



Protect Your People®

Guide to Apparel for Protection against Bacterium, Viruses and Infectious Agents



Lakeland®

MicroMax® Global

MicroMax®

ChemMax®

Interceptor®

Are You Ready for the next Global Pandemic ?

SARS. MERS. Ebola. Covid. Monkeypox. Marburg

The last two decades have seen increasing recognition of the phenomena of global pandemics and their potential consequences, highlighting the need for effective protection of health and emergency workers.

We must be better prepared.

Understanding how to ensure PPE is effective is vital, and protective clothing plays an important role.

This guide explains the purpose of protective clothing in the context of infectious agents, outlines relevant PPE standards, and includes an essential guide to selecting the right apparel for the job.

What are Infectious Agents?

Infectious agents are living organisms that can infect a person and cause harm through infections or infectious diseases. *They come in four basic types.*

Viruses e.g. Influenza | Size: 20-200µm



Bacteria e.g. Staphylococcus | Size: 0.2-20µm

Fungi e.g. Candida | Size: 2µ-2cm



Parasites e.g. Malaria | Size: 10-200µm

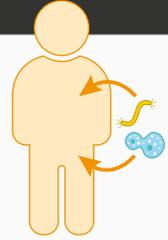
Healthcare workers, emergency response and emergency service workers are at greater risk of infection because close contact with infected persons or environments is part of the job:

- Health & care workers in repeated close contact during the care of patients
- Police, ambulance and paramedic emergency responders dealing with accidents where exposed injuries have occurred
- Police, SOCO, and forensic officers dealing with scenes of crimes
- Emergency responders dealing with outbreaks of viral infections
- Personnel managing or undertaking clean-ups after a range of incidents.

Transfer of infection via



- Direct inhalation or ingestion
- Contamination of hands by airborne particles from touching contaminated surfaces, then transfer to nose and mouth by hands



Infection is primarily through nose and mouth, so why is protective apparel important?

We touch our face between 15 and 25 times per minute. Protective apparel prevents contamination of clothes and skin, from where it can infect hands and be transferred to the face.

The performance of clothing to prevent this is assessed by EN 14126 in Europe, and ASTM 1671 in North America.

Infectious agents can transmit from person to person in several ways.

Exit from infected person via	Infection of a non-infected person via
<ul style="list-style-type: none"> • Droplets / particles from mouth and nose • Sprays / splashes of blood • Open wounds 	<ul style="list-style-type: none"> • Ingestion / inhalation • Direct or indirect contact • Broken skin / wounds • Catheters & tubes

Fabric Selection

EN 14126 contains four tests for resistance against different types of infection transfer. Results are classed 1 to 3 or 1 to 6. This allows selection according to test(s) conducted and classifications achieved.

Tests in EN 14126 for resistance against penetration of infectious agents		
Description	Test No	Classifications
Resistance to penetration by biologically contaminated liquid aerosols	ISO 22611	Measures the Penetration Ratio Class 1: 1 < Log ≤ 3 Class 2: 3 < Log ≤ 5 Class 3: Log > 5
Resistance to penetration by blood-borne pathogens	ISO 16604	Measures pressure at which 'strike-through' occurs Class 1: 0 kPa Class 2: 1.75 kPa Class 3: 3.5 kPa Class 3: 7 kPa Class 5: 14 kPa Class 6: 20 kPa
Resistance to penetration from mechanical contact with contaminated liquids (wet bacterial penetration)	ISO 22610	Measures Breakthrough Time in minutes Class 1: t ≤ 15 Mins Class 2: 15 < t ≤ 30 Mins Class 3: 30 < t ≤ 45 Mins Class 4: 45 < t ≤ 60 mins Class 5: 60 < t ≤ 75 mins Class 6: t > 75 mins
Resistance to contamination by solid particles (dry bacterial penetration)	ISO 22612	Measure penetration of Particles (log cfu) Class 1: ≤ 1 Class 2: 1 < log cfu ≤ 2 Class 3: 2 < log cfu ≤ 3

US Test Standards

<p>In North America, the test ASTM 1671-13 is the recognised standard for infectious agent clothing. It is the same test as ISO 16604 with some key differences.</p>	<p>ASTM 1671-13 vs ISO 16604</p> <ul style="list-style-type: none"> • Both use bacteriophage Phi-X170 to identify penetration • ASTM 1671-13 tests at a single pressure of 13.8 kPa to define pass or fail • ISO 16604 tests at 6 pressures and classifies fabric according to highest pass achieved. 	<ul style="list-style-type: none"> • A pass in ASTM 1671-13 is equivalent to Class 5 in ISO 16604/EN 14126 • A class 6 is a pass at a higher pressure than used in ASTM 1671
--	---	--

Garment Selection

Both EN 14126 and ASTM1671-13 test only fabric. EN 14126 also requires certification to chemical protective clothing Types, according to protection required to assess garment construction.

