FWB Products Ltd 2020 (www.fwb.co.uk)

PPE & WORKWEAR STANDARDS

PPE & Workwear Regulations

It is the responsibility of employers to ensure that their employees are safe in the workplace. This responsibility includes providing instructions, procedures and training to promote safe and responsible working habits. In many workplaces however, hazards still exist despite sufficient control measures being put in place.

These can include, but are not limited to:

- Respiratory hazards such as airborne dust or chemicals
- Hazards to the head and/or feet such as falling objects
- Hazards to the eyes, such as flying particles or corrosive liquids
- Hazards to the skin, such as contact with corrosive liquids
- Hazards to the whole body, such as extreme temperatures

Where these hazards are present, suitable PPE must be provided to employees free of charge.

PPE must meet the appropriate standards and regulations, and be appropriately stored and maintained when not in use to ensure continued protection.

The standards for PPE are defined by the Personal Protective Equipment (Enforcement) Regulations 2018 and Regulation EU 2016/425 of the European Parliament and of the Council.

EN 342 – Protection Against Cold

EN 342 is the standard related to clothing designed to offer protection in hazardous, cold environments with temperatures below 5°C.

The standard is determined by three parameters:

- Thermal Insulation Properties (with and without motion)
- Air Permeability
- Waterproof Penetration Properties

Requirements for effective thermal insulation when standing

Effective thermal insulation I_{cle} [$m^2 \cdot K/W$]	User standing activity [75 W/m^2]	
	8 hours	1 hour
0.31	11	-2
0.39	7	-10
0.47	3	-17
0.54	-3	-25
0.62	-7	-32

Requirements for resultant effective thermal insulation at different activity levels

Resultant effective thermal insulation I_{cler} [m^2 K/W]	Light Wearer Activity 115 W/m^2		Medium Wearer Activity 170 W/m^2	
	8 hours	1 hour	8 hours	1 hour
0.31	-1	-15	-19	-32
0.39	-8	-25	-28	-45
0.47	-15	-35	-38	-58
0.54	-22	-44	-40	-70
0.62	-29	-54	-60	-83

EN 342 – Protection Against Adverse Weather

EN 343 is the European standard that applies to garments designed for use in adverse weather conditions, including rain, fog and humidity.

EN 343 is a self-certifiable standard, meaning manufacturers can certify their own products and do not require assessment by a Notified Body.

A products compliance with EN 343 is usually indicated by an umbrella icon, such as below (source):

The protection levels of the garment are dictated by two separate numbers, commonly referred to as the X and Y numbers:

- **X – Water Penetration Resistance** – This is measured in Pascals (Pa) and is the hydrostatic pressure held by a material.
- **Y – Water Vapour Resistance** – This is measured in m^2*Pa/W and dictates the breathability of the material. The lower the resistance, the more breathable the item.

Both the X and Y values can achieve a Class 1, 2 or 3 protection level.

EN ISO 20471 – High Visibility Clothing

The EN ISO 20471 Standard governs the requirements for High-Visibility (Hi-Vis) clothing. Hi-Vis clothing is primarily used to visually signal the wearer's presence.

Hi-Vis clothing can be categorised in one of three classes, ranging from Low Risk to High Risk (Class 1 to Class 3). The EN ISO 20471 class of an item of clothing is indicated by the following icon (source):

EN ISO 20471

The above icon is accompanied by the Class number of the item, which are defined as:

Class 1 (Minimum Level): Suitable for work in full or partial daylight on private premises where there is a low risk of collisions or accidents, and is not suitable for work on public roads. Class 1 garments can be worn in conjunction with higher class garments.

Class 2 (Medium Level): Class 2 garments are suitable for working on or near Class A or B roads, and for courier services.

Class 3 (Highest Level): Class 3 garments are legally required for working near motorways, dual carriageways or airports. Class 3 garments are also required for working at night.

