



Are you wearing the right protective garment for your needs?



The miracles of science™

Choosing the right garment: a crucial factor



DuPont has long been recognised for its leadership in the field of industrial safety, continually setting standards that help to limit work-related accidents and health problems. Choosing the right Personal Protective Equipment (PPE) is an important part of safety management. When it comes to limited-use chemical protective clothing, how can you make sure you choose the right garment *and* material?

It is not enough to ensure that the garment carries the CE marking






The European Union has identified six levels of protection (**Types**) to facilitate the choice of chemical protective clothing. To carry the CE marking, chemical protective equipment (category III) must pass one or more of the garment “Type” tests, meet or exceed the minimum requirements for the materials’ physical and chemical properties, and be correctly identified and labelled. In addition, the products must be manufactured to a consistent quality, and the manufacturer must either hold a quality certificate such as ISO 9000, or be subject to regular inspections by the notified laboratory.

Protection performance levels may differ even if products are certified with the same Type. The test results reveal the differences

The CE marking means that chemical protective clothing meets certain minimum requirements. However, it does not mean that chemical suits of the same Type offer the same level of protection performance. This is why it is essential to look at the results of the tests carried out on the material used to make the garment.

Chemical protective clothing certified to a specific “Type” can have very different performance properties in terms of protection, durability and comfort. The indicated “Type” simply means that the suit has passed one or more of the whole suit liquid tests and meets the minimum performance requirements for the constituent mechanical and barrier tests.

Our range of chemical and biological protective coveralls

Contamination by radioactive particles	Chemical protection					Biological protection	
Body	Body					Body	
							
	Type 1 Gaseous, vapours	Type 3 Liquids	Type 4 Sprays	Type 5 Solid particles, fibres	Type 6 Light sprays, low-volume splashes	Protection against contaminated liquids	Protection against contaminated dusts
EN 1073-2	EN 943-1/2 - ET	EN 14605	EN 14605	EN ISO 13982-1	EN 13034	EN 14126	
		EN 6529 (see page 10)			EN 6530 (see page 10)		
Coveralls range DuPont TYCHEM®	Coveralls range DuPont TYCHEM®					Coveralls range DuPont TYCHEM®	
TYCHEM® TK.							
TYCHEM® F2, model CHZ5		TYCHEM® F2, model CHZ5			TYCHEM® F2, model CHZ5		
TYCHEM® F Standard		TYCHEM® F Standard			TYCHEM® F Standard		
TYCHEM® C2, model CHZ5		TYCHEM® C2, model CHZ5			TYCHEM® C2, model CHZ5		
TYCHEM® C Standard		TYCHEM® C Standard			TYCHEM® C Standard		
Coveralls range DuPont TYVEK®	Coveralls range DuPont TYVEK®					Coveralls range DuPont TYVEK® *	
TYVEK® Classic Plus	TYVEK® Classic Plus					TYVEK® Classic Plus	
TYVEK® Classic	TYVEK® Classic						
TYVEK® Industry	TYVEK® Industry						
Coveralls range DuPont PROSHIELD®	Coveralls range DuPont PROSHIELD®						
Proshield® 30	Proshield® Comfort 60						
Proshield® 10	Proshield® 30						
	Proshield® 10						
							

* TYVEK® offers limited protection against biologically contaminated dusts.

Other important criteria to be taken into consideration...



Tips for a safe selection

When evaluating the qualities of a suit for a particular job, industrial safety and economic factors both play an important role in the final decision.

Protective barrier

Without doubt, this is the most important consideration in the selection process. The material from which the suit is made must be proven to offer protection against all the hazardous substances to which the wearer could be exposed to.

Quality

In addition to the quality of the garment's material, the quality of garment manufacturing also plays a vital role in the overall level of protection. DuPont checks the finishing and quality of material of each protective garment during the manufacturing process. Buyers should bear the following criteria in mind: seam tightness and strength, sizing, applied quality control and garment guarantees by the manufacturer.

Durability

Many applications require mechanical strength. Therefore it is recommended to test how the material behaves in contact with abrasive surfaces. Only intact material can act as a barrier.

Design is critical to comfort and protection

A good fit ensures that a protective suit provides the wearer with both comfort and adequate protection. Poorly fitting garments run a higher risk of tearing and restrict movement, which can affect the wearer's ability to carry out work safely and efficiently.

