

What is a cleanroom?

A cleanroom is an environment with a controlled level of pollutants such as dust, airborne microbes, aerosols (gas with particles) and chemical vapours. The pollution level is specified as the number of particles equal to or greater than 0.5 micrometers (abbreviated as μm = one millionth of a metre) per cubic metre of air. A hair is approximately 100 micrometres (μm), so the particles we are talking about are extremely small. To provide further perspective, normal outdoor air in an urban environment contains approx. 35,000,000 particles equal to or greater than 0.5 micrometers (μm) per m^3 while a cleanroom of ISO class 3 is permitted to contain no more than 35 particles of the same size.

Why does a cleanroom need to be so clean and how is this achieved?

After World War II technical development underwent significant expansion, but this was soon accompanied by problems. Aircraft flew off course, computers lost memory, hospital infections increased and road traffic sometimes came to a standstill because the traffic lights refused to change from red to green. It was discovered that the cause of this was the pollutants built in during the manufacture of technical equipment and medical devices. The smaller the components people tried to use, the worse the problem got. The first cleanrooms were built in the 1960s, and with the aid of a constant flow of air filtered through what is known as a HEPA (high-efficiency particulate air) filter, it was possible to successfully lower and control particle levels in a very effective manner.

Keeping an empty room clean is not the biggest challenge

The problems start when you put equipment into the room – and people to handle the equipment. People give off hundreds of thousands of particles in the form of skin cells, micro-organisms and hair, and for every minute that goes by, and the more we move, the more particles we give off. In practice, this requires putting filters around the human body to prevent particles from entering the air.

Fristads has manufactured clothing for cleanrooms and controlled environments since 1996.

ISO CLASS	MAX. NUMBER OF PARTICLES PER $\text{m}^3 \geq 0,5\mu\text{m}$
1	*
2	*
3	35
4	352
5	3 520
6	35 200
7	352 000
8	3 520 000
9	35 200 000 (normal room air)

* According to ISO 14644-1: Sampling and statistical limitations for particles in low concentrations make classification inappropriate

ISO CLASS 3	ISO CLASS 4
Suit recommendations:	Suit recommendations:
Hood	Hood
Hair cap	Hair cap
Coverall	Coverall
Underwear	Underwear
Boots	Boots
Face mask	Face mask
Gloves	Gloves
<i>Change interval: Each time cleanroom is entered</i>	<i>Change interval: Each time cleanroom is entered</i>

ISO CLASS 5	ISO CLASS 6
Suit recommendations:	Suit recommendations:
Hood	Hood or hair cap
Hair cap	Coverall or coat
Coverall	Boots or shoe protectors
Underwear	Face mask
Boots	Gloves
Face mask	<i>Change interval: Twice a week</i>
Gloves	
<i>Change interval: Every day</i>	

ISO CLASS 7	ISO CLASS 8
Suit recommendations:	Suit recommendations:
Hair cap	Hair cap
Coat	Coat
Shoe protectors	Shoe protectors
Face mask	Face mask
Gloves	Gloves
<i>Change interval: Twice a week</i>	<i>Change interval: Twice a week</i>



This is why we only use synthetic fibres

Workwear for cleanrooms must not give off particles or fibres. Cotton and other natural materials are woven from short fibres that detach easily and are therefore unsuitable. Cleanroom clothes consist of synthetic fibres – filament polyester, i.e. endless fibres.

The Fristads “bound seam”

Our bound seam is a refined version of the standard bound. It is more impermeable because the hem is like a hood. It is stronger because double rows of stitches each pass through six layers of fabric. It is safer because the carbon filaments woven into the hem produce good electrostatic discharge, even after repeated washes.