entry level up to the highest protection class. At the upper levels, specific requirements apply regarding the type of facepiece or hood that must be used, including options suitable for abrasive blasting.

Additional markings indicate special properties: letter H for heat-resistant systems, F for equipment suitable for environments where exposure to flame is a concern, and S for anti-static air supply tubes. These classifications and markings help users select systems that provide appropriate protection for their working conditions.

EN 149:2001+A1:2009

Respiratory protective devices – Filtering half masks to protect against particles - Requirements, testing, marking



PURPOSE OF THE STANDARD

The standard determines requirements and test methods filtering half masks to protect against particles to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for filtering half masks to protect against particles i.e. filtration efficiency, breathing resistance, comfort of use, thermal resistance including flammability, fitting to the face.

Special features

Filtering half masks to protect against particles are designed as complete and independent respiratory protective equipment to ensure effective protection against harmful particles when total concentration of the particles is below the specified value(s) related to performance levels and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances)

EN 149 provides performance levels within 3 classes:

- **Class FFP1** – low filtering efficiency
- **Class FFP2** – medium filtering efficiency
- **Class FFP3** – high filtering efficiency

EN 405:2001

Respiratory protective devices - Valved filtering half masks to protect against gases or gases and particles - Requirements, testing, marking

PURPOSE OF THE STANDARD

The standard determines requirements and test methods the valved filtering half masks to protect against gases or gases and particles to be used in respiratory protection must meet.

General requirements

The standard specifies safety and usability requirements for the valved filtering half masks to protect against gases or gases and particles i.e. gas capacity, filtration efficiency, breathing resistance, thermal resistance including flammability, comfort of use, fitting to the face, field of vision.

Special features

The valved filtering half masks to protect against gases or gases and particles are designed as complete and independent respiratory protective equipment to ensure effective protection against harmful airborne substances like gases and vapours or combination of gases, vapours and particles when total concentration of the substances are below the specified value(s) of performance levels, and the concentration of oxygen is higher than 19,5%.

Classification (Levels / Classes / Performances)

EN 405 covers valved filtering half masks designed to protect against different categories of hazardous gases and vapours. The standard distinguishes several types according to the substances they are intended to filter, including organic compounds, inorganic gases, acidic gases, ammonia-based substances, low-boiling organic vapours and specific named chemicals. Some types can be combined to create multi-purpose masks that address multiple hazard groups, while certain specialised types cannot be mixed with others.

For masks protecting against gases or mixtures of gases and particles, some types are further divided into capacity classes indicating how much contaminant they can safely absorb. Higher classes provide greater capacity and are suited to higher concentrations or longer use. Other types, such as those designed for specific gases or low-boiling organic vapours, do not use capacity classes. Masks may be reusable unless the manufacturer designates them for single shift use, and all must be used within their intended limits to maintain effective respiratory protection.

5.6 Footwear

Protective footwear is a fundamental element of PPE in the construction sector, where workers face risks such as crushing injuries, punctures, slips, exposure to water or chemicals, and contact with electrically hazardous environments. Selecting appropriate footwear requires matching the identified hazards with the performance categories defined in harmonised standards, including impact resistance, penetration protection, slip resistance and additional optional features. Comfort, fit and compatibility with other PPE influence whether footwear is worn consistently and safely.

EN ISO 20345:2022

Personal protective equipment - Safety footwear

PURPOSE OF THE STANDARD

This standard specifies basic and additional (optional) requirements for safety footwear used for general purposes. It includes, for example, mechanical risks, slip resistance, thermal risks, ergonomic behaviour. It also specifies requirements for safety footwear equipped with customized in socks, customized safety footwear or individual manufactured customized safety footwear. This standard does not cover the property of high visibility because of interaction with the clothing (e.g. trousers cover the footwear) and work area conditions (e.g. dirt, mud).

General requirements

Safety basic requirements (impact protection of 200 J and compression protection of 15,000 N), plus mechanical requirements for the materials (e.g. abrasion on upper material and outsole, unions between upper and outsole…).

Special features

This is the foundation standard for safety footwear, especial features such as chainsaw, chemical or welding protection have additional standards.

Classification (Levels / Classes / Performances):

Safety footwear is categorised according to the protective features it provides beyond the basic requirements for impact and compression resistance. Each category (SB, S1, S2, S3, S4, S5, S6, S7) reflects a specific combination of properties such as closed heel design, antistatic performance, energy absorption, resistance to water penetration or full water resistance, and protection against sole penetration using either metal or non-metal inserts. Higher categories build on the features of the preceding ones, adding further attributes according to the intended use and risk environment. Footwear is also divided into two classes depending on its construction: Class I includes leather and similar materials, while Class II refers to all-polymeric footwear.

Additional requirements may apply, including different types of penetration resistance depending on the insert material and nail type, electrical properties such as antistatic or partially conductive performance, and resistance to specific environmental conditions. These classifications allow footwear to be selected according to the hazards present in the workplace and the level of protection required.

EN ISO 20349:2010

Personal Protective Equipment for Footwear and Leg Protection Used in Foundries and Welding

PURPOSE OF THE STANDARD

Specifies requirements and test methods for protective footwear and leg protection intended for workers exposed to molten metal splashes, sparks, and high radiant heat, such as in foundries, welding, and metal handling operations.

General requirements

Footwear must resist penetration and damage caused by molten metal, provide protection against high heat exposure, and maintain structural integrity during impact or compression hazards. Materials and construction are tested for molten metal resistance, heat transmission, and mechanical strength.

Special features

The standard focuses on footwear and gaiters specifically intended for environments with liquid metal hazards. Products must be designed to prevent trapping molten metal, including minimal openings, secure closures, and specific material construction that resists sticking or burning.