DuPont™
Tyvek®



- TYVEK® provides a barrier against low concentrations of several inorganic chemicals and against particles which are greater than 1µm
- TYVEK® is highly resistant to tearing and abrasion
- It is permeable to air and water vapour
- It is extremely lightweight and flexible, allowing wearers to move freely

To help you choose the right garment, fill in our “Garment selection questionnaire” on our Web site: www.dpp-europe.com, or contact our Techline Team on +352 621 164 043.

Understanding the CE marking “Types”...

Type 1 ET / Norm EN 943-2

Specifies the minimum requirements for the chemical protective suits used by emergency teams (ET), including component parts such as gloves and boots, which may be specified elsewhere.

Type 1 / Norm EN 943-1

Specifies the minimum requirements, test methods, marking and information supplied by the manufacturer for the following categories of ventilated/non-ventilated limited-use and reusable chemical protective suits, including component parts such as gloves and boots, which may be specified elsewhere.

- **Type 1: gas-tight chemical protective suit.**
- **Type 1a: gas-tight chemical protective suit** with a breathable air supply independent of the ambient atmosphere, e.g. a self-contained, open-circuit, compressed-air breathing apparatus, worn inside the chemical protective suit.
- **Type 1b: gas-tight chemical protective suit** with an independent breathable air supply e.g. a self-contained, open-circuit, compressed-air breathing apparatus, worn outside the chemical protective suit.
- **Type 1c: gas-tight chemical protective suit** with a breathable air system providing positive pressure, e.g. an air line.

Type 2 / Norm EN 943-1

Specifies the minimum requirements, test methods, marking and information supplied by the manufacturer for the following categories of ventilated/non-ventilated limited-use and reusable chemical protective suits, including component parts such as gloves and boots, which may be specified elsewhere.

- **Type 2: non-gas-tight chemical protective suit.** A non-gas-tight chemical protective suit with a breathable air system providing positive pressure.

Type 3 / Norm EN 14605

Specifies the minimum requirements for the following categories of limited-use and reusable chemical protective clothing:

- Full-body protective clothing with jet-tight connections between the different parts of the clothing (**Type 3: liquid-tight clothing**) and, if applicable, with liquid-tight connections to component parts, such as hoods, gloves, boots, visors or respiratory protective equipment, which may be specified in other European standards. Examples of such clothing are one-piece coveralls or two-piece suits, with or without gloves, hoods, visors, integrated socks and boot covers.
- Partial body protection garments offering protection against permeation of chemical liquids to specific parts of the body. Examples of such garments are: laboratory coats, jackets, trousers, aprons, sleeves, hoods (without air supply) etc. As partial body protection leaves some parts of the body unprotected, this document only specifies the performance requirements for the clothing material and the seams.

... and knowing how to interpret them

Type 4 / Norm EN 14605

Specifies the minimum requirements for the following categories of limited-use and reusable chemical protective clothing:

- Full-body protective clothing with spray-tight connections between the different parts of the clothing (**Type 4: spray-tight clothing**) and, if applicable, with spray-tight connections to component parts, such as hoods, gloves, boots, visors or respiratory protective equipment, which may be specified in other European standards. Examples of such clothing are one-piece coveralls or two-piece suits, with or without gloves, hoods, visors, integrated socks and boot covers.
- Partial body protection garments offering protection against permeation of chemical liquids to specific parts of the body. Examples of such garments are: laboratory coats, jackets, trousers, aprons, sleeves, hoods (without air supply) etc. As partial body protection leaves some parts of the body unprotected, this document only specifies the performance requirements for the clothing material and the seams.

Type 5 / Norm EN ISO 13982-1

Specifies the minimum requirements for **chemical protective clothing resistant to penetration by airborne solid particles (Type 5)**. These garments are full-body protective items covering the trunk, arms and legs, such as one-piece coveralls or two-piece suits, with or without hoods, visors and foot protection. Requirements for component parts such as hoods, gloves, boots, visors or respiratory protective equipment may be specified in other European standards.

Type 6 / Norm EN ISO 13034

Specifies the minimum requirements for limited-performance, limited-use and reusable chemical protective clothing. Limited-performance chemical protective clothing is intended for use in cases of potential exposure to light sprays, liquid aerosols or low-pressure, low-volume splashes, which do not require a complete liquid permeation barrier (at molecular level). The scope of this standard covers both chemical protective suits (Type 6) and partial body protection garments (Type PB [6]).

