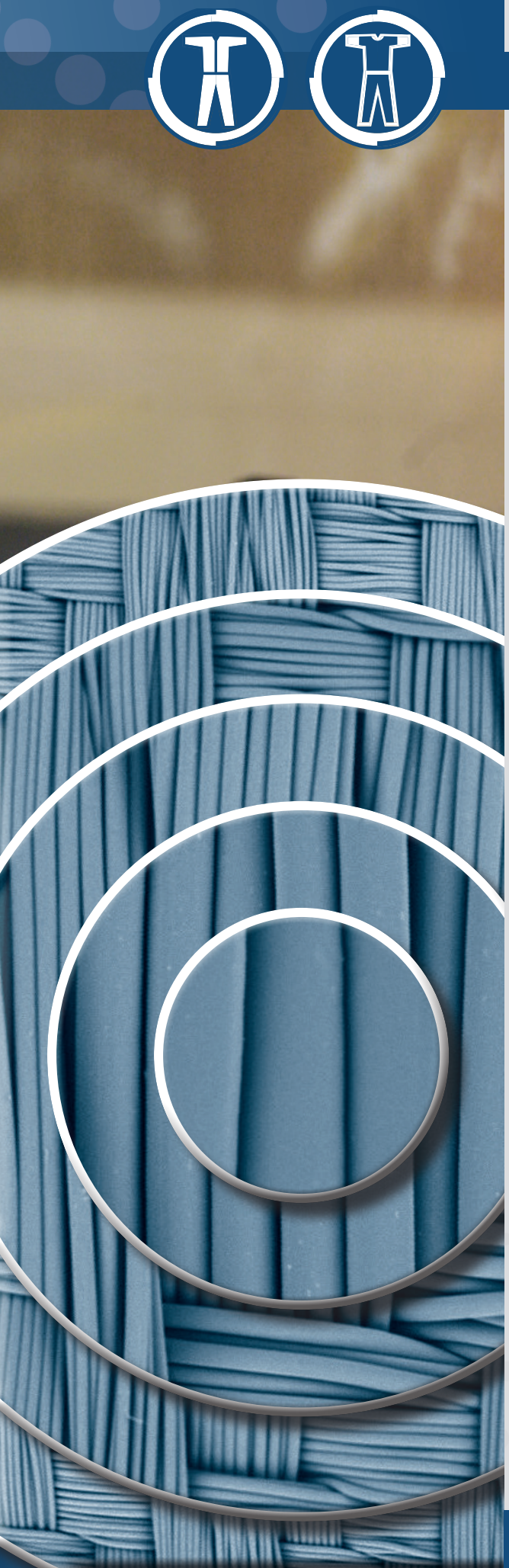
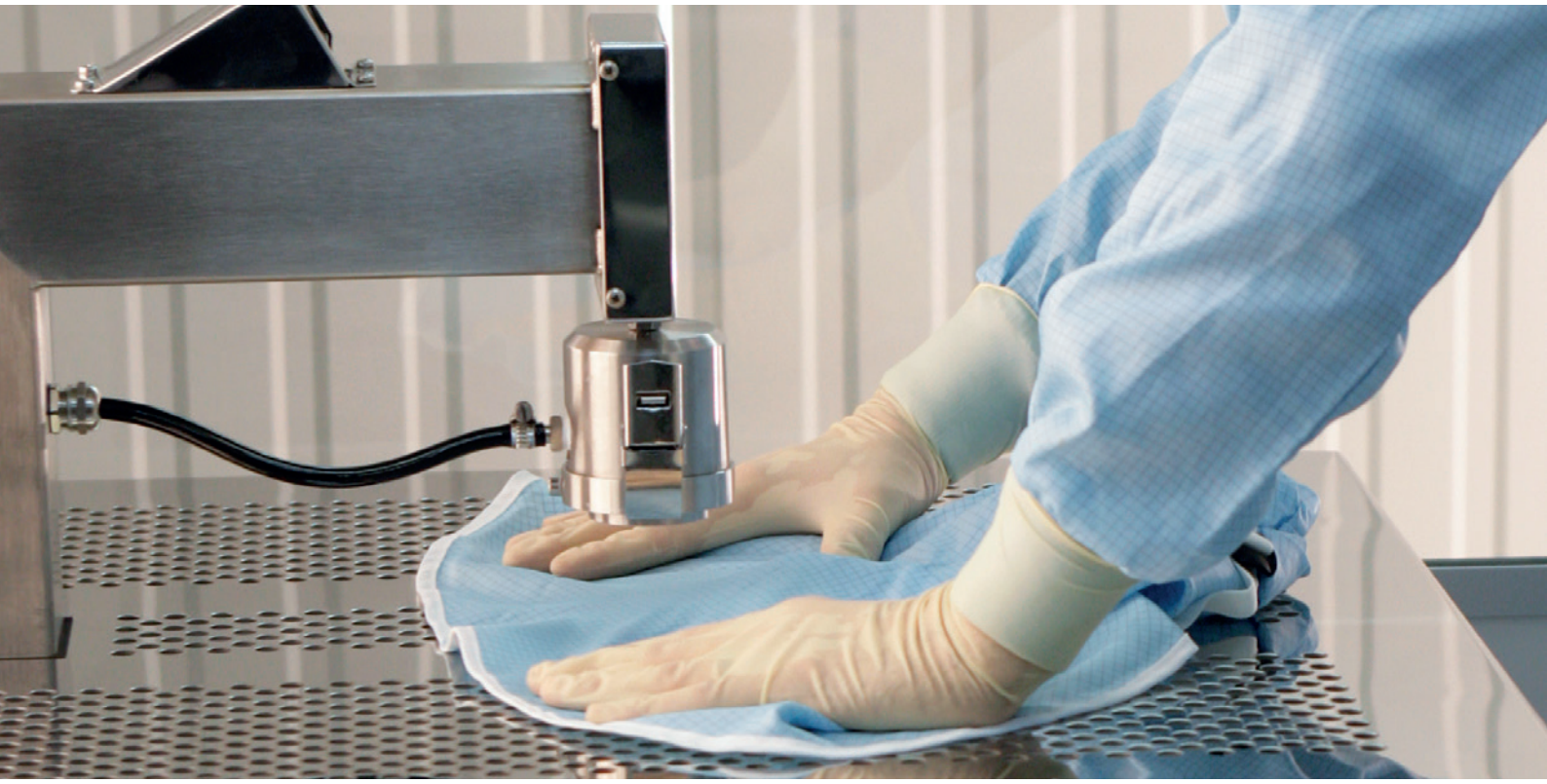
Dastex cleanroom garments range goes „in-depth“!



dastex REINRAUMZUBEHÖR

Chapter 1

Interesting facts about textile cleanroom clothing

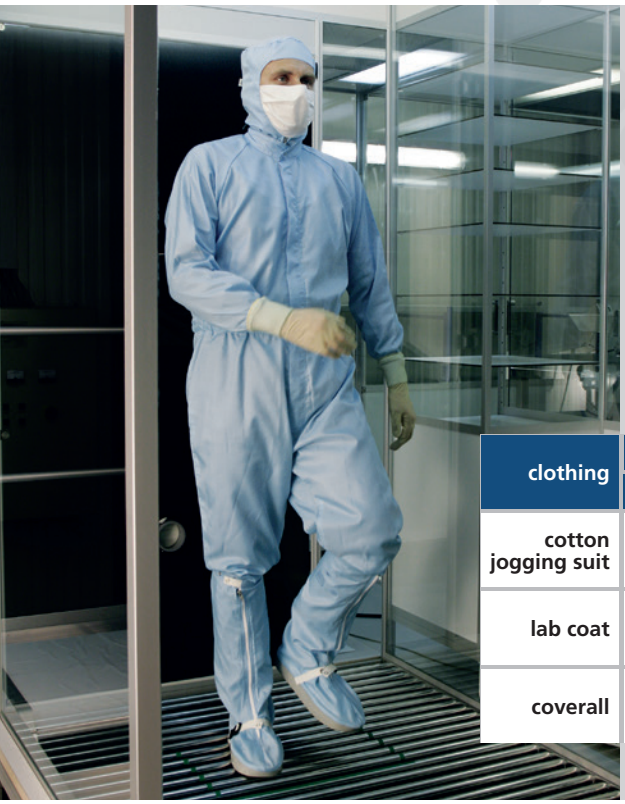


The filter between human and product

Despite all technical advancements the human in the cleanroom remains still one of the biggest contamination sources. This applies to particle contamination as well as microbiological contamination. Only when the product is completely „uncoupled" (separated) from the human being, e.g. with the use of isolators or the SMIF technology (mini environments) is the above statement no longer valid. For all other application areas one can assume that approximately 30 – 40% of the contaminations in the cleanroom may quite be caused by employees.

The survey results in the following pages (an extensive study undertaken in the **Dastex**-owned „Body-Box", a walk-in measuring cabin) proves the above statement and offers clues from which particle and germ counts coming from human beings and their clothes can be calculated.

Airborne particle and germ release due to the human being
Measurements in the **Dastex** Body-Box (details see chapter 1.8) give information about how many particles humans in different garment systems in various motion sequences can emit. The following table illustrates the important role the correct garment system fulfills. When the employee wears an overall, hood and overshoes over his private clothing (in this case simulated with a pair of trousers and a jumper made from 100% cotton) the particle emission reduces by 0.2% – 0.3% from the starting level.



Measurement study for the emission of particles (per m³) per minute

People in various garment systems depending on the intensity of motion

clothing	standing	walking	standing	walking	standing	walking
	Particles ≥ 0.5 µm		Particles ≥ 1 µm		Particles ≥ 5 µm	
cotton jogging suit	873 304	34 955 780	657 312	25 114 780	17 077	448 638
lab coat	331 742	6 304 946	130 901	2 506 495	9 795	101 172
coverall	28 827	106 328	10 396	32 135	331	851

Similar results are delivered by test series where besides the particle counts also the germ counts were detected.

Measurement study for the emission of germs (per m³) per minute

People in various garment systems depending on the intensity of motion

clothing	standing	walking	standing	walking	standing	walking
	Germs ≥ 1 µm		Germs ≥ 5 µm		Germs ≥ 10 µm	
cotton jogging suit	1 379	17 893	758	9 368	557	7 367
lab coat	623	12 496	373	6 474	86	4 847
coverall	18	263	2	36	2	10

Cleanroom garments as a system

Different aspects that affect each other:

- **material characteristics**
  (e.g. particle retention capacity ⟷ breathability)
- **employee training**
- **special workplace requirements**
  (e.g. relating to PPE)
- **outfits**
  (e.g. zippers, pockets)
- **environmental conditions**
  (e.g. temperature, air moisture)
- **professional decontamination**

Even the best cleanroom garment can lead to problems when not all parameters, which influence the so called clothing system, are synchronised.

- First of all material characteristics should be defined in view of the customers' needs. Technical requirements such as tightness **(high particle retention)** and staff need, such as wear comfort **(high breathability)**, have to be phased.
- Additionally come the choice and definition of the **outfits** and the special accessories such as zippers, pockets etc.
- The **environmental conditions** in the particular cleanrooms, in which the garment will be used, are also important. In the first instance, worth mentioning are temperature and air moisture.
- Special demands at workplace, such as specific requirements relating to PPE **(personal protective equipment)** might also need to be taken into account during the definition of the garment systems.
- The **professional decontamination** (= cleaning) of the garment is a basic part of a functional clothing system.
- **Staff training** is counted among the important features of an issue-related system.

Textiles: Garments

In this chapter we give you an overview of the requirements and features of cleanroom textiles, which are used in the manufacturing of the **Dastex** cleanroom garments.

It has to be considered that in the choosing of a suitable textile only recommendations can be made. The definition of cleanroom textiles depends mainly on the manufacturing process requirements of the particular end user. Customers in the semiconductor industry have different requirements than customers from the life sciences industry. But here too, the individual application areas requirement profiles can vary significantly.

The indication of the actual cleanroom class (according to EN ISO 14644-1) respectively of the hygiene zone (according to GMP guide) is in most cases not sufficient on its own for an optimum definition.

We are very happy to advise you at any time on the above subject in a personal interview!

You will also find detailed information on testing methods on pages 62–69.

Characteristics of cleanroom fabrics

www.hohenstein.com
HOHENSTEIN INSTITUTE
Tested QUALITY
BREATHABILITY
TEST NO: HL 07.4.5992/1

Please refer to the table to see which fabrics have already been tested (✗)

Cleanroom fabrics by comparison

In the table, some of our textiles are evaluated with regard to cleanroom-relevant properties.

If you have any questions in this regard, we will be happy to explain the details and advise you specifically on the requirements of your cleanroom.

The technical data (individual values) for the different cleanroom fabrics can be found on pages 70–71.