Classification (Levels / Classes / Performances)

Classified according to resistance to molten metal splash from different metals, primarily:

- **Footwear for Foundry Work (e.g., FE marking)** – tested against molten metal such as iron or steel
- **Footwear for Welding and Similar Processes (e.g., FW marking)** – tested for molten metal droplets and spark exposure

EN 13832

Protective Footwear Against Chemicals

PURPOSE OF THE STANDARD

Defines requirements and test methods for footwear designed to protect the user against chemical risks. The standard evaluates resistance of the footwear materials and construction to chemical penetration, degradation, and permeation when exposed to liquid chemicals in industrial environments.

General requirements

Footwear must resist deterioration and loss of function after exposure to specified chemicals. Tests assess changes in material properties, seams, closures and sole performance. The footwear must maintain its mechanical characteristics (e.g., impact resistance, slip resistance) after chemical exposure and carry markings indicating the chemical performance level and applicable protection class.

Special features

EN 13832 only applies to footwear intended for **chemical splash or short-term exposure**, not for continuous immersion or high-level chemical protection. The performance level depends on the type and concentration of chemicals tested. Compatibility with other protective equipment (e.g., chemical-resistant trousers) is recommended to prevent liquid entry, and design requirements aim to avoid trapping liquids.

Classification (Levels / Classes / Performances)

Protection classes are based on the resistance of the footwear materials to specific chemicals under defined testing conditions:

- **EN 13832-1** – Basic chemical resistance for footwear not primarily designed for chemicals (assesses degradation only).
- **EN 13832-2** – Footwear designed for limited chemical exposure (tested for degradation and permeation against selected chemicals).
- **EN 13832-3** – Footwear intended for higher chemical risks; tested for degradation, permeation and mechanical performance against defined industrial chemicals.

Marking includes the relevant part number (1, 2 or 3) and the chemical code(s) for which the footwear was tested.

5.7 Head Protection

EN 397

Industrial protective helmets

PURPOSE OF THE STANDARD

This Standard specifies requirements for design, performance, test methods and markings for industrial protective helmets. The requirements apply to helmets for general use in industry.

Industrial protective helmets are intended to reduce the risk of head injuries caused by impacts and therefore can reduce consequential effects.

General requirements

All industrial protective helmets must meet the following requirements: absorption of vertical impacts, resistance to penetration (against sharp and pointed objects), fire resistance, chinstrap with a minimum resistance of 150 N and maximum of 250 N.

Special features:

Additional performance requirements for special applications are included to apply only when specifically claimed by the helmet manufacturer.

Classification (Levels / Classes / Performances):

Optional requirements:

- Very low temperatures (-20ºC or -30ºC)
- High temperatures (+150ºC)
- Electric isolation (440 V)
- Molten Metal (MM)

EN 14052

High-Performance Industrial Safety Helmets

PURPOSE OF THE STANDARD

Specifies enhanced performance requirements and test methods for high-performance industrial helmets used in environments with increased risks of severe impact and penetration. It provides a higher level of protection compared to standard industrial helmets (EN 397), particularly for workers exposed to falling objects, lateral impacts, and harsh conditions in heavy industry, construction, mining, and demolition.

General requirements

Helmets must withstand higher impact energies and penetration forces than those under EN 397, including impacts on the top and sides (lateral tests). They must maintain structural integrity across a wider range of temperatures and environmental conditions. Additional mandatory requirements include improved retention system strength, extended shock absorption, and resistance to penetration from pointed objects.

Special features

EN 14052 requires lateral protection, meaning the helmet must provide effective energy absorption on the sides, front and rear, not only on the crown. Helmets may include additional features such as integrated chinstraps, extended coverage and enhanced suspension systems. The standard also introduces specific testing for retention systems to prevent helmet displacement during impact.

Classification (Levels / Classes / Performances)

Performance under EN 14052 is typically differentiated through marking indicating:

- **High-performance helmet** with mandatory **lateral protection**

- Optional additional performance categories such as:
    - **Extreme temperature ratings**
    - **Electrical properties** (when tested)
    - **Flame resistance**
    - **Liquid metal splash protection**

Marking on the helmet must specify compliance with EN 14052 and indicate any optional tested characteristics.

EN 50365

Electrically Insulating Helmets for Use on Low Voltage Installations

PURPOSE OF THE STANDARD

Defines requirements and testing procedures for electrically insulating safety helmets intended for work on or near low-voltage electrical installations. The standard ensures protection against electric shock and prevents current conduction through the helmet to the wearer.

General requirements

Helmets must be constructed from insulating materials and must not contain conductive elements that could compromise electrical protection. They are tested for resistance to electrical current up to 1000 V AC and 1500 V DC, as well as mechanical strength, dielectric properties, aging, heat resistance, and moisture stability. Markings must clearly indicate electrical insulation capacity and reference to EN 50365.

Special features

EN 50365 applies only to helmets providing complete electrical insulation; therefore, metal fittings or ventilation openings that could allow current passage are prohibited. Helmets must be compatible with other electrical PPE (e.g., insulating gloves) without reducing protection. Use is limited to low-voltage environments; misuse outside intended voltage ranges can lead to electric shock.

Classification (Levels / Classes / Performances)

Helmets under EN 50365 are certified as **Class 0 – Electrically insulating helmets for low-voltage applications**, providing verified protection up to 1000 V AC / 1500 V DC.

Markings must include the **Class 0 designation**, voltage rating, and the EN 50365 reference.

5.8 Case Study: Fall Protection in the Construction Industry

Ms. Marion Schiller

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EMEA Regulatory Engagement Specialist

5.8.1 What is Work at Height and Risks

Work at Height is defined differently around the world. In some regions, it is specified by a particular height above the ground or surface where the work is performed. In other areas, it is described by a broad statement without mentioning a specific height.