Chemical protective suits (Type 6) cover and protect at least the trunk and the limbs, e.g. one-piece coveralls or two-piece suits, with or without hoods, integrated socks or boot covers. This standard specifies the minimum requirements for the connections between the different parts of Type 6 suits, by using a whole-suit spray test according to a variant of EN 468:1994, as described in 5.2.

Partial body protection garments e.g. coats, aprons, sleeves etc. of similar limited performance (Type PB [6]) cover and protect specific parts of the body and are not subjected to the whole-suit test.

- The CE marking means that chemical protective clothing meets certain minimum requirements. However, it does not mean that chemical suits of the same Type offer the same level of protection performance. This is why it is essential to look at the results of the tests carried out on the material used to make the garment.

Zoom in on the different test types

Mandatory tests on the mechanical properties of a material

Test method	Scope	Norm
Abrasion resistance	Describes the method of testing abrasion resistance with the help of an apparatus. A standard on abrasion used as a reference for standards and specifications on protective clothing. Outlines the abrasion pre-treatment of materials, specimens of which are later used to evaluate the remaining protective properties after the test.	EN 530 method 2
Flex cracking resistance	Describes a method of assessing the resistance of coated materials to damage by repeated flexing.	ISO 7854 method B
Tensile strength	Specifies a test method using a strip method, which determines the elongation of textile materials at maximum force.	EN ISO 13934-1
Puncture resistance	Specifies a test method used to measure the puncture resistance of protective clothing or materials used for these products. The puncture resistance is expressed as the maximum force required to push a spike through the test specimens at a given speed.	EN 863
Ignition resistance	Specifies methods for flame tests to be applied to respiratory devices in accordance with EN 14325 regarding chemical protective clothing materials.	EN ISO 13274-4 method 3
Seam strength*	Specifies the method used to determine the maximum strength of sewn seams when the force is applied perpendicularly to the seam. This method is known as the grab test.	EN ISO 13935-2

* tested on the clothing

Applications

Example: the performance of a material impacts the level of protection provided

Mechanical and barrier tests are described in terms of performance “class”. This classification system helps you to distinguish between the different barrier properties and the mechanical strength of

garments bearing the same “Type” assessment. Minimum requirements are established for each “Type” assessment. There are 6 classes (1 is low - 6 is high).

→ **Conclusion:**

Some lines of business and exposure risks may call for more than the minimum level of protection. There may also be a huge variation in working conditions.

Take the durability factor for example. When employees come into contact with sharp or abrasive surfaces, some materials, including those with a fine microporous barrier film, may abrade or tear so quickly that barrier protection is either totally or partially destroyed within a relatively short space of time. “CE” barrier tests are only carried out on new garments – so you do not necessarily know how that barrier will perform once the garment has been worn for a few hours (or, in some cases, even less). Protective garments must perform from the moment they are put on to the moment they are taken off.

Exercise: Crawling the ground - rough surface



TYVEK®

- No deterioration
- Barrier intact



Microporous film

- Deterioration
- No barrier

Zoom in on the different test types

Mandatory tests on the mechanical properties of a material

Test method	Scope	Norm
Permeation resistance	Describes the laboratory test methods used to determine the resistance of materials used in protective clothing to permeation by liquid or vapour chemicals with either continuous or intermittent contact.	EN ISO 6529
Penetration resistance and repellency	Specifies a test method used to measure the indexes of penetration, absorption and repellency of protective clothing material exposed to liquid chemicals, mainly of low volatility. Two levels of the material's potential performance are assessed by this method, in order to meet the possible requirements for protection against: a) spray droplets deposited at minimal pressure on the surface of a material, until coalescence or run-off; b) contamination by a single low-volume splash or low-pressure jet, allowing enough time to remove the clothing or take other action required to protect the wearer from any chemicals on the protective garment. Contamination could also occur if pressure is applied to liquid contaminants on the surface of the clothing material as a result of the wearer's natural movements (flexing of contaminated areas of clothing at the arms, knees or shoulders) and contact with contaminated surfaces (e.g. walking through sprayed foliage).	EN ISO 6530

Example: sulphuric acid

It is virtually impossible to make recommendations for garments which are to protect against sulphuric acid, the reasons being that it is used in a wide range of different concentrations and there are a number of different exposure levels. TYVEK® Classic offers a suitable barrier for low concentrations (less than 20%) and low pressures (below 0.12 bar).