Art. No. fabric	textile line name	filtration	abrasion resistance	air permeability	breathability		electrostatic properties	ESD	autoclavable	i
17	ION-NOSTAT VI.2	✱✱✱✱	✱✱✱✱	✱✱✱✱	✱✱✱◗	✗	✱✱✱✱	✓	✓	
10	ION-NOSTAT VI.2 WA	✱✱✱✱	✱✱✱✱	✱✱✱	✱✱✱	✗	✱✱✱✱	✓	✓	○
68	ION-NOSTAT Plus	✱✱✱	✱✱	✱✱✱	✱✱✱	✗	✱✱✱✱	✓	✓	
B08	ION-NOSTAT Comfort I.2	✱✱✱	✱◗	✱✱	✱✱✱✱	✗	✱✱✱	✓	##	
B04	ION-NOSTAT LS Light 125.2	✱✱	✱◗	✱✱	✱✱✱✱	✗	✱✱◗	-	#	
64	DASTAT-V.2	✱✱✱✱	✱✱◗	✱✱	✱✱	✗	✱✱✱	✓	✓	
79	DASTAT-EC	✱✱◗	✱✱✱	✱✱	✱✱✱	✗	✱✱✱	✓	✓	
63	DASTAT-C	✱✱◗	✱✱	✱✱✱	✱✱✱	✗	✱✱	-	#	
B05	DASTAT-MF	✱	✱	✱	✱✱✱✱	✗	✱✱✱	✓	##	
11	DASTAT-GR	✱✱✱	✱✱✱	✱✱	✱✱✱	-	✱✱✱✱	✓	✓	
B02	DASTAT-RS	✱	✱✱✱✱	✱	✱✱✱	✗	✱✱	-	#	△(1)
69	Nomex®	✱	✱✱	✱	✱✱✱	-	✱✱✱	✓	✓	△(2)
B07	DASTAT-P	✱✱✱✱	✱✱	✱	✱	-	✱✱	-	✓	△(3)
B15	DASTAT-REC	✱✱✱	✱✱✱	✱✱✱	✱✱✱◗	-	✱✱✱✱	✓	#	△(4)

✱ adequate ✱✱ satisfying ✱✱✱ good ✱✱✱✱ very good

○ The same basic textile as ION-NOSTAT VI.2 enhanced by a water-repellent PTFE finish, to prevent the penetration of aqueous liquids as far as possible.

In principle possible, but not recommended

Completely not recommended

△(1) A particularly stable special fabric, recommended for applications with high mechanical stress on the textile.

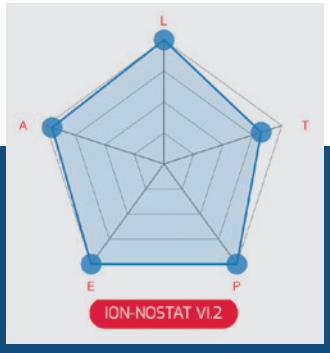
△(2) Special fabric made from an aramid fibre as a continuous filament. Due to the general product characteristics of Nomex®, it is often used in areas with superior requirements with regard to heat generation. The cleanroom compatible version (garment) is not tested or certified as a PPE article.

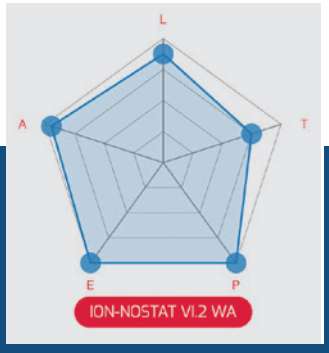
△(3) An especially dense fabric with water-repellent PTFE finish – recommended when water-based liquids should not penetrate the textile, as far as possible.

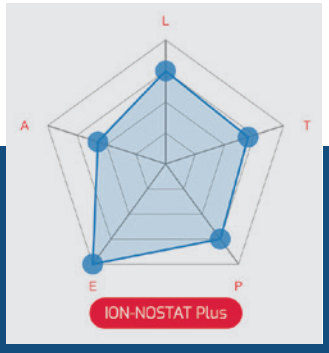
△(4) A fabric made from recycled material

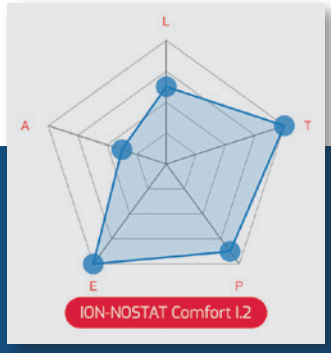
✗ Most of the cleanroom fabrics we supply have been tested by the Hohenstein Institute and have been awarded the BREATHABILITY quality seal. The value of the water vapour transmission resistance is measured here, which result you can find in the respective data sheet.

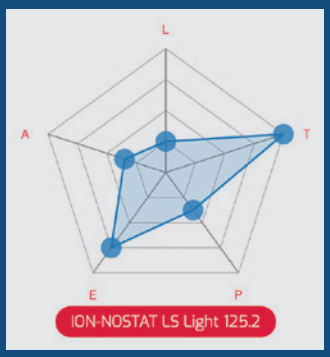
Additional fabrics for special requirements are available on request!

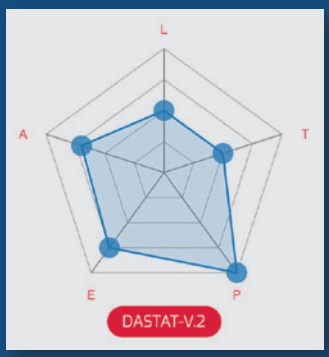


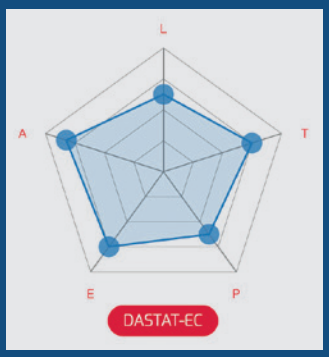


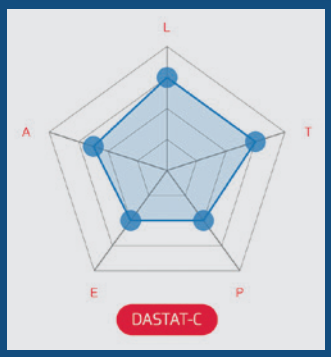


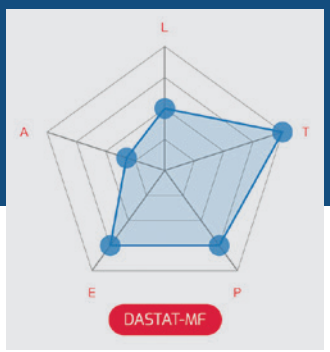


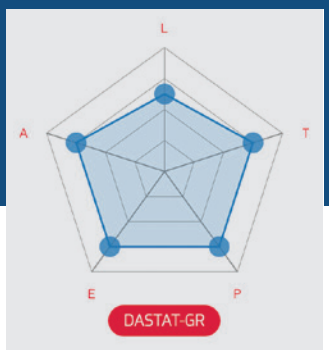


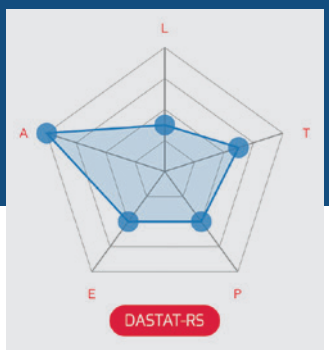


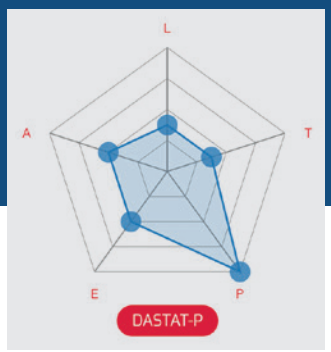




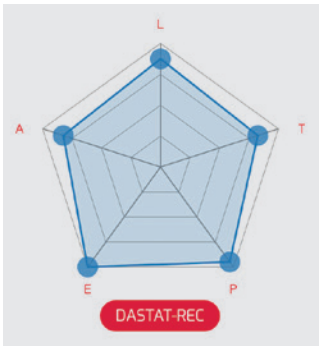








CLEAN GREENCYCLE™ by dastex



Technical characteristics of cleanroom fabrics

This graphic representation is intended to give you a rough overview of the cleanroom fabrics we use in most cases and their respective technical characteristics. Ultimately, of course, the model and the detailed designs also determine the respective properties of the cleanroom garment as an overall system.

The graphic charts were edited with regard to the following fabric characteristics:

- **L Air permeability**
- **T Wearing comfort**
- **P Particle retention capacity**
- **E Electrostatic behaviour**
- **A Abrasion resistance**

The more regular the dyed area in the diagram, the more balanced the fabric. For a variety of applications, it is not essential for a cleanroom fabric to have optimal individual values in all properties. If the process under controlled conditions does not require a very high particle retention capacity, this goes along with a higher vapour permeability, which thus improves the wearing comfort of the wearer.

Product recommendations referring to cleanroom classes

Recommendations (*)	Cleanrooms and associated controlled environments – Part 1 Classification of air cleanliness by particle concentration EN ISO 14644-1								Hygiene zones according to GMP (microbiological controlled areas)				
Fabric	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**low dust**	**A**	**B**	**C**	**D**	**E**
ION-NOSTAT VI.2		■	■	■	■	■			■	■	■	■	
ION-NOSTAT VI.2 WA		■	■	■	■	■			■	■	■	■	
ION-NOSTAT Plus			■	■	■	■			■	■	■	■	
ION-NOSTAT Comfort I.2				■	■	■	■	■			■	■	■
ION-NOSTAT LS Light 125.2						■	■	■				■	■
DASTAT-V.2		■	■	■	■	■			■	■	■	■	
DASTAT-EC				■	■	■	■	■			■	■	■
DASTAT-C					■	■	■	■			■	■	■
DASTAT-MF					■	■	■	■				■	■
DASTAT-GR			■	■	■	■	■	■	■	■	■	■	■
DASTAT-RS					■	■	■	■			■	■	■
DASTAT-P		■	■	■	■	■			■	■	■	■	
DASTAT-REC			■	■	■	■					■	■	

(*)
A one-to-one assignment of cleanroom garments to a cleanroom class according to EN ISO 14644-1 is not possible. Recommendations can only be made based on cleanroom specific necessities, such as „filtration efficiency" or „abrasion resistance". In the VDI guidance 2083 Part 9.2 the users will find additional information.

With this table we want to give you a recommendation for the use of our different cleanroom fabrics for outerwear for the different cleanroom classes. Here too, however, caution is advised, as the complete process environment must be taken into account. The entire clothing concept, i.e. the choice of model, the possible use of cleanroom-compatible intermediate garment, the change and cleaning cycle, etc., is also decisive.

Should you have additional questions or look for customised advices for your cleanroom, please feel free to contact us.

Resource conservation and sustainability are important criteria in the orientation of our cleanroom garment delivery programme

Our sustainable cleanroom fabric **DASTAT-REC** is made from 100% recycled PET bottles. Extensive studies and tests at independent, internationally recognised textile research institutes prove that **DASTAT-REC** also meets the requirements of critical processes in cleanrooms. During the studies – as with all textiles used by Dastex - special emphasis was placed on taking age-related effects into account.

The raw material is certified according to the Global Recycled Standard (GRS) and the fabric has been awarded the OEKO-TEX® STANDARD 100 label for textiles tested for harmful substances.

For more information please contact us!

Textiles: Undergarments

Efficiency of cleanroom compatible undergarments

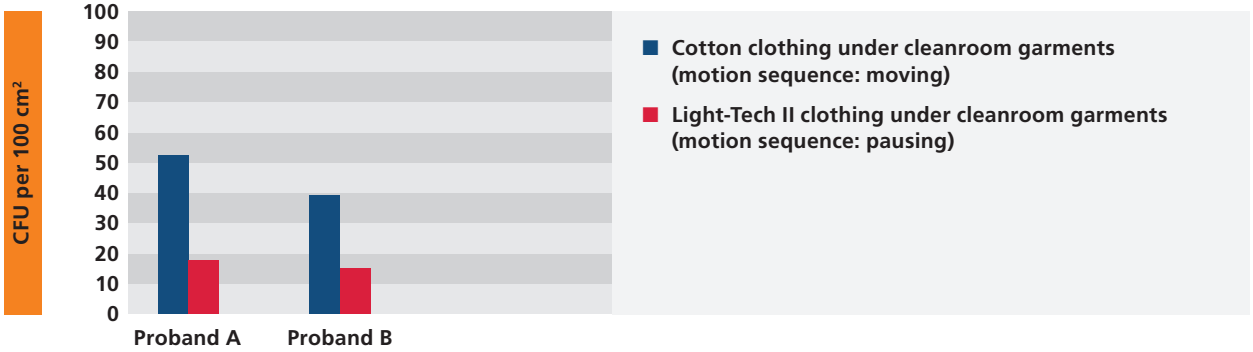
To reduce the particle emission of a human being in a cleanroom, it is necessary to wear suitable clothing beneath the coverall or lab coat. These cleanroom compatible undergarments are worn on top of the personal underwear. It is important that these undergarments have no negative impact on the wear comfort (see to this Study 1 on page 60) and also that no additional particles are generated. Therefore, as with the garment, the textile is to be manufactured from synthetic continuous filaments and not from short staple fibres.