EN ISO 11611 – Protection for Welding and Allied Processes

EN ISO 11611 specifies the minimum safety requirements for welding and allied processes. It does not however cover hand protection.

There are two classifications for EN ISO 11611:

Class 1 (Lower Protection) – Provides protection for less hazardous welding techniques and applications where there are low levels of spatter and/or radiant leak.

Class 2 (Higher Protection) – Provides protection for more hazardous welding techniques and applications where there are higher levels of spatter and/or radiant leak.

EN ISO 11611 has the following testing parameters:

- Tensile Strength
- Tear Strength
- Requirements of Leather
- Limited Flame Spread (A1/A2)
- Heat Transfer/Radiation
- Busting Strength
- Seam Strength
- Dimensional Change
- Molten Droplets
- Electrical Resistance

(Image Source)

EN ISO 13034 – Protection Against Liquid Chemicals

EN ISO 13034 defines the minimum requirements for limited use and reusable limited performance chemical protective clothing (Type 6 and Type PB [6]).

Limited performance chemical clothing is used where there is the potential for exposure to light sprays, liquid aerosols and low volume splashes where a complete liquid permeation barrier is not required.

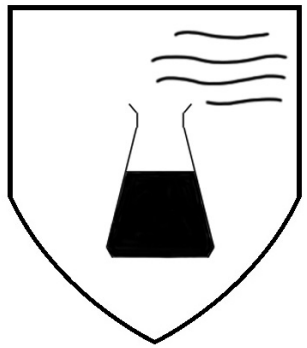
Type 6

Type 6 chemical protective clothing must cover the torso and limbs (for example, a one-piece coverall without a hood, boot-socks or boot covers.

Type PB [6]

Type PB [6] partial body protection protects a specific part of the body, such as coats, aprons and sleeves.

EN 13034 Typ 6

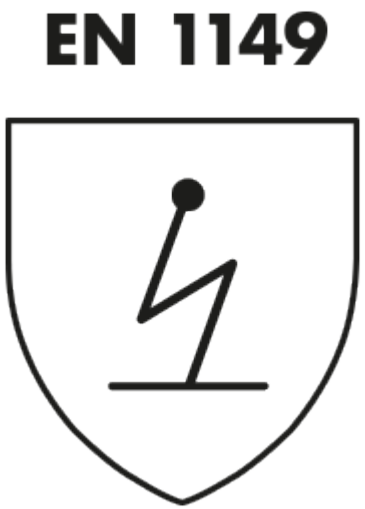


EN 1149 – Electrostatic Properties

EN 1149 is the standard which defines the electrostatic requirements of clothing in order to avoid inflammable discharges. This clothing is required wherever explosive atmospheres may occur.

EN 1149 is comprised of five tests:

EN 1149-1: Test measuring surface resistivity
EN 1149-2: Test measuring vertical resistance
EN 1149-3: Test measuring charge decay
EN 1149-4: Clothing test (This standard is currently in development)
EN 1149-5: Defines the performance requirements for the material and construction requirements for the clothing. The material must be certified in accordance to EN 1149-1 and EN 1149-3.



DIN EN 166 – Personal Eye Protection

DIN EN 166 is the basic safety standard for all eyewear, including safety glasses, goggles and visors. All manufacturers of safety eyewear are required to have their product independently tested and certified. Both the frame and the lens are tested.

Frame Marking

The frame will usually be marked on the inside with EN166, followed by numbers and letters which indicate the quality of the lens.

Frame Shape:

3 – Protects against liquid droplets or splashes
4 – Protects against large dust particles over 5 microns in size
5 – Protects against small dust particles under 5 microns in size

Frame Strength:

A frame can have one or multiple of the following –

S – Can withstand the impact of small objects travelling up to 12 m/sec

F – Can withstand the impact of small objects travelling up to 45 m/sec

B – Can withstand the impact of small objects travelling up to 120 m/sec

A – Can withstand the impact of small objects travelling up to 190 m/sec

T – Can withstand impacts at extreme temperatures

DIN EN 166 – Personal Eye Protection

Lens Markings

Lenses can meet various safety standards, such as EN 166, 170 & 172. The manufacturer's mark and the CE mark must be present, along with the number/letter markings of the appropriate standards.

