Ansell

TYPE 1

EN 943-1:2015 + A1:2019
EN 943-2:2019
TYPE 1 (GAS-TIGHT) CHEMICAL PROTECTIVE

Protective clothing against dangerous solid, liquid, gaseous chemicals, including liquid and solid aerosols.

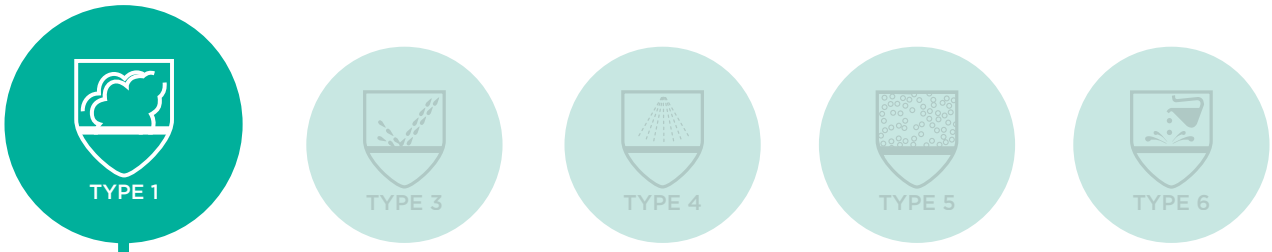
To view other body protection standard guides, please visit www.ansell.com/feelequipped and click on the resources tab

EN 943-1:2015 + A1:2019 | EN 943-2:2019 TYPE 1 (GAS-TIGHT) CHEMICAL PROTECTIVE SUITS

To assist you with the selection of chemical protective clothing the EU has developed six categories for "types" of chemical protective clothing.

Certification to a particular type offers an indication of your suit's protection against a particular hazard (gas, liquid or dust). This guide explains performance requirements for protective clothing providing ***protection against dangerous solid, liquid and gaseous chemicals, including liquid and solid aerosols (Type 1 gas-tight chemical protective suits).***

Type 1 suit: One-piece garment with hood, gloves and boots which, when worn with appropriate respiratory protective devices, provides the wearer a high degree of protection against harmful liquids, particles and gaseous or vapour-phase contaminants. Type 1 suits are divided into 3 different sub-types: **Type 1a, 1b and 1c**.



'Type 1' Protective Clothing Performance Requirements Include:

1. **Type 1**
2. **Resistance to outward leakage of gases (internal pressure test) - ISO 17491-1:2012, Method A2**
   This test defines Type 1
3. **Physical Requirements**
   EN 14325 includes a range of physical performance test requirements.
4. **Chemical Requirements**
   The EN 943 product standard together with EN 14325 specifies for chemical testing to apply to garment material, seams and components.
5. **Practical Performance and Other Requirements**
   Practical work simulation tests are specified and evaluated with pass/fail criteria. Visual acuity requirements are also included.
6. **ET (Emergency Teams) / EN 943-2**
   For Emergency Teams, the requirements for physical properties and chemical performance are higher. A battery of test chemicals is specified as the minimum for testing.

1 TYPE 1

Type 1a

Type 1a suit

Gas-tight chemical protective suit to be used in conjunction with a breathable air supply which is both independent of the ambient atmosphere and worn inside the suit, e.g. a self-contained open circuit compressed-air breathing apparatus.

Type 1b

Type 1b suit

Gas-tight chemical protective suit to be used in conjunction with a breathable air supply independent of the ambient atmosphere supplied from or worn outside the suit, e.g. a self-contained open circuit compressed air breathing apparatus.

Type 1c

Type 1c suit

Gas-tight chemical protective suit to be used in conjunction with breathable air providing positive pressure where the suit is the face piece, e.g. air lines where the wearer breathes from the suit.

Note: A Type 2 was described in older editions of EN 943-1, but it has been removed because it was agreed for EN 943-1 to cover only gas-tight suits as defined by the internal pressure test.

RESISTANCE *to Outward Leakage*

2 Resistance to outward leakage of gases (internal pressure test) - ISO 17491-1:2012, Method A2

This test defines type 1. The complete suit shall be pressure tested both before and after practical performance testing as specified in EN 943-1.

ISO 17491-1 specifies a method to assess the resistance of a gas-tight suit to outward leakage of air, for example through essential openings, fastenings, seams, interface areas between items, pores and any imperfections in the construction materials. The test is performed by inflating a suit with air and then monitoring the pressure inside it to establish its ability to maintain the pressure.

Although the hazard to the wearer arises from leakage in an inward direction, this test method is able to detect very small imperfections, such as holes, splits or tears by assessing the outward leakage of air on a suit that has been inflated, which also allows for the material to stretch and settle from the pressure before the actual test.

Pressure Test Type 1a

Pressure Test Type 1b

PHYSICAL *Performance Requirements*

3a Minimum Performance Requirements of Type 1 Chemical Protective Clothing

Tests and classifications according to EN 14325.