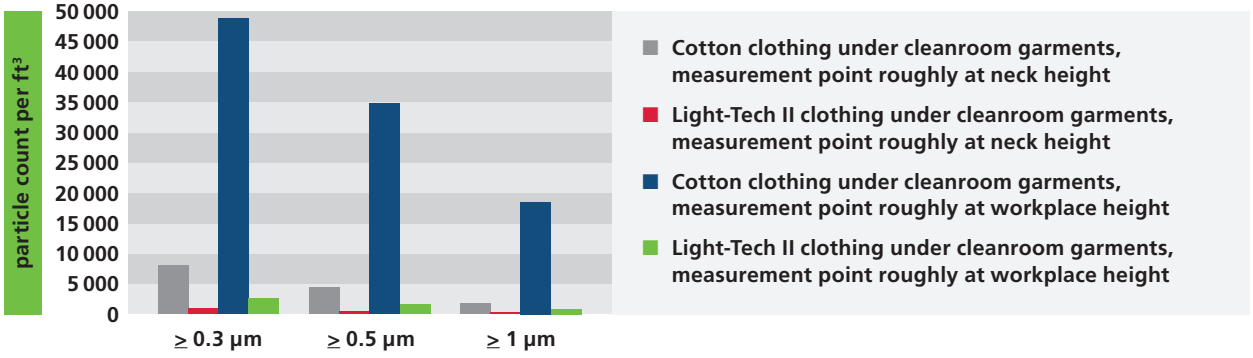
In this chapter we introduce you to our fabrics for undergarments.

Polyester was accepted for a long time as uncomfortable because the surface touch was perceived as particularly unpleasant and transpiration appeared to be unavoidable. This has changed noticeably in the last few years. Functional garments, especially in sportswear applications, have proven that synthetic textiles can be superior in many ways to natural fibres.
The textiles used by **Dastex** profit in a lot of cases from these new, positive wear comfort features.

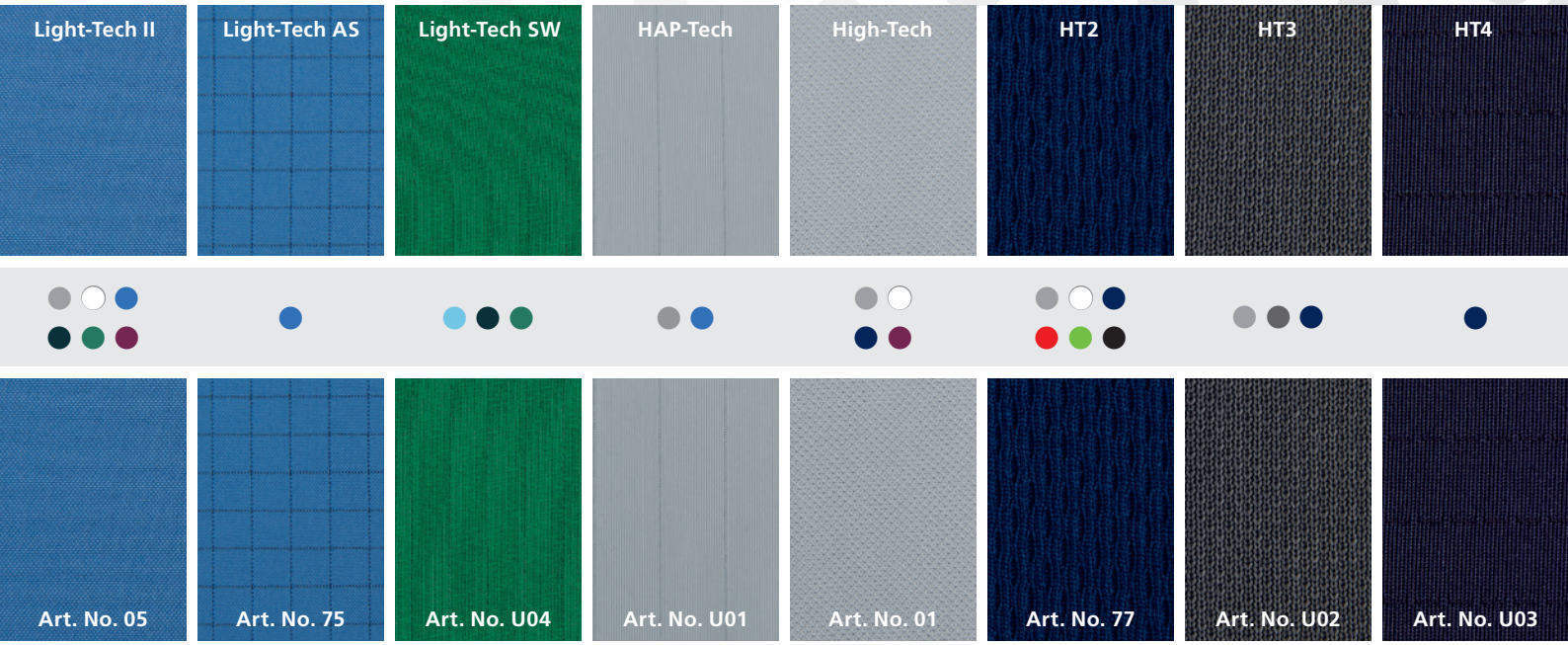
In general the use of cleanroom compatible undergarments for all applications in all cleanroom zones is to be recommended.

The diagrams visualise the influence of the chosen fabrics of the undergarments on the **microbiological contamination** of the cleanroom garments as well as **particle contamination** of the cleanroom air.





Textiles: Undergarments



grey · car grey · dark grey · white · blue · dark blue · navy blue · green · red · wine red · black

Light-Tech II

Light-Tech II is a polyester fabric (100% PES) made from microfibre filaments. This gives it a unique silky feel (haptics) and its lightness of wear is convincing.

Light-Tech AS

Referring to the proven polyester fabric Light-Tech II, conductive fibres were incorporated in warp and weft directions in a 5 mm pattern so that – depending on requirements – additional antistatic characteristics can be offered (98% PES / 2% Carbon).

Light-Tech SW

The textile Light-Tech SW combines a low mass per unit area with an extremely pleasant touch (silk-like). Due to the use of conductive fibres in the warp direction, the fabric Light-Tech SW also has antistatic properties. The antimicrobial finish reduces possible germ growth as well as the often resulting odour formation already under the cleanroom garment.

HAP-Tech

HAP-Tech is the heavy fabric quality of Light-Tech II and is primarily used for cleanroom-compliant undergarments, which should also be worn outside the controlled zones. Due to its texture, it is slightly warmer and also allows model designs that would not be possible with knitted fabrics and/or the lighter version Light-Tech II. In addition, HAP-Tech has conductive fibres and therefore has antistatic properties.

High-Tech

This knitted fabric consists of a polyester knit fabric (100% PES). Due to the smooth surface it is very robust and durable. In comparison with HT2 and HT3 the wear comfort features are somewhat lower.

HT2

In the range of undergarments, the knitted fabric HT2 is enjoying ever-growing popularity. HT2 is a modern functional textile that combines both technical properties and functional

In part 3 (Sample Cards & Technical Data) you will find an extensive selection of our fabric samples, we will be happy to send you more on request.

If you would like to carry out wearing tests, please contact us!

characteristics. The very flexible, snug knitted fabric is based on the COOLMAX® freshFX™ technology already known from sportswear.
This means that in addition to the excellent wearing comfort properties such as breathability and the "cooling effect" from the COOLMAX® freshFX™ fibres, there are also antimicrobial properties.
By embedded silver ions in the COOLMAX® freshFX™ fibres, microbial growth on/in the textile is reduced and thus also unpleasant odour formation is prevented/reduced..

HT3

In addition to HT2, our standard delivery programme includes the further developed textile HT3, also – like HT2 – a knitted fabric.
In the development of the high-performance knitted fabric HT3, the main focus was on providing the wearers of cleanroom undergarments with a material that can develop both slight cooling effects if required, but also has a heat-insulating effect in the opposite direction if necessary.
Special hollow fibres (Thermo°Cool Fresh™ technology) are used for this purpose. With HT3, too, silver ions are firmly (non-migrating) incorporated into the synthetic fibres.
Thus, like HT2, HT3 has an antimicrobial effect, i.e. germ growth on/in the textile is hindered and possible odour nuisance is reduced.
With the additional use of elastane fibres, the wearing comfort properties (especially haptics and elasticity) are significantly improved once again.

HT4

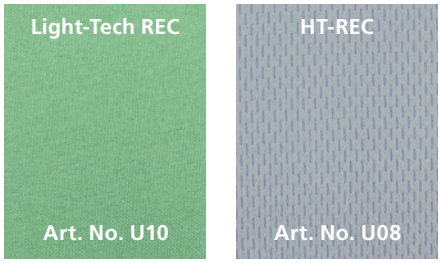
A special feature within our range of functional fabrics is the knitted fabric HT4. This textile is a combination of Thermo°Cool Fresh™ (47.5%), Thermo°Cool™ (47.5%), polyester (3.5%) and 1.5% carbon/polyester. Therefore HT4 offers very similar product characteristics to HT3 but with additional antistatic properties.

Light-Tech REC

The fabric Light-Tech REC made of recycled material (100% PES) is, like Light-Tech II, mainly used for the manufacturing of so-called cleanroom-compatible intermediate garments (undergarments). As with Light-Tech II, the low mass per unit area combined with its extremely pleasant touch (similar to silk) are the special features of this fabric.

HT-REC

HT-REC, made from recycled material (100% PES), is a modern functional fabric that, like HT2, combines both technical properties and functional characteristics. The very flexible, snug knitted fabric uses special polyester fibres, already known from sportswear, for a cooling effect on the human skin. Like HT2, HT-REC has excellent wearing comfort properties such as breathability, "cooling effect" and a soft, pleasant touch.



light green

grey navy blue

CLEAN GREENCYCLE™ by dastex

Cleanroom garments

= A garment system often composed on different models.

Cleanroom garments are the only (defined) filters between employees and the actual cleanroom where the products are manufactured. As is known, the human being is still one of the largest particle sources in controlled environments and accordingly the definition of the clothing system has a lot to take into account. In this chapter we will give you general information and recommendations for cleanroom garments and introduce our models to you.

Model variety

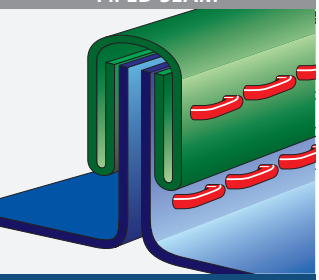
Ultimately **Dastex** can access several 1 000 models or model variants. Individual solutions therefore do not cause a problem. Custom-made solutions won't present a problem just despite as standardized models. Even the manufacturing of special sizes and the joint development of new articles are part of our day-to-day business. From page 28 unwards you will find extracts of standard models and special solutions.

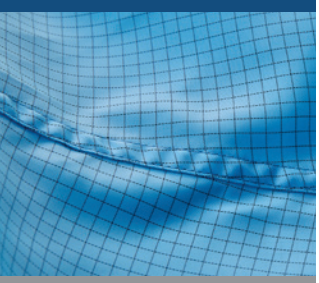
Cleanroom garments on stock

In our head and operational office in Muggensturm (Germany) we have the most common models for you in store. Hence it is possible for us, if required (for example crew changes), to react extremely quickly and deliver the goods to you within hours.

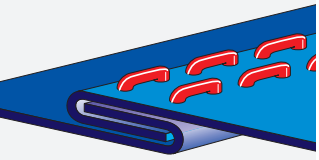
You can find an overview of our stock items on page 59!

PIPED SEAM





FELLED SEAM



Interesting facts on cleanroom garments

Cleanroom garments supplied from **Dastex** will, depending on requirements, be manufactured from different cleanroom fabrics. An overview about the cleanroom fabrics used by **Dastex** and their technical features can be found in chapter 1.2. The garment is easy to decontaminate and in most instances sterilisable (suitable for autoclave up to +134 °C as well as suitable for gamma or beta irradiation). Shrinkage of the garment within the usual tolerances (as well at washable decontamination as with autoclaving) is possible. Should the garment be sterilised, certain clothing elements (e.g. zip) have to be adapted to each applied sterilisation method. We are happy to advise you about this prior to order.