Generally, "**Work at Height**" refers to any activity where there is a risk of falling and getting injured. This encompasses falling from, through, or into something, even if it occurs at or below ground level. Falls from height occur most frequently in the construction sector, where workers routinely operate on industrial plants and tall buildings. High-risk tasks include roof-edge maintenance, façade installation, structural steel erection, scaffold assembly, and installing or servicing equipment on towers and pylons.

Similar exposure exists across other major industries - such as energy, utilities, telecommunications, manufacturing, warehousing, and logistics- whenever personnel must access **elevated structures or large facilities** for maintenance, inspection, cleaning, installation, or for the storage and handling of goods. Due to the risk of falls and the potential for serious injuries when working at height, it is essential to implement **protective measures at every stage of such work**.

These measures should be based on a risk assessment to either **eliminate or minimize** the risk.

The **hierarchy of controls** outlines how to identify and rank safeguards to reduce workplace hazards. From highest to lowest effectiveness, it includes elimination, substitution, engineering controls, administrative controls, and personal protective equipment. Often, the strongest approach is to layer several controls.

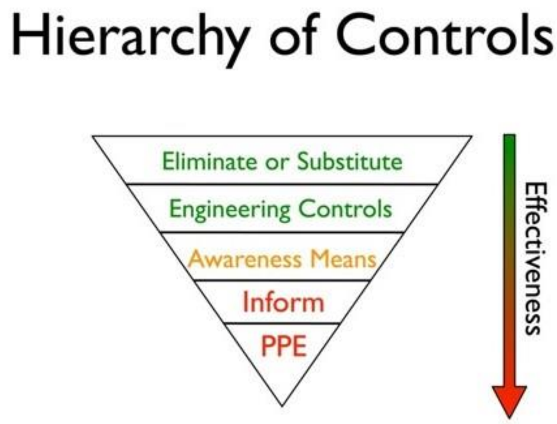

Fig.: *Illustration of the certification processes; Source: OSH Wiki*[14]

If working at height is unavoidable, falls should be prevented by employing technical measures and choosing the appropriate equipment. Additionally, to **further mitigate the risk**, suitable personal protective equipment should be used to lessen the distance and impact of a fall.

5.8.2 Fall Protection

Why fall protection? Fall protection is a critical aspect to ensure a safe, compliant, and efficient construction industry in Europe for several reasons:

- **Safety Regulations**: Europe has stringent safety regulations and standards to protect workers. Compliance with these regulations is mandatory and fall protection is a key component. High-Risk
- **Environment**: Construction sites often involve working at heights, which pose significant risks of falls. Implementing fall protection measures helps mitigate these risks.
- **Worker Safety**: Ensuring the safety of workers is a top priority. Fall protection systems are essential to prevent accidents and injuries, thereby safeguarding workers' health and wellbeing.
- **Legal and Financial Implications**: Failing to implement adequate fall protection can lead to legal consequences, fines, and increased insurance costs. It can also result in project delays and additional expenses due to accidents.
- **Reputation and Trust**: Companies that prioritize safety and implement effective fall protection measures are more likely to gain trust and maintain a good reputation in the industry.

[14] https://oshwiki.osha.europa.eu/en/themes/prevention-and-control-strategies

- **Productivity**: A safe working environment can lead to increased productivity, as workers are more confident and focused when they feel secure. Personal protective equipment (PPE) refers to any gear specifically designed and produced to be worn or held by an individual to safeguard against one or more health or safety risks. This also encompasses interchangeable parts that are crucial for its protective role, as well as connection systems. To ensure safety against falls from height, various devices and components available on the market can be combined by users to prevent injuries associated with falls.

The ABC-DEF of fall protection. Working at height introduces multiple, interacting hazards: the risk of falling, the potential for severe injury from arrest forces and swing, and the danger of dropped objects striking people or property below. Navigating these risks can feel complex, especially when different site conditions, tasks, and equipment types are involved. The ABC-DEF of fall protection offers a practical, memorable way to simplify that complexity. It turns a technical topic into a clear, shared language that workers, supervisors, and safety professionals can use to plan, communicate, and verify safe practices before anyone leaves the ground.

What it means:

A - Anchorage: A strong, properly placed tie-off point capable of withstanding required loads; reduces free-fall and swing-fall risks.

B - Body support: A correctly sized and adjusted full-body harness that distributes arrest forces to minimize injury.

C - Connectors: The links between harness and anchor (e.g., shock-absorbing lanyards, RTFAs, rope grabs, carabiners) that control deceleration and must be compatible with other components and site conditions.

D - Descent/Rescue: A practical, rehearsed plan with trained personnel and equipment to rescue a fallen or suspended worker quickly, mitigating suspension trauma and secondary hazards.

E - Education: Initial and refresher training, competency in equipment selection, fitting, inspection, and safe use; workers and supervisors recognize hazards (leading edges, swing-fall, sharp corners) and follow site procedures.

F - Fall protection for tools: Preventing dropped-object incidents by using rated tool tethers, lanyards, holsters, buckets with closures, and approved attachment points; establishing exclusion zones below, inspecting tethers, and selecting methods appropriate to tool weight and task.