TYCHEM® C offers a suitable barrier for concentrated sulphuric acid that might come into contact with the protective suit at a medium pressure of around 2 bar. TYCHEM® F offers a suitable barrier for high concentrations of sulphuric acid that are used under higher pressure and may contain free sulphur dioxide gas.

→ **Conclusion:**

When choosing the right chemical protective clothing, several factors need to be taken into account including the state of the substance as well as its concentration, temperature and pressure.

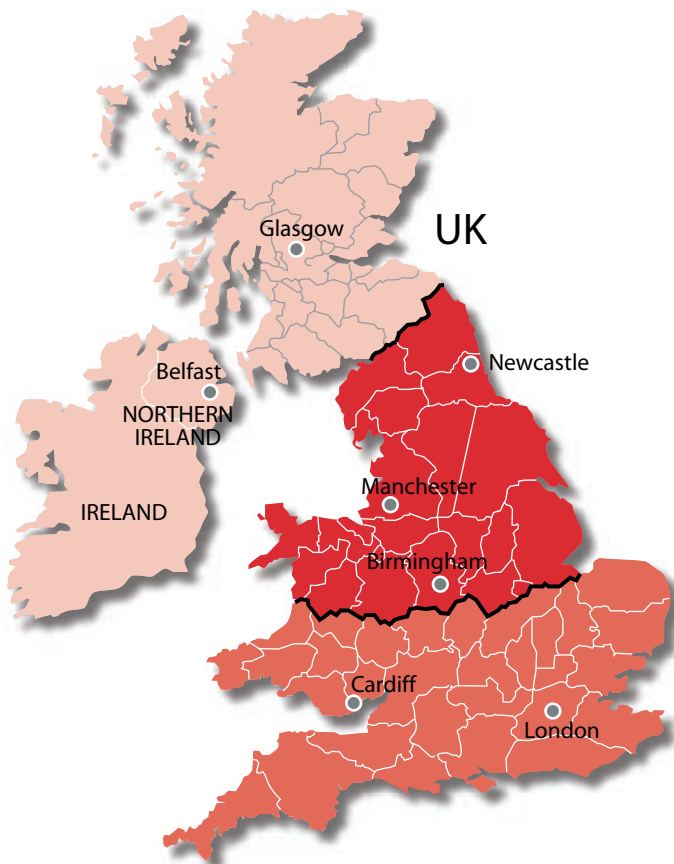
Optional tests

Test method	Scope	Norm
Flex cracking resistance at low temperatures	Specifies the method of assessing the resistance of coated materials to damage by repeated flexing.	ISO 7854 method B
Electrostatic properties	Specifies the requirements for protective clothing which dissipates electrostatic charges to avoid electric discharge which could catch fire. These requirements may not be sufficient in oxygen-enriched inflammable atmospheres. The standard is not applicable for protection against main voltages.	EN 1149-1: 2006 prEN 1149-5: 2005
Protection against infectious agents	Specifies the requirements and test methods for reusable and limited-use protective clothing providing protection against infectious agents.	EN 14126
Resistance to penetration by blood-borne pathogens using bacteriophage Phi-X-174 as a test system	Describes a laboratory test method used to measure the resistance of the materials used in protective clothing to penetration by blood-borne pathogens using a surrogate microbe with continuous liquid contact. Protective clothing either passes or fails depending on whether viral penetration at a specific hydrostatic pressure can be detected.	ISO/DIS 16604
Resistance to penetration by infective agents due to mechanical contact with substances containing contaminated liquids	Describes a laboratory test method used to measure clothing material's long-term resistance to penetration by a dried bacterial suspension. The test method uses mechanical contact to determine if bacteria can be extracted from the damp donor cloth and transported through the clothing material by slightly dampening the opposite side.	EN 14126 annex A
Resistance to penetration by biologically contaminated aerosols	Describes a laboratory test method used to measure protective clothing's resistance to penetration by a contaminated aerosol. This test method exposes material specimens to a specific bacterium suspended in an aerosol, according to a specific set of conditions. This test method is not always effective in testing protective clothing materials with thick inner liners which readily absorb the test fluid.	ISO/DIS 22611
Resistance to penetration by biologically contaminated dusts	This test method assesses the barrier materials' resistance to penetration by particles transporting bacteria.	ISO/DIS 22612



DuPont is there to help you

If you have any questions about the DuPont Personal Protection product range do not hesitate to contact your regional sales representative



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The information given here corresponds to the information we have available at the present time, but specifications may be subject to change. For the latest information log on to our website at:

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