Manufacturing quality

We put particular emphasis on the manufacturing quality of our cleanroom garments and pay particular attention to quality control during and after production process. The production of our garments is exclusively within Europe.

For our cleanroom garments we mainly use the piped seam (internal designation: tunnelled seam) as closing seam. This means that the two fabric edges are enclosed with a polyester strip and secured to each other with an additional seam. This reduces the risk that a seam can open unnoticed allowing particles to escape.

Optionally we can also offer for all products the flat felled seam, which is equally suitable for cleanroom garments.

Cut

The cleanroom garment has to optimise the mobility for the user without creating an „air pocket". Hence a differentiated size scaling enables individual adaptation for each wearer. In the following pages you will find a size table which can be used for guidance. We would always recommend a fitting with a decontaminated sample size set before every order.

If you have questions with regard to this or need additional information, you are welcome of course to contact us.

Size assignment Dastex gender neutral sizes

The sizes listed here are referring to practical experience and are not binding. In order to ensure correct fitting of the sizes we would be pleased to supply you sample pieces.

Sizes	EEES/ XXXS	EES/ XXS	ES/ XS	S	M	L	EL/ XL	EEL/ XXL
Women	34	36/38	40	42	44/46	48/50	-	-
Men	-	44	46	48	50/52	54/56	58/60	62

For many models standard sizes 3EL (3XL) and 4EL (4XL) are also available. In a case where none of the sizes from the sample size set fits, we are able to do size alterations, respectively individual adjustments.

You can find explanations for special sizes on page 58.

Product recommendations referring to cleanroom classes

Recommendations (*)	Cleanrooms and associated controlled environments – Part 1 Classification of air cleanliness by particle concentration EN ISO 14644-1								Hygiene zones according to GMP (microbiological controlled areas)				
Article description	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**low dust**	**A**	**B**	**C**	**D**	**E**
Overall		■	■	■	■	■	■	■	■	■	■	■	■
Coverall with integrated hood		■	■	■					■	■	■		
Jacket in combination with trousers				■	■	■	■	■			■	■	■
Lab coat					■	■	■	■			■	■	■
Full cover hood			■	■					■	■			
Eye slit hood		■	■	■					■	■			
Simple hood					■	■	■	■			■	■	■
Overboots		■	■	■					■	■			
Overshoes				■	■	■	■	■			■	■	■
Clogs with textile shaft			■	■	■				■	■	■		
Shoes with textile shaft			■	■	■	■	■				■	■	
Apron[2]		■	■	■	■	■	■		■	■	■	■	
Sleeve protector[2]		■	■	■	■	■	■		■	■	■	■	

[2] only in combination with the appropriate garments

(*)
A one-to-one assignment of cleanroom garments to a cleanroom class according to EN ISO 14644-1 is not possible. Recommendations can only be made based on cleanroom specific necessities, e.g. a coverall is in all „tighter" than a lab coat, or a full protective hood covers hair better than a bouffant cap. In the VDI guidance 2083 Part 9.2 the users will find additional information.

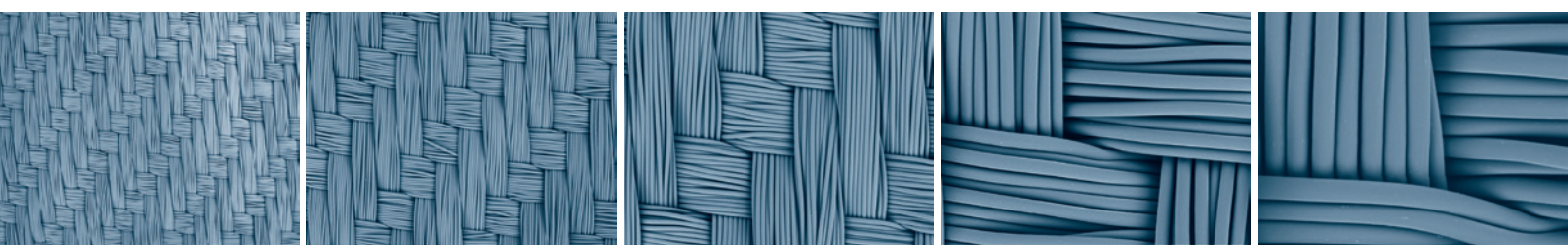
In this table we suggest which models can typically be worn in which environment. As already pointed out in chapter 1.2, when making the choice of cleanroom garments, the complete manufacturing environment needs to be considered. Factors such as the particular used cleanroom garment, as well as the chosen undergarment, influence the model recommendation to a high degree.

We would be happy to examine together with you your process environment and the relevant requirements for the cleanroom garment in detail and offer you hereupon based appropriate recommendations.

OEKO TEX®
STANDARD 100
15.0.65000
Hohenstein HTTI
www.oeko-tex.com

OEKO-TEX® certificate

Our cleanroom garments and undergarments are OEKO-TEX® STANDARD 100 certified.
This applies to standard versions of coveralls, hoods, lab coats, trousers as well as T-shirts and pullovers.



Cleanroom garments

Model variety

In this chapter different models of cleanroom garments are introduced

For each model initially the basic design is described. In the following you will find an overview of additional possible outfits as well as a choice of already developed special models.

Often in practice it turns out that certain details in the operating/production process ask for special requirements for the cleanroom garment and hence standard designs will not be considered or have at least to be modified. It is quite possible that other users had similar „problems" and we have already found an approach. **Dastex** is happy to offer the opportunity to develop and implement bespoke designs in cooperation with the end-user. The following models represent just an extract of pre-existing concepts, and may help in finding a solution to your special requirements.

The complete model and variation diversity cannot be exhibited inside this catalogue. If you are interested in individual solutions or ideas and would like make them a reality with us, we would be delighted to receive a message.

To offer our customers the largest possible flexibility in the definition of their clothing systems, it is possible in many cases to choose freely – like in a modularized system – between standard options and special accessories. That is the reason why a rigid basic article system cannot work.

The basic article numbering system is explained on page 72.

Cleanroom garments

Overall

Basic model 01 with additional equipment: knitted cuffs on sleeves and trouser legs

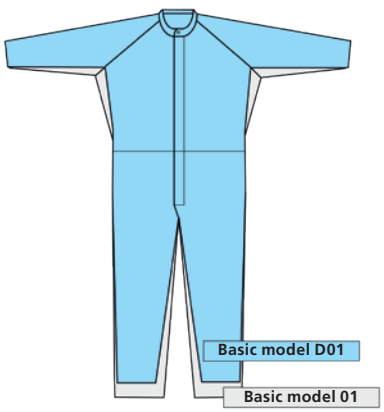
Basic model D01 with additional equipment: knitted cuffs on sleeve ends

Basic model 01, special model: elastic (40 mm) leg end with elastic strap

Main features of the cleanroom overalls are the double-covered zipper (to the outside and towards the body), raglan sleeve cut (for mobility) and a stand-up collar with press stud closure. Additionally a width-adjustable elasticated waistband is worked in to fit the width of the waist.
Further additional equipment is free selectable.

The optimized fit of the new basic model D01 is the implementation of the cut development according to new serial measurements in Germany.

Compare the cut:



Overall basic model 01 / Overall basic model D01

- profile zipper covered inside and outside
- adjustable waistband inside for width regulation
- stand-up collar with press stud closure
- raglan sleeve cut
- sleeve and trouser ends are free selectable (standard: press studs)

The overview of all basic and additional equipment for your individual overall can be found on pages 36 – 37.

ESD models see pages 47 – 48.

Coverall with integrated hood

Basic model 05 with additional equipment: knitted cuffs on sleeves

Basic model 05, special model: zipper up to the chin

The coverall with integrated hood is based on model 01 and has an additional sewn-on hood that can also be configured.

Coverall basic model 05 with integrated hood

- profile zipper with double cover in front
- adjustable inside waistband for width regulation
- raglan sleeve cut
- integrated hood with adjustment in the back free selectable (standard: press studs at the back for setting of head circumference)
- hood cover free selectable (standard: flat hood cover)
- lower sleeve end free selectable (standard: press studs)
- trouser end free selectable (standard: press studs)
- neck cuff free selectable (standard: metal press studs ahead)

The overview of all basic and additional equipment for your individual overall can be found on pages 36 – 37 and 40.

ESD models see pages 47 – 48.

Cleanroom garments

Coverall / overall with zipper at legs

Basic model C01:
Overall with zipper at legs

Closing the zip fastener

Basic model C05: Coverall with zipper at legs and integrated hood with open field of view

Basic model C07: Coverall with zipper at legs and integrated eye slit hood

The main feature of the coverall/overall with zipper at legs is a continuous zipper in the inner leg seam. In contrast to the classic coveralls, this one has no zipper and no seams in the front part. The elastic waist band is fixed in the back part and is not flexibly adjustable due to the dressing procedure. Further additional equipment is free selectable.

Coverall/overall with zipper at legs basic models

- spiral zipper in the inside leg seam
- waistband with tight gathering in the back part
- raglan sleeve cut
- arm/leg ends are free selectable

Basic model C01

- short zipper at the collar
- supplementary hood models and sizes are free selectable

Basic model C05

- integrated hood – open field of view

Basic model C07

- integrated eye slit hood

The overview of all basic and additional equipment for your individual overall can be found on pages 36 – 37 and 40.

ESD models see pages 47 – 48.

The leg ends of the coveralls with zipper at legs are different to all other overall models due to the zipper in the inner leg seam.

Trouser ends

1. open at both sides and press studs at the hem
2. open at both sides and elasticated cuffs 40 mm at the hem
3. open at both sides with shortened zipper and press studs to shorten the leg length
4. closed at both sides and knitted cuffs
5. closed at both sides and knitted cuffs with elastic strap

Dressing procedure for coveralls with zipper at legs

Cleanroom garments

Coverall with zipper at legs and integrated eye slit hood – an example of a special model with higher protection

Forehead area, 2-layer:
comfortable to wear inside,
water-repellent outside*.

Sleeve, 2-layer:
outside made of a particularly dense, liquid-repellent textile for protection against water-based liquids, such as e.g. disinfectants*.

Base material of the coverall:
made of the comfortable to wear, especially breathable and proven fabric ION-NOSTAT VI.2.

Sleeve end:
knitted cuff with thumb loop

Pant leg end:
press studs on the inside hem to attach to the inside of the pant leg, to prevent ground contact when dressing.

Adapted **field of vision**:
for wearing goggles.

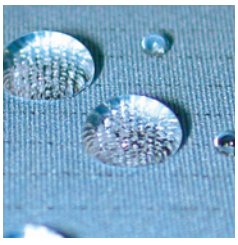
Gauze insert in the **mouth-nose area**:
for improved freedom of breathing. A suitable disposable face mask must be worn underneath.

Chest area:
made of water-repellent textile, more breathable than the one on the sleeves.

* **Forehead, chest and sleeve area**
are suitable for the prevention of the penetration of survivable contaminations (transpiration) due to their particularly water-repellent finish.

The coverall can of course be adapted to further special customer requirements!

Textiles with PTFE finish



Some application processes require that no liquids can pass through the fabric. For these special requirements, textiles are usually equipped with an additional PTFE (polytetrafluoroethylene) finish – colloquially also called Teflon™ finish – which is intended to prevent the penetration of a water-based liquid as far as possible.

However, the effect of the finish diminishes with increasing washing cycles, but, depending on the application, can be refreshed as required by a textile service partner.

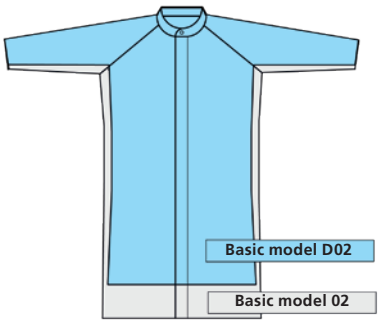
Lab coat and lab coat with integrated hood

Basic model 02 with additional equipment: knitted cuffs on sleeve ends

Basic model D02 with additional equipment: knitted cuffs on sleeve ends

Basic model 08 with additional equipment: knitted cuffs on sleeve ends and zipper in front

Compare the cut:



The **lab coat** is characterized by a raglan arm cut and a stand-up collar with press stud closure.
The optimized fit of the new basic model D02 is the implementation of the cut development according to new serial measurements in Germany.

Lab coat basic model 02 / Lab coat basic model D02

- collar closure with one press stud
- raglan sleeve cut
- lower sleeve ends free selectable (standard: press studs)
- closure in front free selectable (standard: metal press studs)

The **lab coat with integrated hood** is also characterised by a raglan sleeve cut and has a firmly sewn-on hood which can be closed at the front with press studs. The width of the hood can be adjusteded at the back.