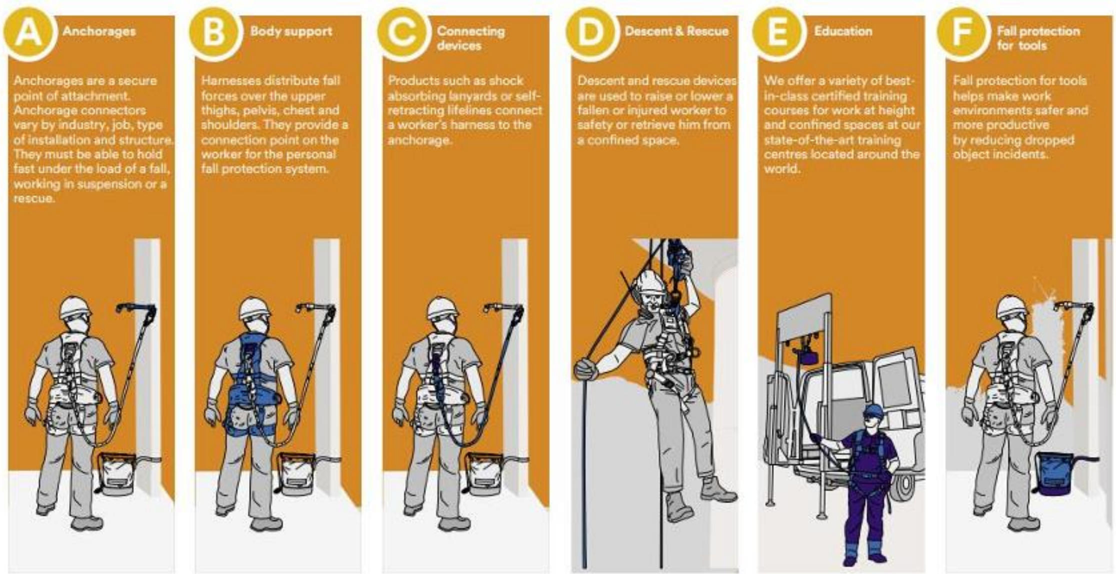

Fig. The ABC-DEF of fall protection Source: Beuermann-gmbh[15]

As a supportive tool ABCs helps teams think systemically. Instead of treating harnesses, lanyards, and anchor points as separate items, the framework emphasizes **compatibility and interdependence**: the right anchor, matched with the right harness and the right connector for the task and environment. This prevents common pitfalls such as mismatched components, insufficient fall clearance, or anchors placed in ways that increase swing-fall risk.

ABCs also supports training and continuous improvement. Because it is simple and consistent, new workers can quickly learn the essentials of safe equipment use, while experienced crews can use it to audit their setups and catch gaps before work begins. Extending the framework with **D (Descent and Rescue)**, **E (Education)**, and **F (Fall Protection for Tools)** makes it even more powerful: descent and rescue planning ensures a prompt, effective response if a fall occurs; education builds competence and safe habits, and tool fall protection prevents struck-by incidents from dropped tools and materials. Together, ABC + D, E, and F broaden the focus from gear alone to the people, plans, and surroundings that determine whether work at height is truly safe.

Importantly, **the ABC-DEF framework supports - not replaces - the hierarchy of controls**. Eliminating exposure, using collective protection like guardrails, and designing out hazards should always come first. Where personal fall protection is required, ABC-DEF provides the structure to select and use it correctly, verify **compatibility**, and confirm that **site conditions** (including rescue readiness and dropped-object controls) are addressed.

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[15] https://www.beuermann-gmbh.de/lieferprogramm/3m-absturzsicherung-fall-protection

5.8.3 Regulatory environment

Because local and regional laws, regulations, and standards differ, properly implementing a compliant fall protection programme requires considering and following the applicable requirements.

EN363 "Personal fall protection equipment – Personal fall protection systems" is a European standard that specifies the requirements for fall protections systems used in PPE for work at height. These systems include restraint systems, work positioning systems, rope access systems, fall arrest systems, and rescue systems. Each system consists of an assembly of components, which are connected to a reliable anchorage point.

When assembling a **personal fall protection system**, several factors must be considered: the suitability of components for the intended use, workplace characteristics, user competence, component compatibility, ergonomic considerations, usage limitations, rescue facilitation, and anchorage characteristics.

Components **must be designed and tested for their intended purpose**, with suitable connectors conforming to EN 362 and temporary anchor devices conforming to **EN 795 or CEN/TS 16415**; note that **EN 17235** is a new standard for permanently installed anchor devices, but it has not yet been incorporated into the current edition of EN 363. Manufacturer information should be considered, and additional system information may be necessary.

The **EN 363** categorizes fall protection systems into several types, each serving a specific purpose:

Restraint Systems: A restraint system is designed to prevent falls from height by limiting the user's movement, ensuring they cannot reach areas where a fall could occur. It is not intended to arrest falls or provide support for work in tension or suspension. The system typically includes a waist belt (EN358), sit harness (EN813), or full-body harness (EN361), and a restraint or work positioning lanyard (EN358, EN354). The assembly involves selecting the appropriate lanyard length and anchor device position to effectively restrict access to fall-risk zones.

Work Positioning Systems: A work positioning system allows users to work while supported in tension or suspension, effectively preventing free falls. It enables precise positioning at the workplace. The system typically includes a work positioning belt (EN358), sit harness (EN813), or a full-body harness (EN361) with integrated positioning elements, along with a work positioning or adjustable lanyard. For ergonomic benefits and rescue attachment options, a sit harness or integrated full body harness is preferred over a standalone belt. Since users rely on the equipment for support, a backup such as edge protection or a fall arrest system is recommended.

Rope Access Systems: A rope access system is designed to enable users to reach and return from their worksite in tension or suspension, effectively preventing or arresting free falls. It allows movement between different heights and may facilitate traversing. The system includes two harness attachment points: one for the working line and another for the safety line, both separately secured to the structure using anchor devices. Rope adjustment devices enable position changes along the lines, and the system can be used for work positioning and rescue operations. Assembly involves a full-body harness (EN 361 and EN 813), potentially incorporating a waist belt (EN 358) for work positioning, and rope adjustment devices (EN 12841) for both lines.