Radiation Protection:

2 – UV Protection (EN170), may effect colour recognition.

3 – UV Protection (EN170), allows good colour recognition.

4 – Infrared Protection (EN171), protection from heat.

5 – Solar Protection (EN172), 100% glare protection with no infrared protection.

6 – Solar Protection (EN172), 100% glare protection with infrared protection.

Lens Shading:

1.2 – Allows between 74.4% and 100% light transmission.

1.7 – Allows between 43.2% and 58.1% light transmission.

2.5 – Allows between 17.8% and 29.1% light transmission.

3.1 – Allows between 8.0% and 17.8% light transmission.

DIN EN 166 – Personal Eye Protection

Optical Quality:

1 (Class 1) – High optical quality, suitable for continuous use. Refractive power ± 0.06 dioptres.

2 (Class 2) – Medium optical quality, for intermittent use. Refractive power ± 0.12 dioptres.

3 (Class 3) – Low optical quality, for occasional use. Refractive power ± 0.25 dioptres.

Mechanical Strength:

S – Increased Robustness: Able to withstand the impact of a 22mm, 43g ball travelling at 12 m/sec or falling 1.3m.

F – Low Energy Impact: Able to withstand the impact of a small object (6mm, 0.86g) travelling up to 45 m/sec (Max for Safety Glasses).

B – Medium Energy Impact: Able to withstand the impact of a small object travelling up to 120 m/sec (Max for Safety Goggles).

A – High Energy Impact: Able to withstand the impact of small objects travelling up to 190 m/sec (Max for Safety Visors).

T – High Temperature Impact: Able to withstand the impact of extreme temperature particles (-5 to +55ºC).

Lens Coating:

K – Resistance to Mechanical Damage

N – Resistance to Misting/Fogging

Other Safety Eyewear Standards

EN 167: Optical Test Methods

EN 168: Non-Optical Test Methods

EN 169: Welding Filters

EN 170: Ultraviolet Filters

EN 171: Infrared Filters

EN 172: Solar Protection for Industrial Use

EN 175: Welding Work Equipment

EN 207: Glasses for Laser Protection

EN 208: Glasses for Laser Adjustment

EN 379: Welding Filters Specification

EN 397 – Industrial Safety Helmets

EN 397 applies to protective helmets used in industry where the user requires protection from potential falling hazards.

EN 397 is tested against four compulsory criteria:

Impact - A 5kg mass is dropped onto the helmet from a height of 1 metre. In order to pass this test, the helmet must not allow more than 5Kn of energy to spread to the head. This test is performed at +50ºC and -10ºC.

Penetration – A 3kg is dropped from a height of 1 metre, the tip of which must not come into contact with the skull in order to pass this test. Similarly to the impact test, the penetration test is conducted at +50ºC and -10ºC.

Flammability – The helmet is exposed to a flame and must not continue to burn more than 5 seconds after the flame source has been removed.

Anchorage – EN 397 requires that the helmet is fitted with a chinstrap or has the means of attaching one. The chin strap will be released at a force between 15kg and 25kg (150N-250N). This test is conducted after the penetration test has been completed.

It is important to be aware of the date of manufacture of a safety helmet to ensure it is still suitable for use. The marking of the helmet should include both the year and quarter in which it was manufactured. The period of obsolescence for the helmet and its components must be declared on the user sheet, which is provided with the helmet.

EN ISO 11612 – Protection Against Heat and Flame

Protective clothing certified to the EN ISO 11612 standard, which replaces EN 531, gives the wearer protection against **brief** contact with heat and flame.