Lab coat with integrated hood basic model 08

- integrated hood with adjustabilities at the back free selectable (standard: snap fasteners for setting of head circumference)
- raglan sleeve cut
- lower sleeve ends free selectable (standard: press studs)
- neck cuff ahead free selectable (standard: metal press studs)

The overview of all basic and additional equipment for your individual lab coat can be found on pages 36 – 37 and 40.

ESD models see pages 47 – 48.

Cleanroom garments

Jacket

Basic model 03 with additional equipment: knitted cuffs on sleeve ends

Basic model J01 with additional equipment: knitted cuffs on sleeve ends

Special model shortened with zip in model colour

Special model with elasticated cuffs on sleeve ends without coloured piping

The jacket is cut slightly shorter than the lab coat and also has a stand-up collar. We offer two different standard jacket models.
Further additional equipment is free selectable.

Jacket basic model 03

- profile zipper sidelong staggered (not covered)
- stand-up collar with flap and press stud closure
- raglan sleeve cut
- lower sleeve ends free selectable (standard: press studs)
- slits on the side for mobility

Jacket basic model J01

- stand-up collar
- front profil zipper in centre
- spherical arm cut
- cover strip outside
- yoke both at the front and at the back
- 40 mm elasticated waistband on the hip seam
- lower sleeve ends free selectable (standard: press studs)

The overview of all basic and additional equipment for your individual jacket can be found on pages 36 – 37.

Trousers

Basic model 06 with additional equipment: knitted cuffs on trouser ends

Basic model H01 (Jeans style)

Basic model 90

Adjustable waist band

Waist elastic adjustable via drawstring

As with the jacket, we have two trouser models as standard as well as the basic model 90 from chapter 1.5 (Cleanroom undergarments). The trousers „basic model 06“ have a slightly wider cut and are adjusted in width by a waistband. The trousers „basic model H01“, also called Jeans style, have a narrower but comfortable cut.

Trousers basic model 06

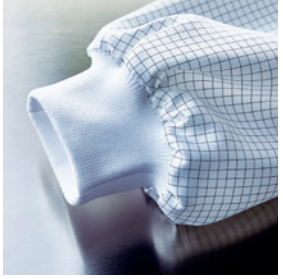
- elasticated waistband adjustable by button
- trouser ends free selectable (standard: press studs)

Trousers basic model H01

- put on waistband
- belt loops
- covered zipper with front press stud closure
- piped seam
- trouser ends free selectable (standard: press studs)

Trousers basic model 90 see page 56.

The overview of all basic and additional equipment for your individual trousers can be found on pages 36 – 37.



Short
knitted cuff

Elastic cuff with
opening for thumb

Garments
Arm and leg cuffs

- knitted cuffs
- conductive knitted cuffs
- combi cuffs (elastic cuff on the outside, knitted cuff on the inside)
- press studs
- simple hem
- elasticated cuffs (small and wide)
- thumb loop
- elasticated cuff with elastic strap

Conductive
knitted cuff

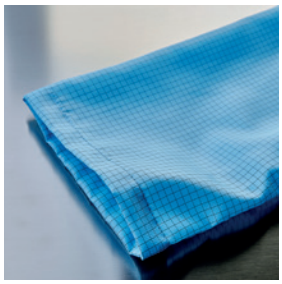
Combi cuff
(elastic cuff on the
outside, knitted cuff
on the inside)

Wide elastic cuff
(40 mm)

Long conductive
knitted cuff

Double elastic cuff
(40 mm and 8 mm)

Normal
hem



Knitted cuff

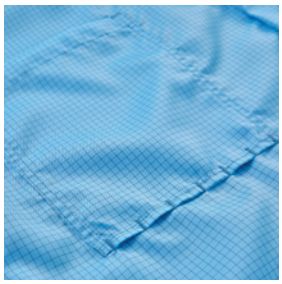
Press studs
at hem

Loop for
mobile phone

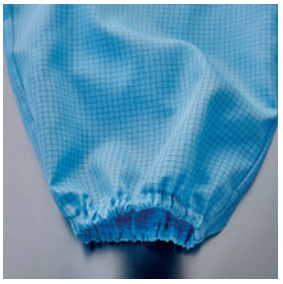
Elastic cuff
40 mm
and
elastic stirrup

Garments
Pocket variations

- open pockets
  (in various dimensions)
- pockets with lockable flap
- net pockets
- pockets with outlets
- removable pockets
- other options



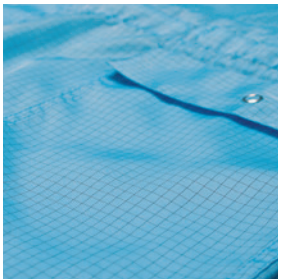
Small elastic cuff
(8 mm)



Pocket with outlets

Pocket with outlets at
sides cut diagonally

Open pocket



Pocket with flap
to close

Loop for pencil short

Imprint with company logo

Additional press studs at the back or on the side of the trouser leg for attaching overboots

Loop for pencil long

Collar with loop and two press studs

Spiral zipper

Two-way zipper

Net pocket for ID-card

Profile zipper

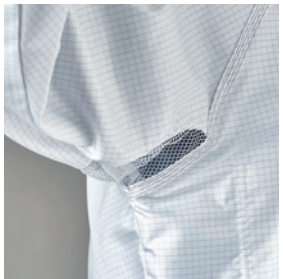
Garments
Additional special options

- different zippers:
  profile, spiral, metal, two-way
- reinforced cover strip for zippers
- reversible collar (for lab coats)
- personalised markings / coding
- name clip bands
- logos
- net inserts and reinforcements
- other options available on request

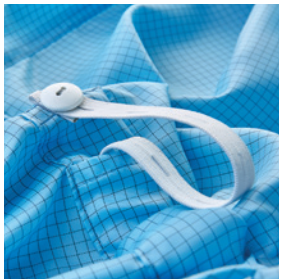
Press studs to attach on sleeves/waist or trouser legs/thighs to avoid contact with the floor during the dressing procedure

Thumb loop

Clipband for names



Net under armpid



Adjustable waistband inside for width regulation

Cleanroom garments

Hoods

Full cover hood basic model 20 with ballon shaped top (bouffant)

Cleanroom hoods are very sensitive accessories because they have to fit perfectly to cover the critical area, the visual field, without diminishing the work of the operative. With a full protective hood, the eyes, nose, mouth and chin are not covered, making it important that the face mask shall be adjusted accordingly.

With the eye slit hood on the other hand, only the eye area is open, which can be covered by using cleanroom goggles.

Full cover hood basic model 20
- top form free selectable (standard: flat top shape)
- adjustment options free selectable (standard: rear press studs for adjusting the head circumference)
- spiral zipper in front

Eye slit hood basic model 21
- top form free selectable (standard: flat top shape)
- adjustment options free selectable (standard: rear press studs for adjusting the head circumference)

Equipment Hood
- optional hood tops: flat, half-height or ballon shaped (type bouffant)
- press studs at the back to adjust the head circumference
- buckle at the back to adjust the head circumference
- straps for tying and adjusting the forehead circumference
- press studs for fastening the face mask
- slits for temple spectacles
- bands under the armpits and press studs at the front avoid slipping when putting on the overall
- ear net (in two different material versions)

The overview of all basic and additional equipment for your individual hood can be found on page 40.

Options on additional standard hoods

Bouffant cap basic model 62

Hood with elasticated neck part basic model 63

Peaked cap basic model 66

Cap with neck guard customer model

Eye slit hood basic model 21
with flat top

Full protection hood special model 23,
narrowed field of vision, bouffant top,
special design for spectacle wearers

Eye slit hood special model 21,
gauze in the mouth-nose area,
flat top

Textile face masks (attachable to the hood)

Basic model 40

- made of cleanroom fabric, with two darts to give shape
- fixing possibilities: press studs as standard
  (Velcro fastener possible on request)

Basic model 43

- made of cleanroom fabric with gauze strip
  (different woven net veil qualities available)
- fastening possibilities: press studs inside as standard
  (Velcro fastener possible on request)

Basic model 40

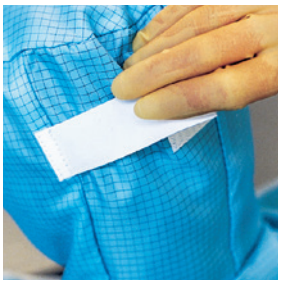
Basic model 43

Variations

Additional equipment for hoods

Ear net
extra fine meshed

Full cover hood
basic model 20
with flat top



Adjustable
Velcro fastener

Cover of the
zipper slider
at the chin

Face mask
with press studs
inside

Face mask
with press studs
outside

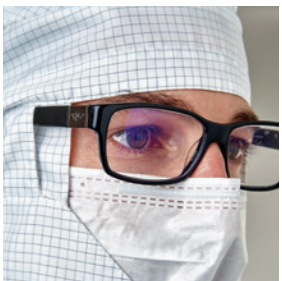
Bands under the
armpits and press
studs at the front
avoid slipping
when putting on
the overall

Full cover hood
basic model 20
with bouffant top

Face mask
with Velcro fastener
outside

Press studs to
adjust the hood
at the back

Buckle as stepless
adjustment possi-
bility at the back



Special design:
slits for temple
spectacles

Cleanroom garments

Eye slit hoods for the use of the hood-goggles combination in GMP zones A and B

Basic model 24
Mouth area made of gauze, duckbill shaped

Basic model 25
Mouth area made of cleanroom fabric

Basic model 26
Mouth area made of gauze, semicircular

Our product innovation was nominated for the renowned Red Dot Award and was selected as the winner!

reddot winner 2020

Hood basic models 24 / 25 / 26
- eye slit hood with nose cover and nose bridge (clip)
- half-high head attachment with inner ring
- buckles on the side to click on the safety goggles

Additional equipment
- bands under the armpits
- width adjustment on the hood: buckle, press studs, velcro tape

One of the most frequently discussed points of a cleanroom garment system for use in sterile areas is certainly the goggles prescribed in Annex 1 (GMP guidelines). Without doubt, this is not a boon from the point of view of wearing comfort, but from a cleanroom point of view, it is a garment element that has its justification.

The fact that beard hairs and hairs on the scalp have to be covered is understandable for everyone, but consequently also the eyelashes and eyebrows together with the corresponding skin areas.

Relevant decision criteria
- fit
- field of view (as unrestricted as possible)
- anti-fogging properties
- no impairment of visual acuity
- ventilation system of the frame
- easy handling
- secured covering of all still open skin areas in the face

Adaptable safety goggles see following page!

Only two clicks and pulling on two straps – the goggles fit and are fixed

Removing the goggles from the packaging

Inserting the buckle on the first side

Inserting the buckle on the second side

Adjustment of the strap

Disposable and reusable protective goggles

Model selection

The model variety of cleanroom safety goggles has increased significantly due to growing importance and regulatory requirements. Typical differentiation criteria are:

Cleanroom protection goggles with direct ventilation
Here the air can reach the lenses inside unhindered, usually from above. A major advantage: the lenses fog up less. Disadvantage: Contamination can escape unhindered via the large openings.

Cleanroom protection goggles with indirect ventilation
With these frame constructions, the air only enters the goggles via „detours". The risk of contamination, e.g. hair or skin scales escaping, is thus significantly lower. However, these goggles often fog up more quickly. But then, when cleaning overhead with detergents or disinfectants, they offer significantly better protection against the unwanted entry of liquids.

Cleanroom protection goggles with anti-fogging equipment
Especially for protection goggles with indirect ventilation, goggles lenses with special coatings against fogging are recommended. However, these lenses with such special options have to be replaced more frequently, as the coatings are affected more quickly by the cleaning, disinfection or sterilisation processes.

Art. No. 4081403

Art. No. 4081400

Art. No. 4081401
For small faces

	Description	sterile	autoclavable	Coating	Colour
reusable	**SUPBLCLAVE** indirect ventilation, for prescription glasses/face mask	no	10 – 30 cycles	anti-fog/ scratch resistant	○
reusable	**COVACLAVE** indirect ventilation, drain channel for liquids	no	10 – 30 cycles	anti-fog/ scratch resistant	○
reusable	**uvex ultrasonic CR** indirect ventilation, adjustable headband	no	20 cycles	anti-fog	○
reusable	**UNIVET® 611.S0.00.00** direct ventilation / **UNIVET® 611.S0.00.01** direct ventilation	no	40 cycles	none/ anti-fog/scratch resistant	●
reusable	**UNIVET® 611.S1.00.01** indirect ventilation	no	10 cycles	anti-fog/ scratch resistant	●
reusable	**BioClean Clearview™ BCAP** indirect ventilation, special elastic band	no	40 cycles	anti-fog/ scratch resistant	○
reusable	**ELITE AUTOCLAVE ELATPR** direct/indirect ventilation at the top, indirect below	no	10 – 30 cycles	anti-fog/ scratch resistant	○
reusable	**ELITE AUTOCLAVE ELATPR2** direct ventilation at the top, sealed bottom	no	10 – 30 cycles	anti-fog/ scratch resistant	○
reusable	**ELITE AUTOCLAVE ELATPRS – small version** direct ventilation at the top, sealed bottom	no	10 – 30 cycles	anti-fog/ scratch resistant	○
disposable	**BioClean Clearview™ BCGS1** indirect ventilation, strap made of silicone rubber	yes	–	anti-fog/ scratch resistant	⊘
disposable	**VisitorSpec – visitor goggles with temples** with all-round protection, without distortion	no	–	scratch resistant	●

Frame and/or temple: ○ white ● black ● blue ⊘ transparent

We are expanding our product range – if you are interested, please contact us!