EN Chemical Protective Clothing Types				
Type	Pictogram	Standard	Description	General Construction Requirements
Type 1		EN 943	Protection against hazards gases and vapours	<ul style="list-style-type: none"> • Fully encapsulating, sealed construction with independent air supply • Impervious chemical barrier fabric • Sealed (not stitched) seams
Type 3		EN 14605	Protection against strong liquid jets sprays	<ul style="list-style-type: none"> • Coverall with hood & sealable front fastening & effective connection with other PPE (masks, gloves etc) • Impervious chemical barrier fabric • Sealed (not stitched) seams
Type 4		EN 14605	Protection against liquid sprays and splashes	<ul style="list-style-type: none"> • Coverall with hood & sealable front fastening & effective connection with other PPE (masks, gloves etc) • Allows breathable design options (e.g. Cool Suits) • Sealed (not stitched) seams
Type 5		EN 13982-1	Protection against hazardous dusts	<ul style="list-style-type: none"> • Coverall with hood and front fastening • Allows breathable or permeable fabrics • Stitched seams (not sealed)
Type 6		EN 13034	Protection against light aerosol liquid sprays	<ul style="list-style-type: none"> • Coverall with hood and front fastening • Allows breathable or permeable fabrics • Stitched seams (not sealed)

Note: The pictograms shown are not required by EN standards. Some garments may display only 'Type 1', 'Type 3' etc without any pictograms. However, use of the pictograms shown have become a common convention.

Selection of garment relates to the Type of protection required. For example, Types 1 to 4 feature sealed, rather than stitched seams, which might be important for higher risk applications.

Labelling

Garments certified to EN 14126 feature the infectious agent pictogram and chemical protective clothing Type, with the suffix "-b".



EN 14126
:2004



Type 3-b
EN 14605



Type 4-b
EN 13034

Lakeland garments also indicate the tests and classifications.



EN 14126
:2004
AG B6 C3 D3

The four letters represent each of the four tests. - The numbers indicate the classes achieved

EN 14126 is the European Standard for clothing to protect against infectious agents.



Garments certified to EN 14126 feature this pictogram on the label.

ASTM 1671-13 is the the US test standard to measure resistance to penetration of viruses. It is the same test as ISO 16604 in EN 14126 but with different requirements.

A Simple 3-step selection process

EN 14126 provides the information for a simple 3 step process for selection of clothing for protection against infectious agents suitable for your application.

1. IDENTIFY route of transmission of infection.

Choose a garment subjected to the most appropriate of the four tests in EN 14126.



2. ENSURE fabric has sufficient classification.



A6 B3 C3 D3

A= ISO 16604: Class 6

B= ISO 11610: Class 6

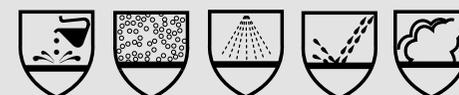
C= ISO 11611: Class 3

D= ISO 11612: Class 3



3. SELECT appropriate protective apparel

according to the expected contact with the infection and the five chemical protective clothing Types.



Type 6 Type 5 Type 4 Type 3 Type 1

The Mysterious Fifth Test

EN 14126 includes **four** tests for assessment of fabric resistance to penetration of infection.

Yet some manufacturers provide classification for a fifth, ISO 16603.

Don't be misled by classifications for ISO 16603!

Whilst EN 16603 is mentioned in the standard, it clearly states it is *only a screening method for the ISO 16604 test!*

It States that.

"The synthetic blood test (ISO/FDIS 16603) is used for screening purposes, i.e. to predict the level where a strikethrough can be expected when performing the bacteriophage test (ISO/FDIS 16604)"

(Source: EN 14126: 2004)

What is ISO 16603?

ISO 16604 is a complex and expensive test using a real virus (Phi x174 – one of the smallest known), growing a culture to identify penetration. To avoid testing at all 6 pressures, ISO 16603 provides a simple method of identifying a starting pressure where strikethrough is likely to occur. It uses a simple, visual assessment of synthetic blood penetration so is much easier and cheaper screening option to reduce required testing in ISO 16604.

Similarly, in North America, a screening test, ASTM 1670 is used to discount fabrics unlikely to pass ASTM 1671-13.

It is important to understand that neither ISO 16603 nor ASTM D1670 should be used as an indication of protection, and are for screening only.

Only ISO 16604 or ASTM 1671-13 should be used to indicate resistance against blood borne pathogens.

However, because some manufacturers quote a classification for ISO 16603 or ASTM F1670, Lakeland make the equivalent information available for comparative purposes only.