Clothing conforming to EN ISO 11612 is marked with the following parameters:

A1 – Limited Flame Spread

A2 – Limited Flame Spread (Hemmed garments)

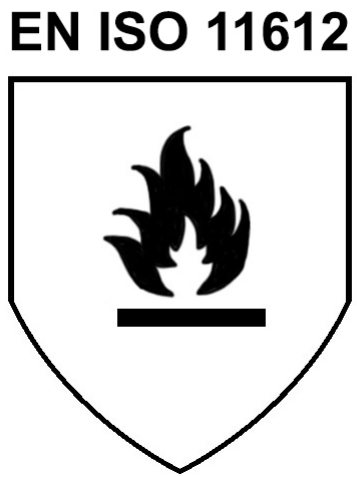
B – Convective Heat (This is scaled 1-3, where 3 is the highest level of protection)

C – Radiant Heat (This is scaled 1-4, where 4 is the highest level of protection)

D – Molten Aluminium Splashes (This is scaled 1-3, where 3 is the highest level of protection)

E – Molten Iron Splashes (This is scaled 1-3, where 3 is the highest level of protection)

F – Contact Heat (This is scaled 1-3, where 3 is the highest level of protection)



EN ISO 20345:2011 – Safety Footwear

EN ISO 20345 is the specification for safety footwear with suitable characteristics for protecting the wearer from injuries that may occur in the professional settings for which the footwear is designed, with toe caps for impact protection. Footwear conforming to this standard is tested at an impact energy level of 200 joules (J).

There are two classes of safety footwear, defined by the materials with which the footwear is made:

Class I – Leather and other materials, excluding all-rubber and all-polymeric footwear
Class II – All-rubber and all-polymeric footwear

The footwear is then marked with the appropriate category depending on its class and safety features:

Category	Class	Requirement
SB	I or II	Pass the Basic Requirements for Safety Footwear
S1	I	SB plus Closed Seat Region, Antistatic Properties & Energy Absorption of Seat Region
S2	I	S1 plus Water Penetration & Water Absorption Properties
S3	I	S2 plus Penetration Resistance and Cleated Outsole
S4	II	SB plus Antistatic Properties & Energy Absorption of Seat Region
S5	II	S4 plus Penetration Resistance & Cleated Outsole

EN ISO 20345:2011 – Additional Requirements

Some applications for safety footwear may also have additional requirements for the footwear to be compliant:

Requirements for the Whole Shoe

P – Penetration Resistance
C – Conductive Footwear
A – Antistatic
E – Electrically Insulating
HI – Heat Insulation of Sole Complex
CI – Cold Insulation of Sole Complex
E – Energy Absorption of Seat Region
WR – Water Resistance
M – Metatarsal Protection
AN – Ankle Protection

Requirements for the Shoe Upper

WRU – Water Penetration and Absorption
CR – Cut Resistance

Requirements for the Outsole

HO – Resistance to Hot Contact

EN ISO 20347 – Occupational Footwear

EN ISO 20347 defines the basic and additional optional requirements for occupational footwear that is not exposed to risks such as impact or compression. EN ISO 20347 is similar to EN ISO 20345 (Safety Footwear) in it's requirements, but the footwear does not require a steel toe cap due to not being exposed to mechanical risks.

Similarly to EN 20345, occupational footwear can be categorised as one of the following:

Class I – Leather and other materials, excluding all-rubber and all-polymeric footwear
Class II – All-rubber and all-polymeric footwear

The footwear is then marked with the appropriate category:

Category	Class	Requirement
OB	I or II	Pass the Basic Requirements for Occupation Footwear
O1	I	OB plus Oil Resistant Sole, Closed and Energy Absorbing Seat Region & Antistatic Properties
O2	I	O1 plus Water Penetration and Absorption
O3	I	O2 plus Cleated Sole
O4	II	OB plus Oil Resistant Sole, Closed and Energy Absorbing Seat Region & Antistatic Properties
O5	II	O4 plus Penetration Resistance and Cleated Sole

EN ISO 13287:2019 – Slip Resistance

EN ISO specifies the requirements for slip resistance in safety footwear. The standard does not apply to footwear designed for soft ground such as sand, which may feature specific elements such as studs.