Frame	PPE classification	Packaging	Packaging unit	Art. No.
TPR	EN 166	PE primary bag	5 pieces in a carton individually packaged	40841
TPR	EN 166	PE primary bag	5 pieces in a carton individually packaged	40845
PP/TPE	EN 166/EN 170 5-1,2	PE primary bag	4 pieces in a carton individually packaged	4088100
TPE	EN 166	PE primary bag	5 pieces in a carton individually packaged	40850 / 40850 -1
TPE	EN 166	PE primary bag	5 pieces in a carton individually packaged	40855
TPR	EN 166	PE primary bag	12 pieces in a carton individually packaged	408041
TPR	EN 166	PE primary bag	5 pieces in a carton individually packaged	4081403
TPR	EN 166	PE primary bag	5 pieces in a carton individually packaged	4081400
TPR	EN 166	PE primary bag	5 pieces in a carton individually packaged	4081401
PVC	EN 166	double Tyvek®/ PE bag	60 pieces in a carton individually packaged	408050
PC	EN 166/EN 170	PE primary bag	200 pieces in a carton individually packaged	4081110

On request, we can replace the adjustable straps on some goggles with a belt strap to reduce the pressure the straps exert!

Replacement lenses and tapes on request!

Cleanroom garments

Overboots

Different outsoles depending on requirements

Basic model S11 / Basic model S15

Basic model 56 with additional equipment: band with tilt buckle on top, bootleg without zipper

Basic model 53 with additional equipment: 2nd buckle on the forefoot

Basic model S14 with additional equipment: tie at the top and strap around ankle

The use of cleanroom overboots completes the protection of products and processes. The particles and germs emitted by humans from the shoe and leg area are retained. Here it is important to select the right outsole for the condition of the cleanroom floor cover.

Profile zipper with round metal slider

Overboots basic models

- front profile zipper
- elastic band and press studs as adjustment
- buckle made from plastic over instep

Basic model S11

- grey conductive plastic outer sole with pimpled tread

Basic model S15

- grey, slip-resistant and conductive plastic outer sole with honeycomb profile
- wider sole, specially developed for wearing over safety shoes

Basic model 56

- white plastic outer sole, slightly profiled, conductive, special heel form (pulled up for better hold of heel)

Basic model 53 with flexible outer sole

- flexible brown plastic outer sole
- due to the outer sole consistency we can also manufacture the basic model 53 in special sizes

Basic model S14

- conductive, slightly ribbed, anti-slip sole

Additional equipment overboots

- closed shaft (without front zipper)
- various zipper qualities
- strap to tie in the seam (continuous) as upper shaft adjustment
- press stud at shaft to attach to garment
- synthetic leather-like reinforcement on heel and toes (only for model 56)

Plastic buckle with strap lock, different strap colours for size identification

Strap around the ankle – to optimize the hold – reduces the risk of accidents

Press studs on the side of the overboot to attach to the trouser leg

Tie strap in the hem (continuous) as upper adjustment at the top

Strap with tilt buckle at the top

Closed shaft (without front zipper)

Overshoes

Basic model D50

Basic model S04

Basic model D50

- flexibel grey synthetic sole
- elastic and press stud as single upper shaft adjustment

Basic model S04

- conductive, slightly ribbed outsole
- non-skid
- elastic band and press studs as single shaft adjustment at the top

Additional equipment overshoes

- integrated antistatic band
- individual heights/lengths
- individual coding
- customised imprints

For more cleanroom shoes & socks, see chapter 4 (Part 2).

Shoes and clogs with shaft / overstockings

ESD shoe with textile shaft

Clog with textile shaft

Overstocking with soft outer sole

For certain applications the classical overboots may not be suitable. Here, the special models with textile shaft/upper for shoes and clogs offer an interesting alternative. Which models can be used for this is to be clarified individually.

Overstockings with which you can slip into the shoe or clog are also a possibility in such cases.

Sleeve and knee protectors

Basic model 70, 40 cm long, with slight elastic bands

Basic model 70, 40 cm long, with broad elastic bands

Customer model, 60 cm long, with multiple elastic bands

Customer model, knee protector with pocket for pads

Cleanroom garments with special ESD requirements

On this topic we will be happy to advise you!

**Overall 01ESD1,
elastic cuffs (40 mm) at sleeve ends**

Quite often the process requirements include ESD specifications in addition to the classic cleanroom requirements. Dastex offers a wide range of different solutions for this. Many of our textiles comply the classic ESD basic requirements with regard to the dissipating of static electric charges (DIN EN 61340) and those for Electrostatic Protected Areas.
At the STFI Chemnitz two optimized coveralls and lab coats with ESD equipment, each made of the cleanroom fabrics ION-NOSTAT VI.2, DASTAT EC and ION-NOSTAT Plus, have been tested successfully according to DIN EN 61340. The cleanroom fabric ION-NOSTAT Plus has proved particularly successful here, due to its increased number of conductive carbon fibres.

Tested ESD overalls basic models

- felled seam
- front zipper made of plastic with covered strip in front and back
- back sleeve and back in one piece
- sleeve and side seams with conductive tape
- front raglan seams with conductive tape and antistatic yarn
- hanging loop in the middle of the collar at the back
- elastic wristband (8 mm) on the trouser end
- EPA woven label left side seam

##01ESD1

- elastic wristband (40 mm) on the sleeves

##01ESD2

- antistatic knitted cuffs on the sleeves

Cleanroom garments with special ESD requirements / Thermo-garments

Special equipment: press studs for fastening a grounding strap

Lab coat 02ESD2 with knitted cuffs, antistatic T3

ESD lab coat, customer model

Tested ESD lab coats basic models

- felled seam
- back sleeve and back in one piece
- sleeve and side seams with conductive tape
- front raglan seams with conductive tape and antistatic yarn
- hanging loop in the middle of the collar at the back
- EPA woven label left side seam

##02ESD1

- elastic wristband (40 mm) on the sleeves

##02ESD2

- antistatic knitted cuffs on the sleeves

piped seams

3-layer: ION-NOSTAT VI.2, Thinsulate™ quilted non-woven fabric, ION-NOSTAT VI.2

Thermo-garments

Thermo jacket with hood basic model J02

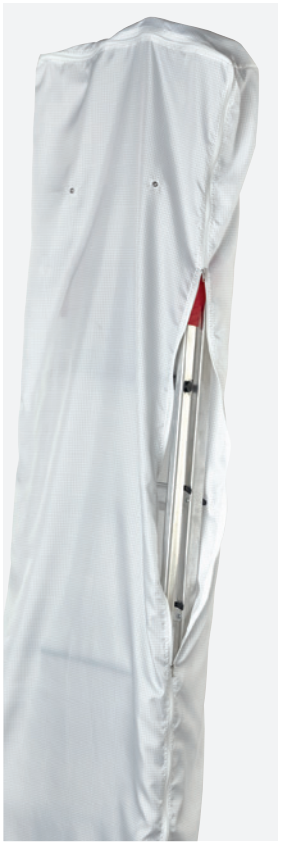
- 2-layered non-woven fabric (chest/shoulder/upper back), single-layered (beneath)
- hood with band to tie for closing
- front zipper made of synthetic material
- knitted cuff on sleeves
- hanging loop inside, centre of collar

Thermo trousers basic model H02

- waist tie with cord, adjustable with cord stopper
- press studs (metal) on the trouser legs (2-step adjustable)
- hanging loop at the back inside centre

Bag for
mobile phone

Tool bags
large and small



Textile special solutions

In addition to the usual cleanroom garments, special features often have to be considered.

Some standard solutions have been established for such special applications.

In individual cases, complete individual developments can also be realized.

Cover
for ladder

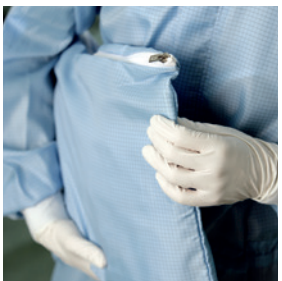
Bag at waist with
integrated belt

Cover for
cleaning trolley

Curtain

Cover for robots,
machines and
other equipment

Transpot bag,
e. g. for garments



Cleanroom undergarments

Functionality combined with design

Cleanroom suitable undergarments which can also be worn at any time outside of the cleanroom!

= A garment combination which can be worn in grey and black areas as well as under cleanroom garments!

Interesting facts about textile undergarments

Cleanroom undergarments are made of abrasion-resistant, synthetic materials compared to ordinary streetwear. This prevents large quantities of particles from entering the cleanroom uncontrolled by diffusion, migration or due to the overpressure under the cleanroom garment.

The particular efficiency of cleanroom undergarments has been proven in various measurements, amongst other at the DITV Denkendorf (see Study 2 on page 68).

In addition to this aspect, use of cleanroom undergarments can also improve the wearing comfort of the complete garment system and in this way can improve the acceptance of the employees.
A variety of fabrics are available for our cleanroom undergarments. The description of the fabrics can be found on pages 22 and 23.

Do you have questions regarding model choice?

We will be happy to advice you!

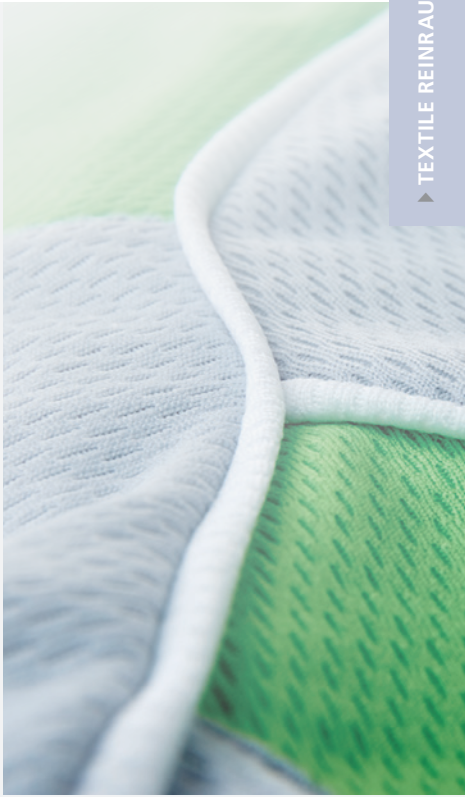
Model variety cleanroom undergarments

Top part

For the top of the undergarments, a model with long sleeves is always recommended. This covers the employee's arms completely and the skin does not come into direct contact with the fabric of the outer garment. There are exceptions in less critical areas.

The shirt and the pullover differ in cut. As the shirt is made exclusively of knitted fabric, which is more elastic, the shirt is tighter. The pullover is mainly made of microfibre fabrics and is therefore not elastic. For this reason, the cut is slightly wider.

The shirt and the pullover are available in different designs. Below we give you an overview of the most important models. Due to the variety of models and the different versions, we ask for your understanding that we cannot present all models and versions here.



Basic model 88

Polo neck with shoulder cover

At workplaces where employees complain that there is a draught, especially in the neck area, the so-called polo neck with shoulder cover offers a remedy.

Usually made of the functional textile HT3, this garment is simply worn under the cleanroom garment.

Cleanroom undergarments

T-shirt

T-shirt short sleeve, basic model 82 | T-shirt long sleeve, basic model 83 | T-shirt long sleeve in three colour design

The T-shirt is characterized by the use of a knitted fabric.
Depending on the kind of knitted fabric it is more or less elastic.

Short sleeve:
Basic model 80 (sleeve head cut)
Basic model 82 (raglan cut)

- collar cutting out shapes free selectable (standard: textile collar with round neckline, slightly overlapping in front)
- hemmed sleeve end
- hem at hip

Long sleeve:
Basic model 81 (sleeve head cut)
Basic model 83 (raglan cut)

- collar cutting out shapes free selectable (standard: textile collar with round neckline, slightly overlapping in front)
- sleeve ends free selectable (standard fabric cuffs or hem – depending on model)
- hem at hip

Important information on cleanroom compatible undergarments can be found on page 21.