Lakeland Options for Protective Apparel for Infectious Agent Protection: MicroMax® GLOBAL



Type 5
EN 13982

*Hazardous
Dusts*



Type 6
EN 13034

*Light Aerosol
Spray*

**OSHA
Protection
Level C**



MicroMax.**NS** Global

- Coverall with hood
- Global range developed for rapid distribution during global pandemic
- Passes ASTM 1671-13 and achieves highest classes in all four tests in EN 14126
- Dual-sized for easy ordering and reduced stock-holding
- Meets all regional standards
- Bulk packed options for easy distribution & storage
- Microporous film barrier fabric with high MVT for comfort

Serged (stitched) seams



Type 4
EN 13034

*Liquid
Sprays*

**OSHA
Protection
Level B**



MicroMax.**TS** Global

- Coverall with hood and sealable zip flap
- Global range developed for rapid distribution during global pandemic
- Passes ASTM 1671-13 and achieves highest classes in all four tests in EN 14126
- Dual-sized for easy ordering and reduced stock-holding
- Meets all regional standards
- Bulk packed options for easy distribution & storage
- Microporous film barrier fabric with high MVT for comfort

Stitched & taped seams

During the Covid-19 pandemic the industry was unprepared for the rapid increase in demand for relevant PPE. Lakeland responded by focusing production on protective apparel most needed by healthcare workers.

Following a review of demand and preparedness for the next pandemic, MicroMax® Global was developed.

A key challenge is that different regions demand different styles of product according to local standards, regulations, and convention, so flexibility to produce and ship globally at short notice is hampered.

Thus, MicroMax® Global coveralls have been designed to meet all global standards and requirements, and are certified accordingly. This means that as demand rapidly increases in different regions, Lakeland can respond by immediate shipping of product from any regional warehouse or manufacturing unit to any region in the world, enabling greater flexibility to respond to local needs.

And simplicity of design means production can be quickly ramped up to maximise output.

MicroMax® Global uses Lakeland MicroMax® NS fabric, combining lightness and flexibility with a high level of protection, achieving the highest classes in all four EN 14126 tests.

Two MicroMax® Global versions are available, one with serged (stitched) seams (Type 5 & 6), and one with taped (sealed) seams (Type 4).



Type 5
EN 13982

*Hazardous
Dusts*



Type 6
EN 13034

*Light Aerosol
Spray*

**OSHA
Protection
Level C**



MicroMax.NS

- Coverall with hood
- Apron and gown versions available
- Good liquid repellency
- High MTVR

Serged (stitched) seams



MicroMax.NS Cool Suit

- Coverall with breathable panel to rear, allowing air into the suit for comfort
- Good liquid repellency
- High MTVR

Bound seams

Garment Sizes

- Most garments are available in sizes SM to 3XL.
- All CE certified garments are sized to fit the body height (A), chest (B), and waist (C) of the wearer according to the table below.
- Body sizes in cm

A	B	C	SM	MD	LG	XL	2X	3X									
			164-170	84-92	82-88	170-176	92-100	88-94	176-182	100-108	94-100	182-188	108-116	100-106	189-194	116-124	106-112

MicroMax® Global are available in "Dual Sizing" which maximises capacity for rapid production and minimises ordering and stockholding. Sizes are: SM-MD, LG-XL, 2X-3X, 4X-5X

All garments shown achieve the highest classes in all four tests in EN 14126 and meet the requirements of ASTM 1671-13.



Type 3
EN 14605
Strong Jet Spray



Type 4
EN 13034
Liquid Sprays

**OSHA
Protection
Level B**



<p>MicroMax.<i>TS</i></p>	<p>ChemMax.<i>1</i> EB</p>	<p>ChemMax.<i>1</i></p>
<ul style="list-style-type: none"> • Coverall with hood and sealable zip flap • Type 4 only • Lightweight • High MTRV 	<ul style="list-style-type: none"> • ChemMax® 1 version developed for the 2014 Ebola UK response • Coverall with hood and sealable zip flap 	<ul style="list-style-type: none"> • Spunbonded PP with HDPE barrier film laminate • Coverall with hood and sealable zip flap • Other styles available including gowns and aprons
<p>Stitched & taped seams</p>	<p>Stitched & taped seams</p>	<p>Stitched & taped seams</p>

All garments shown achieve the highest classes in all four tests in EN 14126 and meet the requirements of ASTM 1671-13.