Safety footwear is tested on two surfaces: ceramic tile with a Sodium Lauryl Sulphate Solution present and a steel floor with Glycerol. The performance level of the shoe is determined by the forward heel slip and the forward flat slip of the shoe on one or both of these surfaces.

Marking Code	Test Surface	Friction Coefficient	
		Forward Heel Slip	Forward Flat Slip
SRA	Ceramic Tile with SLS Solution	<0.28	<0.32
SRB	Steel Floor with Glycerol	<0.13	<0.18
SRC	Ceramic Tile with SLS Solution & Steel Floor with Glycerol	<0.28 <0.13	<0.32 <0.18

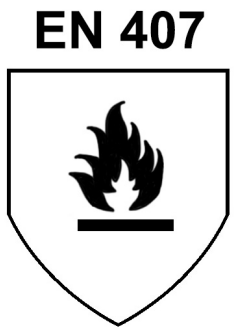
SRA – Tested on a ceramic surface with a Sodium Laryl Sulphate Solution present, which acts as a lubricant to test the slip resistance of the footwear in slippery conditions.

SRB – Follows a similar testing process to SRA, but instead performed on a steel floor with glycerol.

SRC – This marking is awarded to footwear that passes both the SRA and SRB slip resistance tests.

EN 407 – Glove Protection Against Thermal Risks

EN 407 identifies the suitability of protective gloves in different areas of thermal risk. Items conforming to EN 407 will be marked with the standard's pictogram along with six numbers, each ranging from 1 to 4, as seen below:



1 4 2 3 1 1

The higher the performance level, the greater the protection of the glove against the corresponding risk:

Resistance to Flammability - The likelihood of the glove catching fire after a flame is applied.
Resistance to Contact Heat – The ability of the glove to resist heat when placed in direct contact with a hot surface or heated object.
Resistance to Convective Heat – The ability of the glove to resist heat from a flame.
Resistance to Radiant Heat – The ability of the glove to resist heat from a radiant heat source.
Resistance to Small Splashes of Molten Metal – The amount of molten droplets required to raise the inside temperature of the glove by 40ºC.
Resistance to Large Splashes of Molten Metal – The amount of molten iron (g) required to cause damage to skin inside the glove.

EN 511 – Glove Protection Against Cold

EN 511 specifies the requirements and tests for protective gloves used in cold climates or activities.

There are three performance tests for EN 511, which are indicated on the glove:

Convective Cold Test

In this test, the glove is placed on a model which is heated to 30-35ºC. The performance level of the glove is determined by the amount of energy required to maintain this temperature. There are 4 performance levels (1-4) and the higher the level the greater the insulation properties of the glove.

Contact Cold Test

This test involves a sample material being held in a test chamber between a heated metal plate and a cooled metal plate. The thermal resistance of the material is calculated by measuring the temperature drop of the material and comparing it to a control sample. Again, there are 4 performance levels (1-4), with the higher levels having greater insulation.

Water Penetration Test

In the final test, the glove is submerged in water for 30 minutes. If no water is able to penetrate the material within those 30 minutes, the glove passes the test. This is marked with a 0 (fail) or a 1 (pass).

EN ISO 374 – Glove Protection Against Chemicals and Micro-Organisms

EN ISO 374 is the standard for protective gloves handling dangerous chemicals or micro-organisms, which replaces EN 374. The standard is made up of several other specific standards, which are:

EN ISO 374-1:2016

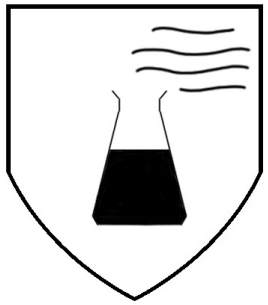
Terminology and performance requirements for chemical risks. Gloves are tested with 18 chemicals (formerly 12 with EN 374) and given a classification (A,B or C).