Fall Arrest Systems: A fall arrest system is designed to arrest a free fall and limit the impact force on the user's body to a maximum of 6 kN during fall arrest. It allows users to access areas where a fall risk exists, arresting the fall and holding the user in a suspended position until help arrives. The system requires a full-body harness (EN 361) and may include components like an energy absorber (EN 355) with a lanyard (EN 354), a retractable type of fall arrester (EN 360), or a guided type of fall arrester with an anchor line (EN 353-1 or EN 353-2). Components should not be used in parallel to avoid exceeding arrest loads. Adequate clearance below the user must be ensured to prevent collision with the ground or obstacles, considering manufacturer information and anchor device interaction.

Rescue Systems: A rescue system is designed to enable self-rescue or the rescue of others while preventing a free fall during the process. It facilitates the lifting or lowering of the rescue to a safe location. The system includes a rescue harness (EN 1497) or a rescue loop (EN 1498), with class B recommended for ergonomic reasons. For lifting, a rescue lifting device (EN 1496) is suitable, while a descender device (EN 341) is used for lowering. Components from other fall protection systems, such as a full-body harness (EN 361) or a retractable type of fall arrester with rescue lifting function (EN 360 and EN 1496), may be integrated.

Each type of system is designed to **address specific risks** associated with working at height, and they must be used in accordance with the manufacturer's instructions and relevant safety regulations.

5.8.4 Maintenance and inspection

Regular maintenance and inspection are vital to safe work at height; **EN 365 "Personal protective equipment against falls from a height - General requirements"** sets out the key requirements to be included in the manufacturer's instructions and information to prevent equipment failure and ensure reliable performance. Before each use, users must visually and functionally check the entire system or component for damage, wear, contamination, corrosion, deformation, missing or illegible labels, and proper operation. If there is any doubt, the item must be removed from service and examined by a competent person.

Periodic examination must be carried out by a competent person in accordance with the manufacturer's instructions and information. The frequency is defined by the manufacturer and the conditions of use; **EN 365 sets a maximum interval of 12 months** between examinations. Examination is also required after exceptional events such as a fall arrest, impact, exposure to chemicals or heat, or suspected misuse. Items with unknown history, illegible markings, or missing instructions shall be withdrawn from service pending examination.

In order to maintain records and traceability, a **written examination record** shall be kept for each item, including product identification, manufacturer, date of manufacture if available, dates of inspections, findings, actions taken, the name and qualification of the examiner, and the next due date. Records should be retained for the product's service life and be available to users and supervisors.

Maintenance, care and storage of the equipment have to be in accordance with the manufacturer's instructions and information: clean and dry only as specified, lubricate only when approved, and protect items from heat, UV, chemicals, sharp edges, and damage during storage and transport.

The **lifespan of a product** can be affected by several factors and in order to ensure structural integrity and proper functionality follow the manufacturer's instruction and information for advice on inspection, service, maintenance and obsolescence. Any item shall be **immediately removed from service** that has arrested a fall, shows damage or malfunction, has been exposed to harmful chemicals or heat, or cannot be verified as compliant.

Finally, the complete system shall be examined for compatibility and correct function as a whole, as mismatched components can create hazards even when individual parts appear sound.

It's important to point out, that the specific manufacturer's instructions and information shall always be consulted and followed for each product, as they operationalize EN 365 requirements and may set stricter maintenance and inspection intervals based on design and use conditions.

5.8.5 Training and education

Training and education are essential for anyone working at height because they transform a high-risk environment into a planned, controlled activity. Effective programs combine classroom learning with hands-on practice, are refreshed regularly, and are tailored to specific jobs and site conditions while aligning with local requirements. In some countries, training is **legally required**. It should also be provided before starting work for the first time, when job tasks or conditions change, and upon returning to work (e.g., after illness); at a minimum, it is advisable.

Knowledge enables workers to **recognize hazards** such as leading edges, fragile surfaces, swing-fall potential, weather impacts, and the danger of dropped objects, and to apply the hierarchy of controls. Proficient training ensures people **select and use equipment correctly**. Workers learn the ABC-DEF of fall protection as an integrated system, choosing compatible components, fitting harnesses properly, placing anchors to reduce free fall and swing, and **selecting lanyards or self-retracting lifelines suited to the task** and available clearance. Equally important, they understand fall geometry: how to calculate required clearance, account for deceleration distance and harness stretch, and avoid layouts that allow contact with lower levels.

Rescue training is also of fundamental importance, as rescue planning may sometimes receive less attention when using personal fall protection equipment. While preventing falls is rightly a priority, training helps teams recognize when specialized rescue measures are needed should an individual become suspended in a fall-arrest system.

Education also builds the habits that prevent failures before they happen - thorough pre use inspections, recognizing wear and damage, following manufacturer instructions, and knowing when to retire equipment. Teams train for rescue and descent so they can respond promptly and safely, reducing the risk of suspension trauma and secondary hazards, and they learn to prevent dropped-object incidents through proper tool tethering, inspection of attachments, and setting exclusion zones to protect people and property below.

Because requirements vary by country, local laws, regulations, and **standards must be integrated into training, procedures, and documentation**. Programs should align with the relevant legal and technical frameworks in the jurisdiction where the work occurs, confirm equipment is certified to the appropriate regional or local specifications, and ensure worker competencies, permits, and recordkeeping satisfy local enforcement expectations.

The result of effective training programs is **fewer incidents and near-misses, less downtime, and more reliable outcomes** - because everyone knows not just what to do at height, but why it matters and how to do it in compliance with the rules that apply where they work.

5.9 SUCAM

In the evolving landscape of occupational safety, the focus has shifted beyond the mere availability of PPE to a more holistic consideration of its effectiveness throughout its lifecycle. The **SUCAM framework—Selection, Use, Care, and Maintenance**—has emerged as a central concept for managing PPE in a way that is both safe and sustainable. Developed within the European standardization system, SUCAM responds to increasing regulatory demands, technological innovation, and environmental challenges.