Raglan cut (offers a better freedom of movement)

Sleeve head cut

Textile collar with round neckline

Textile collar with round neckline, overlapped in front

Three colour design

Textile collar with V-neck

Elastic band

T-shirt

Collar types

- textile collar with round neckline
- textile collar with round neckline, overlapped in front
- textile collar with V-neck

Sleeve ends

- hemmed sleeve ends
- knitted cuffs
- fabric cuffs (made of the basic material of the shirt)
- elastic band

Fabric cuff (made of the same basic material)

Knitted cuff

Flat seam

Polo shirt, special model

Hemmed sleeve ends

Cleanroom undergarments

Pullover and overall

**Pullover (long sleeve) basic model 86
with additional equipment: upper button bar and
slightly elasticated waistband on sleeves and hip**

**Overall basic model 31
with additional equipment:
elasticated bands on arm and leg ends**

Short-sleeved pullovers on request!

Pullover

The pullover is made of a microfibre fabric and is therefore inelastic.

Long sleeve basic model 86

- collar neckline free selectable (standard: fabric collar and button bar made of three polyacetal press studs.) However, we recommend the additional equipment „knitted collar with round neckline".
- sleeve ends free selectable (standard: elasticated wristband 4 mm)
- seam at hip height

Ends at hip height

- only seam
- elastic cuff (4mm or 15mm)
- knitted cuff

Overall

The overall can be made of knitted fabric as well as microfibre.
Optionally it can be completed with knitted cuffs, pockets, suspension bands etc.

Overall basic model 31

- textile stand-up collar
- spiral zipper in front
- adjustable inner waistband
- pocket insert in basic colour, hip left/right
- raglan sleeve cut
- elasticated bands (4 mm) on sleeve and trouser legs

Knitted cuff
as sleeve end

Elastic band
as sleeve end

Knitted collar
with V-neck

Pullover

Collar types

- knitted collar and button bar with three polyacetal press studs
- knitted collar with round neckline on non-stretch garment
- knitted collar with V-neck on non-stretch garment

Sleeve ends

- hemmed sleeve ends
- knitted cuffs
- elastic band

Knitted collar
with round neckline

Textile collar
with button bar

Special model:
Long-sleeved pullover
with special collar

Cleanroom undergarments

Jacket and trousers

Jacket
basic model 33

Basic model 90 made from Light-Tech II
with knitted cuffs

Basic model 90 made from HT2
with fabric cuffs

If you are interested, please contact us!

Jacket

The jacket of the undergarment can be made from knitted fabric as well as fine microfibre fabric. The jacket always has a wide elastic waistband and a round collar.

Jacket basic model 33

- elasticated band (slightly gathered) at hip height
- textile collar with round neckline
- zip fastener in front
- sleeve ends free selectable (standard: elasticated bands)

Jacket basic model 34

- two-colour design

Trousers

The trousers of the undergarment can be made from knitted fabric as well as from fine microfibre fabrics.

Trousers basic model 90

- tighter, but comfortable cut
- adjustable waistband (drawstring)
- 2 side pockets (optional)
- trouser leg end free selectable (standard elastic waistband) (see adjacent list „trouser leg ends“)

Fabric cuff, made of the basic material of the trousers (standard)

Elastic band

Loop
e.g. for ID card

Knitted cuff

Trousers

Trouser leg ends

- fabric cuff, made of the basic material of the trousers (standard)
- only hemmed
- knitted cuff
- elastic band

Pocket variations

- side pockets
- open pockets
- pockets with zipper
- other options on request

Side pocket

Trousers made from HAP-Tech basic model H01 (see chapter 1.4 / Trousers)

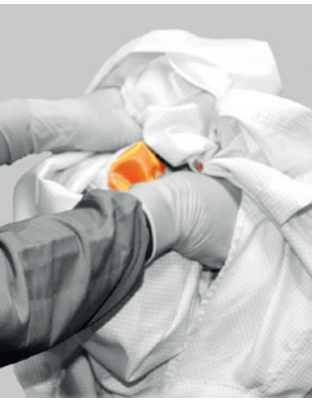
Trouser leg end only hemmed

Miscellaneous

Training coverall for dressing procedures






As part of employee training „correct dressing" of cleanroom garments is always a recurring subject. But what does „correct" mean?

From the viewpoint of the cleanroom plant operator, the answer has to be „correct dressing is when the laundered cleanroom garment is not going to be contaminated due to flawed handling".

When training on the dressing procedure, the vivid demonstration and the explanation of each single step are one of the essential problems of the prevailing training concept. This is especially true for the coverall because it is by far the most difficult garment part concerning contamination free dressing procedure.

Therefore we offer for training purposes a specially designed coverall which, due to colour applications, simplifies the correct dressing procedure. It is also important that during training all employees have the right size available. For a person who normally wears size ES, it is nearly impossible to put on a coverall size EEL correctly.

Dastex can offer you a training set (consisting of a coverall size set ES – EEL as well as an illustrative documentation on CD).

For further information to the subject of training we are happy to receive a call!

Special dimensions for textile garments / undergarments

In addition to the standard sizes/dimensions, there is also the possibility of having clothing made individually. However, the aim of special sizes should be to remain as close as possible to standard sizes in order to ensure reproducibility on the one hand and to keep the additional costs involved as low as possible on the other. A typical example from practice would be a coverall with the standard size L but with the leg length shortened by 10 cm and the arm length shortened by 5 cm.

More complex and therefore also associated with higher costs are special sizes where the cutting templates have to be adapted to a much greater extent. For this purpose, Dastex offers you a form to record the body measurements of the person concerned. Thereupon we first produce a release sample before the actually required (complete) number of garments is produced for this person.

You can download the form „Personal dimensions" to determine the dimensions on our website: **www.dastex.com / Media**

Cleanroom garments on stock – available for prompt delivery

As a rule, cleanroom garments are individually tailored and manufactured to suit the customer and his requirements

The advantage for the customer is that his wishes can be implemented accordingly. Due to the high diversity of variants and the associated production depth, corresponding delivery times must be taken into account.

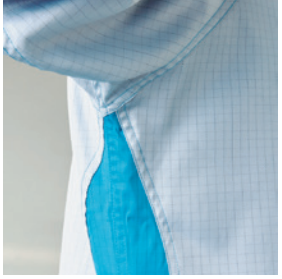
Of course, there are also applications where customers rely on simple standard models without special options. Or there may be situations that have to be served at short notice, such as a change of employees or special shifts etc.
In order to be able to meet these requirements as quickly as possible, Dastex has developed and built-up in the past a delivery programme for cleanroom garments as stock items.

Note:
The current stock quantities per article are designed in such a way that smaller required quantities per size can be absorbed. For larger quantities, our usual production and delivery times apply.

Garments should be decontaminated properly before first use by a specialist company (cleanroom laundry)!

Stock items – cleanroom garments

Garments	Short description	Fabric	Colour	Art. No.	Page
Overall (01)	knitted cuffs as arm and leg ends	ION-NOSTAT VI.2		1701LAG1	28
Coverall (05)	integrated hood, knitted cuffs as arm and leg ends	ION-NOSTAT VI.2		1705LAG1	29
Sleeve protector (70)	40 cm long, with broad elastic bands	ION-NOSTAT VI.2		1770LAG1	46
Lab coat (02)	with metal press studs	ION-NOSTAT VI.2		1702LAG1	33
Lab coat (02)	with zip fastener	ION-NOSTAT VI.2		1702LAG2	33
Full cover hood (20)	with flat hood cover	ION-NOSTAT VI.2		1720LAG1	38
Full cover hood (20)	with bouffant top	ION-NOSTAT VI.2		1720LAG2	38
Bouffant cap (62)	with elasticated neck part, 2 press studs	ION-NOSTAT VI.2		1762LAG1	38
Hood (63)	with elasticated neck part	ION-NOSTAT VI.2		1763LAG1	38
Cap (65)	side cap shape, 2 press studs	ION-NOSTAT VI.2		1765LAG1	38
Face mask (43)	made of cleanroom fabric with gauze strip	ION-NOSTAT VI.2		1743LAG1	39
Overboots (S11)	plastic buckle over instep, conductive sole	ION-NOSTAT VI.2		17S11LAG1	44
Overshoes (50)	with flexible outer sole	ION-NOSTAT VI.2		1750LAG1	45
Textile shaft (59)	for many low shoes of type 1	ION-NOSTAT VI.2		175932T1RV1LAG	46
Undergarments					
Shoulder cover (88)	with polo neck	HT 3		U0288LAG1	51
T-shirt long sleeve (83)	hemmed arm/hip, round neckline, overlapped in front	HT 2		7783LAG1	52
Trousers (90)	adjustable waistband (drawstring), fabric cuff	HT 2		7790LAG1	56
Pullover (86)	elastic band, knitted collar with round neck	Light Tech II		0586LAG1	54
Trousers (90)	adjustable waistband (drawstring), elastic band	Light Tech II		0590LAG1	56



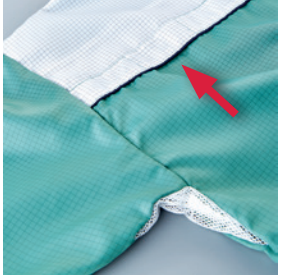
Special fabrics (see page 18) can be used individually for your requirements.

Design

Cleanroom garments do not always have to be single-coloured.

With coloured parts cleanroom garments can be designed more fashionable to promote therefore acceptance of the wearer and general motivation.

Design meets functionality



Ventilation slits in the front and back increase wearing comfort and can thus increase employee acceptance!

Certain parts, for example the sleeves or the front, can be colour-contrasted or made of a different material.

Different cleanliness zones can be clearly identified with the help of colours.

Sporty styles

Cleanroom garments background knowledge

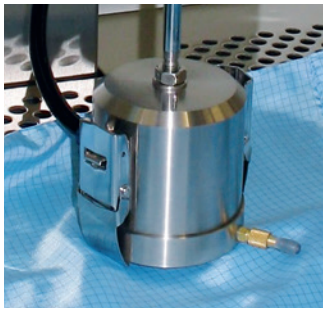
Cleanroom garments for different cleanliness zones

New filter test bench for cleanroom fabrics, a joint development by Dastex and Fraunhofer IPA (Stuttgart)

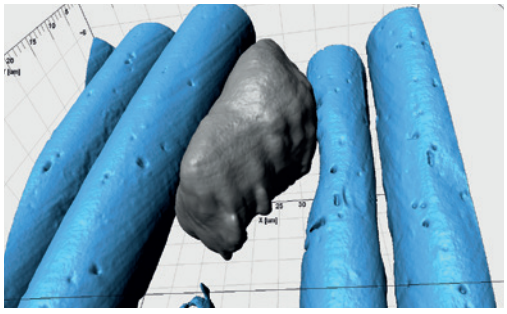
We will be happy to advise you on this topic!

A frequently chosen approach of defining cleanroom garments solely on the basis of the targeted air cleanliness class can lead to major problems for the user for a variety of reasons. Aspects of wearer comfort or additional special technical requirements, such as ESD requirements, cannot be assigned one-to-one to specific air cleanliness classes. The new VDI Guideline 2083, Part 9.2 takes a clear stance on this issue and provides corresponding guidelines that users can follow when defining of a clothing system.

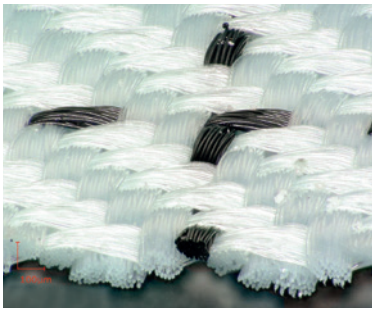
In accordance with this guideline, you will find information on pages 18, 20 and 26 on the different product properties of the different product properties of the different cleanroom textiles, weighted and also with corresponding recommendations.



Measurement of residual contamination



Microscope picture (CLSM) „Particles between textile fibres"



Microscope picture of ION-NOSTAT VI.2

Requirements for cleanroom garments

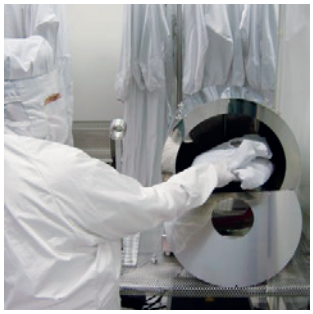
FROM A BUSINESS POINT OF VIEW:
cost-benefit ratio

FURTHER REQUIREMENTS FOR THE PROTECTION OF THE PROCESSES:
ESD / EPA requirements or outgassing behaviour

FROM USER'S POINT OF VIEW:
wearing comfort › breathability, pleasant grip and a good fit

FROM PRODUCT PROTECTION POINT OF VIEW:
filtration efficiency and abrasion resistance

ADDITIONAL REQUIREMENTS FOR THE PROTECTION OF THE WEARER:
protection from toxic substances or heat, cold, explosion, etc.