Type A – Permeation resistance of at least 30 minutes each for at least 6 test chemicals.

Type B – Permeation resistance of at least 30 minutes each for at least 3 test chemicals.

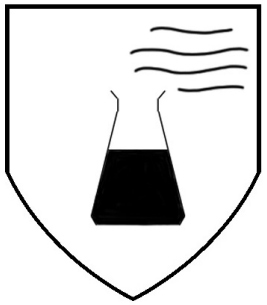
Type C – Permeation resistance of at least 10 minutes for at least 1 test chemical.

EN ISO 374-1:2016/Type A



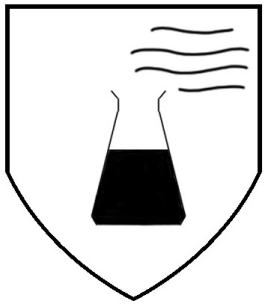
A B C D E F

EN ISO 374-1:2016/Type B



A B C

EN ISO 374-1:2016/Type C



EN ISO 374 – Glove Protection Against Chemicals and Micro-Organisms

EN 374-2

Determines the resistance to penetration. Gloves are tested for Air and Water.

EN 374-4

Determines the resistance to degradation by chemicals.

EN ISO 374-5

Terminology and performance requirements for protection against micro-organisms. This test now includes an additional level of protection for viruses.

EN 16523-1:2015

Determines the resistance of the material to permeation by chemicals through continuous contact. This replaces EN 374-3 and now includes additional cuff testing for gloves over 400mm in length.

EN140 – Respiratory Half Masks

EN 140 specifies the minimum requirements for half and quarter masks as part of respiratory protection devices. A Half Mask is defined as a facepiece covering the nose, mouth and chin, whereas a Quarter Mask covers just the nose and mouth. They are designed to provide a seal on the face protecting the user from the ambient atmosphere, instead allowing air to enter and exit through inhalation valves.

There are four key tests to determine a mask's usability under EN140:

Resistance to Temperature

Masks are tested for 24 hours at 70ºC and then for another 25 hours at 30ºC. The facepiece must show no deformation in this time to pass this test.

Resistance to Flammability

In this test, the mask is exposed to a direct flame. Any part of the mask that may come into contact with a flame during use must not burn for more than 5 seconds after the flame is removed to ensure that the mask is suitable for use in conditions of extreme heat.

Breathing Resistance

This test ensures that the user can breathe comfortably while wearing the mask. To pass this test, a mask must not exhibit a breathing resistance of more than 2.0 millibar for inhalation and 3.0 millibar for exhalation.

Inward Leakage

This test ensures adequate protection when wearing the mask. When correctly fitted, the percentage of the ambient atmosphere allowed to pass through the facepiece should not exceed 2%.

EN149 – Respiratory Protection

EN 149:2001 is the standard covering the technical requirements for respiratory half masks for protection against dangerous particles. There are three classifications for respiratory half masks (FFP1, FFP2 and FFP3) which are obtained through three mandatory tests as follows:

Inward Leakage

This test measures the effectiveness of the mask against potential hazards by sampling the air inside the mask after use in a controlled environment with a concentration of Sodium Chloride aerosol. The lesser the inward leakage the greater the protection level of the mask.

Penetration of Filter Material

This test exposes a dummy wearing the mask to two test aerosols (Sodium Chloride and Paraffin Oil). The percentage penetration for each aerosol is then measured. Similarly to the previous test, the lesser the penetration the greater the protection level.

Breathing Resistance

This test determines the breathing capability of the user while wearing the mask. The permitted breathing resistance is typically lower for FFP1 masks as they are typically lighter than FFP2 and FFP3 masks.

For more details on EN 143 and EN 149, see our guide on Respiratory Protection Levels:
https://www.fwb.co.uk/files/ww/FWB%20Respiratory%20Protection%20Levels.pdf