5.9.1 Origins and Scope of SUCAM

The SUCAM concept was developed as part of the European PPE Lead Market Initiative. In 2012, CEN and CENELEC accepted a mandate from the European Commission to advance harmonized guidelines for PPE across sectors. A dedicated working group (CEN-CLC BT WG 8) identified the need for comprehensive technical documentation addressing not only the design and certification of PPE, but also its practical application in workplaces.

SUCAM guidance documents are now published as Technical Reports by CEN/TC 162 and are widely referenced across Europe. They are designed to support employers, users, service providers, manufacturers, and regulators in ensuring that PPE fulfils its protective function throughout its intended lifecycle. Moreover, they serve as an important foundation for integrating sustainability criteria, such as life cycle costs and environmental impact, into PPE management.

5.9.2 Selection: Getting It Right from the Start

The selection phase is critical. PPE must match the specific hazards of a workplace and fit the individual user. SUCAM guidelines recommend starting with a **detailed risk assessment** that considers the nature, duration, and intensity of exposure. Based on this analysis, employers must determine which parts of the body require protection, which standards apply (e.g., EN ISO norms), and how the new equipment interacts with existing PPE.

Importantly, SUCAM promotes a **user-centred approach**. Garments must not only provide the necessary protection but also meet practical requirements for comfort and compatibility. Overprotective or ill-fitting PPE can cause discomfort and lead to misuse—undermining safety.

Pre-purchase wear trials, user feedback, and additional testing (such as after repeated laundering or UV exposure) are encouraged to ensure long-term performance. Procurement decisions should also consider lifecycle cost, logistics, and support services such as training or repair.

5.9.3 Use: From Initial Training to Daily Practice

Once PPE is selected and delivered, its correct use must be ensured. According to SUCAM, this involves training workers on proper handling, wearing, and adjusting procedures. Training should also cover the limits of the equipment and the need for regular inspection.

Deployment of PPE—particularly high-risk garments such as chemical or flame-resistant clothing—requires supervision. Any deviations in use, signs of damage, or failures in protective performance must be addressed immediately. **Traceability is key**: PPE items should have unique identifiers and lifecycle records, tracking their use, washing, repairs, and scheduled retirement.

Modern textile service providers and laundries can support this requirement through digital solutions that document each item's history. This ensures transparency and supports evidence-based decisions about maintenance and replacement.

5.9.4 Care: Keeping PPE Functional and Hygienic

PPE care includes routine cleaning, drying, and re-impregnation (if necessary), all of which must be performed according to manufacturer instructions and without compromising safety properties. For example, certain flame-retardant or chemical-repellent treatments degrade over time and require professional reprocessing.

Industrial laundering is often preferable to home washing, as it ensures controlled parameters and validated procedures. This is particularly critical for PPE exposed to biological agents, hazardous chemicals, or flammable substances.

Decontamination, if needed, must be **handled by trained personnel**, and protective measures must be in place for those handling contaminated items. All care instructions, labels, and markings must remain legible and intact, as they are essential for safe handling and regulatory compliance.

5.9.5 Maintenance and Repair: Sustaining Safety Through Structure

The **maintenance phase is often where PPE programs fail**—or succeed. According to the EU PPE Regulation (2016/425), maintenance includes inspection, repair, and scheduled retirement of PPE. These actions must follow documented procedures and be carried out by qualified personnel.

Routine inspections should identify mechanical damage, degraded materials, or other defects. For garments, which might include torn seams, damaged closures, or fading reflective elements. Each type of PPE should have an inspection plan that defines what to check, when, and who is responsible.

Repairs, when necessary, are not simply a matter of patching fabric. They must use original or superior materials, follow the manufacturer's technical guidelines, and be documented to ensure traceability. Unauthorized repairs or alterations can invalidate certification and introduce safety risks. Therefore, SUCAM emphasizes that only trained and authorized professionals should perform such work.

Finally, PPE that no longer meets protective standards **must be removed from service**. Safe disposal or recycling—where feasible—should be planned in accordance with environmental and occupational safety requirements.

5.9.6 A Shared Responsibility

SUCAM is not a set of rigid rules but a structured approach that **helps stakeholders navigate the complex requirements** of PPE management. It recognizes that protective equipment is not a static product, but a system embedded in daily work routines and long-term safety planning.

Employers must implement policies, assign responsibilities, and allocate resources. Users must be trained and empowered to recognize and report issues. Service providers—especially laundries and repair specialists—must deliver compliant, high-quality services. And regulators must provide clear guidance while supporting innovation.

Beyond Compliance to Best Practice

SUCAM represents a shift from compliance-driven PPE management to a best-practice model rooted in lifecycle thinking. By integrating risk analysis, user engagement, technical documentation, and sustainability criteria, it offers a comprehensive strategy for safe and effective PPE use.

As workplaces evolve and new risks emerge—from pandemics to climate extremes—the SUCAM approach will be key to ensuring that PPE not only protects, but also supports broader goals in occupational health, environmental responsibility, and economic efficiency.

6 Sustainability Aspect of PPE

This chapter explores how sustainability considerations are increasingly shaping the design, procurement, maintenance and end-of-life management of PPE. While safety remains the primary purpose of PPE, environmental performance is becoming an important decision factor for construction companies. The chapter examines how durability, professional repair, textile service management, eco-design and recyclability can extend product lifecycles without compromising certified protection. It also highlights the technical and regulatory challenges that make sustainable PPE strategies complex, particularly due to strict certification requirements and multi-layered material compositions. By linking safety performance with environmental responsibility, this chapter demonstrates how sustainable PPE management can protect workers while supporting circular economy goals within the construction sector.