Type 1
EN 943
Gas & Vapor Protection

**OSHA
Protection
Level A**



<p>Interceptor.Plus</p>
<ul style="list-style-type: none"> • Multi-layer barrier, tough yet flexible fabric • Fully encapsulating gastsuit with internally worn SCBA or remote air supply options
<p>Stitched & double taped seams</p>

Protective Apparel for Infectious Agents Selection Chart

		CE Type 5 & 6 Protection OSHA Level C				CE Type 4 Protection		CE Type 3 & 4 Protection OSHA Level B			CE Type 1 OSHA Level A
		MicroMax®				MicroMax®		ChemMax®			Interceptor®
		NS Global	NS	NS Gown or Apron*3	NS Cool Suit*1	TS Global	TS	1EB*6	1	1 Gown or Apron*3	Plus
Applications *6	Cleaning & disinfection of contaminated areas	●	●	●	●						
	Scene of crime operations (SOCO) *5	●	●		●	●					
	Cleaning & disinfection of controlled healthcare areas	●	●	●	●	●	●	●	●		
	Healthcare workers in proximity to general patients	●	●	●	●						
	Frontline health workers in direct contact with known infected patients					●	●	●	●		
	Emergency response where injured victims present					●	●	●	●		
	Emergency response to high hazard infectious agents										●
	Biological hazard warfare agent response										●
Infectious Agent Protection	EN 14126 Certification - EN 14126 Test Classifications:	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	ISO 16604 - Resistance to blood borne pathogens (BBP's) (1 to 6) (A)**	6	6	6	6*2	6	6	6	6	6	6
	ISO 22610 - Resistance to mechanical contact with liquid (1 to 6) (B)**	6	6	6	6*2	6	6	6	6	6	6
	ISO 22611 - Resistance to contaminated aerosols (1 to 3) (C)**	3	3	3	3*2	3	3	3	3	3	3
	ISO 22612 - Resistance to Contaminated Particles (1 to 3) (D)**	3	3	3	3*2	3	3	3	3	3	3
	ASTM 1671-13 (Pass / Fail)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Chemical Clothing Protection Types	EN 1149-5 - Surface Resistance < 2.5 x 10 ⁹ according to EN 1149-3 *4	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Type 6 - EN 13034 - Light aerosol protection	✓	✓	✓ [PB]	✓						
	Type 5 - EN 13982 - Dry particle protection	✓	✓		✓						
	Type 4 - EN 14605 - Liquid Spray Protection					✓	✓	✓	✓	✓ [PB]	
	Type 3 - EN 14605 - Jet Spray Protection							✓*6	✓	✓ [PB]	
	Type 1 - EN 943 - Gas / Vapour Protection										✓
	OSHA Level C	✓	✓		✓						
	OSHA Level B					✓	✓	✓	✓		
	OSHA Level A										✓

Notes ● = Recommended best options ● = Option. May be a suitable depending on circumstances and risk assessment. ** Indication letter on garment labels

NOTES: -

*1 MicroMax® NS Cool Suit features a breathable panel to the rear to enhance comfort. However, whilst meeting the requirements of Type 5 & 6 the panel fabric has a lower resistance to penetration than the rest of the garment and does not achieve any classifications in the EN 14126 tests. MicroMax® NS Cool Suit may be a suitable option where greater comfort is a need, but may not be suitable for all applications so should only be used following a suitable risk analysis

*2 Applicable to the main body fabric only. The breathable rear is lower protection and does not achieve any classification in EN 14126 tests

*3 Gowns and aprons are classed as Partial Body (PB) protection (either Type 3-PB, Type 4-PB or Type 6-PB). They will protect ONLY the parts of the body they cover from liquid sprays so may not be suitable for some applications or air-borne infections.

*4 EN 1149 for anti-static garments ensures the surface resistance is sufficiently low to allow dissipation of a static charge to earth without resulting in an electrostatic discharge (ESD). Such charges could damage sensitive electronic equipment such as medical equipment or could ignite flammable atmospheres or liquids.

*5 Scene of Crimes Operations (SOCO). A primary requirement is to protect the environment from contamination by the wearer. However, in some cases infectious agents could be present, so garments that protect the wearer may be important.

*6 ChemMax® 1EB is Type 3 only if additional tape sealing is applied to the zipper cover.

Notice: This document contains general use information of the products and services described. All products should be used only by trained and qualified personnel who have examined all relevant cautions and warnings. Always review all applicable laws and regulations, as well as your company's procedures before use. Consult your company's safety/health officer for more information.



Lakeland Industries

1525 Perimeter Parkway NW
Suite 325
Huntsville, AL 35806

Phone: 1-256-350-3873
Toll Free: 1-800-645-9291

Customer Service: info@lakeland.com

Europe: 44-1430-478140
Canada: 519-757-0700
Toll Free: 800-489-9131
Argentina: 5411-4767-9484
Chile: 562-29980545
Uruguay: 5411-4767-9484
Asia-Pacific: 86-10-64379226
Australia: 61-0-437075686
India: 91-120-4249261 / 62

September 2022
© Lakeland Industries Inc. 2022

Protect Your People®

The chart shows recommended and possible options for different applications, along with indicating classifications achieved in all EN 14126 tests and the chemical protective clothing Type certification.

Applications listed and recommendations are general. This is for general guidance only.

Selection of protective apparel should be made with an understanding of the infectious agent and how it transmits, and following a risk assessment by suitably qualified personnel.