Property	Minimum Performance Class		
	EN 943-1	EN 943-2 Regular Robustness	EN 943-2 Enhanced Robustness
Abrasion Resistance (EN 14325, EN 530)	Class 3	Class 4	Class 6
Flex Cracking (EN 14325, ISO 7854:B)	Class 1	Class 1	Class 4
Flex Cracking @ -30 °C (ISO 7854:B) *Note: The -30 °C is optional in EN 943-1*	Class 2	Class 2	Class 2
Trapezoidal Tear Resistance (EN ISO 9073-4)	Class 3	Class 3	Class 3
Tensile Strength (EN ISO 13934-1)	Class 3	Class 4	Class 6
Puncture Resistance (EN 863)	Class 2	Class 2	Class 3
Resistance to permeation by chemicals (liquids and gases)	Class 3	Class 2*	Class 2*
Resistance to Ignition (EN 13274-4 method 3)	Pass	-	-
Resistance to Flame (EN 13274-4 method 3)	-	Class 1	Class 3

** Minimum 14 of 15 specified chemicals must achieve at least Class 2.*

3b Seams, Joins & Assemblages

Seams (joining two pieces of the garment material) are tested for seam strength and chemical permeation. Assemblages (joining different materials) are also required to be tested for chemical permeation. Joins i.e. non-permanent attachments of e.g. gloves or boots are subject to a 100 N pull-test requirement.

CHEMICAL *Performance Requirements*

4a Chemical Permeation - ISO 6529

Permeation is the process by which a hazardous chemical moves through a material on a molecular level. Molecules of the chemical absorb into the outer surface of the material. They then diffuse across the material and are released or desorbed from the inner surface.

Measuring Permeation

The resistance of a protective clothing fabric to permeation by a potentially hazardous chemical is determined by measuring the breakthrough time and the permeation rate of the chemical through the fabric. Using EN 14325:2018 for chemical protective clothing, cumulative permeation is also measured i.e. the total amount (weight) of permeated chemical per unit area.

Permeation Test Methods

There are various permeation test methods in use today. Which one to use depends on a number of factors including the country of use for the protective clothing, and the type of chemical (i.e. gas or liquid). In the EU, the EN 16523 is used for PPE in general but for type 1 chemical protective clothing specifically ISO 6529 is used as specified in EN 14325:2018.

The resistance of AlphaTec® clothing to permeation by a hazardous chemical is determined by measuring the breakthrough time, permeation rate and cumulative permeation of the chemical through the fabric. Permeation tests are carried out by independent, accredited laboratories in accordance with ISO 6529 and EN 16523.

4b Chemical Testing Requirements

The EN 943 requires chemical breakthrough time and cumulative permeation to be measured and classified according to EN 14325:2018.

For EN 943-1 the chemicals are chosen by the manufacturer in accordance with the intended use of the suit. A minimum performance of class 3 (> 60 minutes) is required.

For EN 943-2 emergency teams, there is a battery of 15 specified chemicals that must be tested.

The chemical test requirement applies to materials, seams/assemblages and components. Typically, these would be garment materials, visor, gloves and boots.

Zippers are also included but with a lower permeation breakthrough time requirement. Also, zippers have to be covered by a splash protective flap if not class 3 is achieved for all chemicals tested on the zipper.

PRACTICAL *Performance Requirements*

5a Practical Performance

EN 943-1 requires test subjects wearing suits to perform a series of movements and work simulation tasks at room temperature. A questionnaire is used for the suit to be evaluated and graded by the test subject. If present, the visor is assessed for visual acuity. Pass/fail criteria are applied in the form of a minimum score. The suit also has to pass the internal pressure test before and after the practical performance test.

For EN 943-2, slightly different movements and tasks are applied to better simulate typical tasks for emergency teams such as fire brigade “hazmat teams” (see section 6 below).

Examples of practical performance testing

5a Full Suit Tests for Type 1c

In addition to practical performance, there are tests for Type 1c suits relating to this product being an RPD (Respiratory Protective Device). EN 14594 is referenced and include testing of breathing resistance, carbon dioxide level etc.

Also, a total inward leakage test performed with a solid particulate aerosol or a gas is required.

ET (EMERGENCY TEAMS) / EN 943-2

6 ET (Emergency Teams) / EN 943-2 Minimum Requirements

For Emergency Teams, the requirements for physical properties and chemical performance are higher (table 3a above). A battery of 15 test chemicals is specified as the minimum for chemical testing (table below).

Minimum 14 of the 15 specified chemicals must achieve at least Class 2. (Class 1 is accepted for 1 chemical only and in this case, there must be a warning in the IFU for exposure to this chemical.)

The 15 chemicals are selected to represent a wide range of chemical groups, and small molecules that can be expected to permeate faster than corresponding larger ones are specified. This is to ensure a good barrier against as many chemicals as possible, which is desirable for responders to chemical emergencies where the chemical may not be known beforehand.

ET / EN 943-2 Test Chemicals	
Acetone	**Hexane**
Acetonitrile	**Hydrogen chloride (gas)**
Anhydrous ammmonia (gas)	**Methanol**
Carbon disulfide	**Sodium hydroxide, 40%**
Chlorine (gas)	**Sulphuric acid, 96%**
Dichloromethane	**Tetrahydrofuran**
Diethyl amine	**Toluene**
Ethyl acetate	

EN 943-2 practical performance requirements specify different movements and tasks to better simulate typical tasks for emergency teams such as fire brigade “hazmat teams”. This includes work at at -15 °C where e.g. fogging of the visor can be a big problem and reason for failure.

For more info, visit www.ansell.com/enresourcecenter

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