6.1 How Textile Services Ensure the Safe Reprocessing and Repair of PPE

PPE is a critical safeguard for workers across industries like firefighting, chemical processing, construction, and healthcare. But ensuring PPE remains protective after use requires more than just a standard wash - it demands **specialized knowledge, technology, and responsibility**. This is where professional textile service providers and industrial laundries step in.

Unlike conventional workwear, PPE is classified as certified safety equipment. It must continue to meet **stringent regulatory requirements even after repeated use**. Professional textile services handle this task with precision, relying on validated washing and finishing processes that remove contaminants without compromising the material's integrity. Water temperatures, detergents, and drying techniques are tailored to each type of PPE, with particular attention given to garments requiring hygienic reprocessing or flame-resistant finishes, which must be restored according to manufacturer specifications.

Inspection plays a pivotal role in this cycle. Every item is examined before and after processing to detect wear, damage, or functional degradation. Seams, closures, reflective materials, and logos are all scrutinized. By **closely monitoring the condition and usage history** of each garment - including the number of laundering cycles - service providers help clients determine when repair is appropriate or when an item must be decommissioned.

Repairs themselves are carried out with the same rigor. Only **technicians trained and authorized** to work on PPE may undertake such tasks, using materials approved by the original manufacturer. These repairs must follow technical guidelines and legal frameworks such as the EU PPE Regulation (2016/425). Once completed, the garment is re-inspected to ensure it continues to meet safety performance standards.

Equally important is traceability. Modern textile services use digital tracking systems to record every step in the PPE's lifecycle - from cleaning and repair to eventual retirement. This documentation not only helps businesses stay compliant with safety regulations but also provides peace of mind so that their employees are protected.

Moreover, this process supports **sustainability**. By maintaining and repairing PPE rather than discarding it prematurely, textile services help reduce waste and the carbon footprint associated with manufacturing replacements. It's a practical approach to extending product life while upholding safety.

In sum, textile service providers offer much more than clean clothing. They are strategic partners in PPE lifecycle management, helping businesses navigate the delicate balance between worker protection, legal compliance, and environmental responsibility.

6.2 Repairability of PPE: A Key to Sustainable Safety

The ability to repair PPE is an often-overlooked factor in sustainability and occupational safety. When PPE is properly maintained and repaired, its **service life is extended** - reducing environmental impact, lowering costs, and maintaining worker protection. Yet, the repair of certified protective gear is not a simple matter.

Unlike casual workwear, PPE is governed by strict legal and technical standards. Any repair has the potential to affect the garment's protective performance and invalidate its certification. To mitigate this risk, only qualified professionals, trained by the manufacturer or certified according to regulatory requirements, are permitted to repair PPE.

Repairs must follow precise guidelines. Materials used must be identical or superior to those in the original garment. Improvisation is not an option—using unapproved fabrics or threads can render the protection ineffective and expose workers to serious harm. After any intervention, the item must be thoroughly inspected to confirm that it still meets its intended performance specifications.

This controlled approach to repair is embedded within the **SUCAM framework** (Selection, Use, Care, and Maintenance). From the initial procurement phase, employers should consider whether the PPE is designed to be repairable. During daily use, workers and supervisors must be trained to detect early signs of damage. The care phase involves professional laundering and finishing processes that prevent premature wear. **Maintenance** - including timely, expert repair - is what ultimately ensures that the PPE continues to do its job safely and sustainably.

Extending the life of PPE through repair is more than a cost-saving measure. It supports **circular economy** goals by **reducing waste and resource** consumption. It also ensures that protective equipment is available, functional, and safe for longer periods - particularly important in times of supply chain stress or heightened demand.

To make repairability a true pillar of PPE sustainability, **greater collaboration is needed** among manufacturers, service providers, employers, and policymakers. Repair should not be treated as a last resort but as an integral component of responsible PPE lifecycle management.

6.3 Eco-Design in Protective Workwear: Balancing Safety and Sustainability

Sustainability has become a driving force in the textile industry, and PPE is no exception. European regulations such as the proposed **Ecodesign for Sustainable Products Regulation (ESPR)**[16] are reshaping how products are developed, emphasizing durability, reparability, and environmental impact. But integrating these principles into PPE design presents unique challenges.

Unlike fashion or everyday workwear, PPE is subject to rigorous standards meant to shield workers from life-threatening hazards such as flames, chemicals, and electric arcs. Achieving this protection often requires complex materials, multi-layer constructions, and chemical treatments. These technical demands make the **application of eco-design principles far from straightforward**.

Multinorm PPE—designed to meet multiple protective standards in one garment—is particularly affected. These garments are widely used in high-risk sectors like petrochemicals, logistics, and energy. While practical and cost-effective, they often rely on fluorocarbon-based finishes to ensure resistance to oil, chemicals, and moisture. Unfortunately, these very substances are now under scrutiny for their environmental persistence and potential toxicity.

Although alternative treatments exist—especially fluorine-free options for basic water repellence—they currently fall short in providing the level of chemical resistance required by many PPE standards. Replacing fluorocarbons without compromising safety is not yet technically feasible on a large scale.

Moreover, the **effectiveness of protective finishes** must be maintained throughout the garment's entire lifespan. This includes repeated industrial laundering and, in some cases, re-impregnation. If these properties degrade, the PPE no longer fulfils its function, putting workers at serious risk. Therefore, the push toward greener materials cannot be separated from the **obligation to protect human lives**.

Navigating this **tension between ecological responsibility and protective performance** requires an honest, collaborative effort. Manufacturers, policymakers, and employers must acknowledge current limitations and support innovation that bridges the gap between safety and sustainability.

For now, a cautious and evidence-based approach is essential. Eco-design in the PPE sector is not about quick fixes, but about **long-term investments in technologies** that can truly align sustainability with uncompromising protection.

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[16] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en

6.4 The Recyclability of PPE: A Circular Economy Challenge

As industries strive to **reduce waste** and **embrace circular economy models**, the question of how to recycle PPE has become increasingly urgent. These garments are indispensable in hazardous work environments—but their complex composition makes them among the most difficult textile products to recycle effectively.

PPE is typically constructed from multiple technical layers, each serving a different function: flame resistance, chemical repellence, durability, insulation. Materials like aramids, modacrylics, and coated fabrics are commonly used, often in combination. These heterogeneous structures defy conventional recycling systems, which are designed to handle uniform material streams such as pure cotton or polyester.

Adding to the challenge are the chemical treatments applied to enhance safety—flame retardants, antistatic agents, oil- and water-repellent coatings, many of which contain persistent substances. These **treatments complicate recycling**, not only by interfering with existing processes but also by posing health and environmental risks when not properly handled.

PPE garments are also exposed to **substantial wear and contamination** during use. Dirt, chemicals, and biological residues reduce the recyclability of fibres and may require intensive decontamination before further processing—if recycling is even feasible at all. Furthermore, **strict regulations governing PPE safety** mean that recycled content cannot typically be used to produce new protective gear unless its safety can be unequivocally proven.

Despite these obstacles, research is underway. **Emerging approaches** include designing PPE for disassembly, using mono-materials with built-in protective functions, and applying advanced chemical recycling methods. Digital tools such as RFID tagging and product passports could also improve traceability and sorting at the end of a product's life.

Still, these technologies remain in development, and their commercial application is limited. The most practical solution at present is to **extend the usable life of PPE** through professional maintenance, timely repairs, and responsible care. Recycling, while important, must be approached realistically and supported by coordinated efforts from regulators, manufacturers, and recyclers alike.

Key Takeaways: Sustainability of PPE

Safe Reprocessing and Repair of PPE

Professional textile services ensure PPE remains protective throughout its lifecycle through validated cleaning processes, material-specific finishing, and systematic inspections before and after each cycle. Repairs are performed by trained specialists using approved materials, and digital traceability documents each step—from use to maintenance and eventual retirement—supporting compliance and extending product life.

Challenges:

- Maintaining certified protective performance during repeated industrial laundering requires strict process control.
- Damage detection must be accurate to avoid unsafe re-use, and repairs risk compromising compliance if not executed correctly.
- Traceability demands robust digital systems, and balancing safety with sustainability places ongoing pressure on service providers and employers.

Repairability of PPE: A Key to Sustainable Safety

Repairability extends the safe service life of PPE and supports sustainable resource use. Repairs must follow precise technical guidelines, use approved materials and be conducted by qualified professionals. Integrated into SUCAM, repairability relies on careful selection, early damage identification, proper care, and professionally managed maintenance.

Challenges:

- Improper repairs can invalidate certification or reduce protection.
- Some PPE materials or constructions have limited repair options.
- Employers must plan for repairability already at procurement, and workers require training to detect wear early.
- Dependence on manufacturer specifications can constrain repair timelines and capacity.

Eco-Design in Protective Workwear

Eco-design principles—durability, reparability, reduced environmental impact—are gaining prominence through EU policy developments. PPE, especially multinorm garments, often uses advanced materials and finishes essential for high-risk protection. Any eco-design effort must preserve safety performance throughout frequent industrial laundering and long service life.

Challenges:

- Safety requirements limit the immediate feasibility of alternatives to certain chemical treatments.
- Complex multilayer constructions hinder simplification for sustainability purposes.
- Maintaining protective properties over time makes substitution of materials difficult, and innovation is required to bridge the gap between ecological aims and uncompromised protection.

Recyclability of PPE: A Circular Economy Challenge

Many PPE products remain difficult to recycle due to multi-layer constructions, technical fibres, and specialised chemical treatments. Contamination from use further restricts recycling options. Research is advancing in design-for-disassembly, mono-material solutions, chemical recycling, and digital traceability tools that could improve end-of-life management.

Challenges:

- Current recycling technologies are poorly suited to heterogeneous, treated textile structures.
- Safety regulations limit the reintroduction of recycled content into new PPE unless performance can be proven, which is rarely feasible today.
- Practical recycling pathways remain limited, making extended use through good maintenance and repair the most effective circular strategy in the short term.

RESOURCES

REFERENCES

- OSH Wiki – PPE: *https://oshwiki.osha.europa.eu/en/themes/ppe*
- OSHA Europa – Accident prevention in the constructions sector: *https://osha.europa.eu/sites/default/files/Factsheet_15_-_Accident_Prevention_in_the_Construction_Sector.pdf*
- OSH Wiki – Sectors and occupations: *https://oshwiki.osha.europa.eu/en/themes/sectors-and-occupations"/*
- Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work: *https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A31989L0391*
- Sächsisches Textilforschungsinstitut e.V.: *https://www.stfi.de/en/*
- OSH Wiki – Actions to improve safety and health in construction: *https://osha.europa.eu/sites/default/files/Magazine_7_-_Actions_to_improve_safety_and_health_in_construction.pdf*
- Beuermann-Gmhb: *https://www.beuermann-gmbh.de/lieferprogramm/3m-absturzsicherung-fall-protection*
- OSH Wiki – Prevention and control strategies: *https://oshwiki.osha.europa.eu/en/themes/prevention-and-control-strategies*
- Ecodesign Sustainable Products Regulation: *https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en*

USEFUL RESOURCES

- PPE Regulation Guidelines - Guide to application of Regulation EU 2016/425 on personal protective equipment - *https://ec.europa.eu/docsroom/documents/62554*