Requirements

- **from the point of view of product protection / process protection**
  Filtration efficiency in direct relation to the required level of cleanliness in the production process as well as the **highest possible abrasion resistance** so that the garment itself poses a very low risk of contamination.
- **from the point of view of the wearer (employee)**
  High breathability (keyword „sweat sensation") as well as **pleasant „handle" (haptics)**, the textiles used should feel as pleasant as possible on the skin.
- **further process requirements for the protection of the product / process**
  Possibly ESD / EPA requirements, as well as the **lowest possible molecular loads** (keyword: outgassing behaviour).
- **further process requirements for the protection of the wearer (employee)**
  Protection against toxic risks, heat or cold, explosions and cuts.

Wearing comfort / Employee acceptance

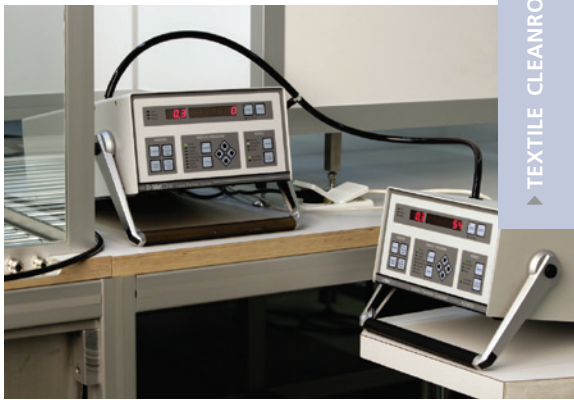
Thermal images show that heat can accumulate under the cleanroom garment over a period of time

In addition to the technical properties – retention capacity and abrasion resistance - wearing comfort is one of the most important characteristics of a cleanroom clothing system. Employee acceptance is mainly determined by wearing comfort. For this reason, **Dastex** has for many years attached great importance to the fact that wearing comfort properties are taken into account accordingly in new and further developments.

In addition to standard tests on water vapour transmission resistance (R_{et}), the majority of cleanroom garments produced by **Dastex** have been/are successfully certified in terms of „breathability". **Dastex** also attaches great importance to the „handle behaviour"– the haptics – of the textiles used.
It should be emphasised here that it is also extremely important for our company to understand cleanroom garments as a system when it comes to wearing comfort, specifically the „interaction" of cleanroom-compatible undergarments and the corresponding cleanroom garments.
In an extensive study (Study 1 page 68) with the Hohenstein Textile Testing Institute, different combinations of garments and undergarments were investigated with regard to a holistic view of wearing comfort properties. One component was also a direct comparison with ordinary (private) cotton clothing (as undergarments). This study unquestionably proves that modern functional cleanroom-suitable undergarment (made of synthetic fibres) clearly outperforms cotton undergarment in terms of wearing comfort. In addition, there are the cleanroom-relevant advantages of undergarment made of synthetic fibres with a significantly (> 50%) lower risk of contamination emanating from persons in controlled areas (Study 2 page 68).

With cleanroom garment systems, investments in a high level of wearing comfort also pay off financially for the respective company. This is shown by our study conducted together with the Hohenstein Textile Testing Institutes.
In the course of these studies, it became clear that employees/test persons made fewer mistakes with cleanroom garments that were better assessed than with garments that were rated as unpleasant in terms of wearing comfort. (Fachzeitschrift Reinraumtechnik, GIT Verlag 2012, No. 1).

Research and development (R&D)



The continuous optimisation and further development of our cleanroom textiles and cleanroom garments is, in addition to our stringent quality policy, certainly one of the special features that distinguish **Dastex**. As well as the many external studies carried out together with research institutes, universities and customers, **Dastex** puts a great deal of effort into its own R&D facilities.

The Body-Box, a walk-in measuring cabin which has been further developed in various details, forms the heart of the company's own research facilities. The technical equipment of the Body-Box has been extended by the possibility of UVC sterilisation of the entire cabin and by the addition of a special BioTrak® 9510-BD measuring device for the detection of particles such as viable organisms.

Another highlight of the **Dastex** research facilities is a newly developed filter test bench. Together with the Fraunhofer IPA in Stuttgart a textile test bench was developed that allows cleanroom fabrics to be tested for and to study the particle retention capacity (airborne particles).

In addition, both a Helmke drum and a testing device are available, in accordance with ASTM F51/ F51M-00 (2014) e1 for the determination of the residual contamination level in textiles.

The primary goal of all efforts in the area of research and development is still to advice and to support our customers in the definition and the further development of textile cleanroom garment systems.

Body-Box

By means of a „Body-Box“, which is described rudimentary, among other things, in the Recommendation Practice IEST-RP-CC003.4, it is possible for **Dastex** to identify different clothing, clothing systems and individual components of cleanroom garment under very practical conditions.

Basic studies, e.g. „How many particles does a person emit in different clothing systems?“ or a direct comparison of disposable vs. reusable clothing are just as possible as checking possible changes to an existing clothing system. The many years of experience with this measuring method as well as the continuous further development and optimisation of the measuring cabin enable a high reproducibility of the determined values as well as a correspondingly well-founded interpretation of the respective measuring results.

The **Dastex** Body-Box is also available to third parties, to our customers and suppliers, for corresponding studies. It has already been used several times.

Fabric testing methods (independent and neutral)

Different measuring methods are usually used to assess cleanroom fabrics. Often the data on certain textile properties differ considerably depending on the method. Therefore, it is recommended to always compare only data measured according to the same method and, if possible, at the same testing institute (since test set-up or different measuring devices can also lead to different results). You can find more information on this in VDI Guideline 2083, Part 9.2. Even before the publication of this guideline, **Dastex** was guided by the recommendations, methods and values stated in.
Based on our many years of experience, it is advisable not to rely solely on manufacturer's statements. Independent and internationally recognised institutes guarantee the necessary neutrality and also offer the possibility to put test results into the context of possible requirement profiles of the end user.

In order to include ageing phenomena in such tests and studies from the outset, **Dastex** considers it absolutely necessary to determine not only the original quality but also the respective properties after 50 decontamination cycles. For the safety of its customers and to ensure consistent quality, **Dastex** repeats the most important tests for fabrics with particularly high requirements, such as ION-NOSTAT VI.2, at regular intervals.

Further information on this is available on request.

The majority of cleanroom fabrics offered by Dastex for the production of cleanroom garments are subjected to the following studies – in new and used condition:

- particle retention capacity against airborne particles
- air permeability
- water vapour transmission resistance – resulting wearing comfort rating for cleanroom fabric (breathability)
- surface resistance
- triboelectric behaviour
- roughening disposition

Further studies on request, e.g.:

- ESD properties (if so also for single models)
- particle migration behaviour (towards mechanically transported particles and/or fibres)
- germ permeability (dry and/or moist)
- possible (special) damage caused by different sterilisation methods
- protective properties against defined toxic substances (e.g. cytostatics)

Dastex has been working intensively for many years with the following research institutes, among others, for the studies listed above:

- DITF Denkendorf
- Hohenstein Textile Testing Institute (HTTI)
- STFI Chemnitz
- Fraunhofer IPA (Stuttgart)

TESTED QUALITY
FROM INTERNATIONAL RECOGNIZED RESEARCH INSTITUTES

Studies carried out

Study 1

The right combination makes the difference! Different textiles for undergarments together with ION-NOSTAT VI.2 in the wearing comfort comparison

When it comes to wearing comfort, often only the cleanroom garment is considered and analysed. The textile layer that is usually directly underneath is thus wrongly completely disregarded.

This is because water vapour transmission resistances add up and, in combination, influence breathability. In the worst case, an unintentional water vapour barrier is formed under a possibly very breathable outer garment.

In general, an evaluation of wearing comfort also includes important properties such as absorption behaviour and the tendency to stick. For this reason, **Dastex** commissioned an extensive study in order to be able to document the difference between this and ordinary cotton clothing (as undergarment).

Based on the results of the study, **Dastex** is now able to provide well-founded information on which combinations are more or less suitable in terms of wearing comfort.

Study 2

Undergarments – important component of a good cleanroom garment system

Cleanroom operators are always asking themselves whether cleanroom-compatible undergarments are worth the expense – or is it possible to „save money" at this point? Various studies have shown how efficiently undergarment components tailored to cleanroom requirements can reduce the risk of contamination from humans.

Both from the particulate point of view and from the microbiological point of view, contamination has been demonstrably reduced by 50% and more.
Thus, cleanroom compatible undergarments are one of the important pillars of an efficient clothing system and even allows the user (depending on the requirements) to make compromises in other areas.

Study 3

Comparison in terms of particle emission of disposable and reusable clothing

Disposable clothing is often presented as an alternative to reprocessed cleanroom reusable clothing and advertised accordingly. As a rule, however, these statements refer exclusively to the filtration performance of the disposable material used. The contamination (particulate and microbiological) that is usually present on these disposable materials from the outset (caused by the simple production process) is completely disregarded. Other important aspects from the point of view of wearers and users, such as wearing comfort, fit, colour variations etc. are also not considered in detail.

An extensive study carried out in the Body-Box not only shows the differences between disposable and reusable clothing, but also demonstrates how different disposable materials can be in terms of particle emission.

Despite all this, disposable clothing is still needed as a supplement but also as standard cleanroom clothing. Visitors and service technicians are typical users and in the area of PPE (Personal Protective Equipment), disposable clothing certified accordingly under PPE aspects is indispensable.

The first suppliers of disposable garments for use in controlled areas are moving towards cleaning the garments designed for these purposes before packaging, in order to reduce the risk of contamination from the material.

Study 4

Ageing-related changes in particle retention capacity

A long-term study over several years should help to provide a well-founded answer to the question, which is always justified from the user's point of view, „How does the particle retention capacity change after 50 decontamination cycles? With the help of the Body-Box, seven different textiles were examined in this regard under the same general conditions. By means of a comparative study, cleanroom clothing systems of identical design in new condition were tested against the same clothing systems after 50 decontamination cycles.

There were textiles that deteriorated in terms of particle release over the number of decontamination cycles. Surprisingly, there were also textiles that improved significantly.

A material combination of two different cleanroom textiles developed during the study also performed very well. In this combination, wearer comfort properties (high breathability and haptics) were taken into account in addition to particle retention capacity, without any deterioration in the overall release of particles: instead, an improvement was also recognisable in this case.

Study 5

Does wearing comfort influence the ability to concentrate and thus the performance of employees?

A cleanroom garment system stands and falls with employee acceptance. Thus, the wearing comfort properties are important clothing features that must be taken into account. However, satisfaction/acceptance also has a direct influence on the employees' ability to concentrate and thus directly influences efficiency, error frequency, rejects and ultimately the quality of the work performed in the cleanroom.

In a joint study, the Hohenstein Institutes and **Dastex** were able to prove this causality. Employees who wore cleanroom garments that they said were more comfortable to wear made measurably fewer errors than those who wore cleanroom garments that they rated as more uncomfortable.

Study 6

Germ source humans – airborne germs originating from humans and / or their personal clothing

There have already been several studies on the topic of „Humans as a source of particles", and the **Dastex** Body-Box has also proved to be an extremely helpful tool for determining such figures in a well-founded manner.

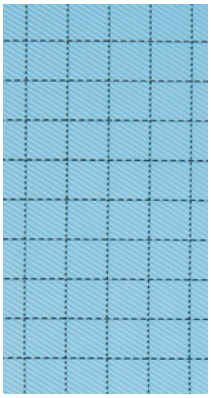
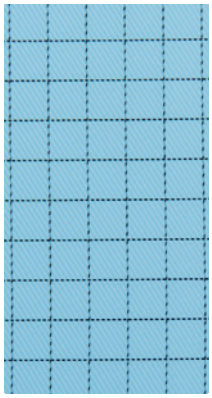
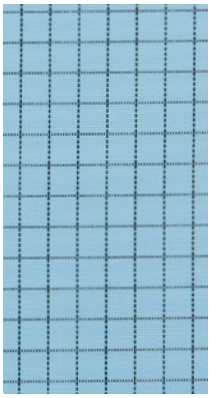
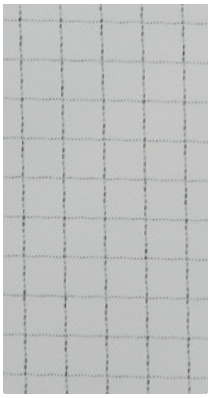
It has long been known that humans are also a very large source of germs - but this statement refers first and foremost to the germs that settle directly on humans. How many airborne germs are emitted by a person on average has now also been studied in more detail with the Body-Box. Details on the Body-Box can be found in chapter 1.1. A new measuring device that uses fluorescence to make survivable contaminants visible was used here. The values determined in the course of the studies are certainly a novelty and must now also be classified in comparison to other measuring methods.

As with the studies on particle emission by humans, it could be proven that the degree of movement, the respective clothing system and, if necessary, cleanroom-compatible undergarments are decisive influencing factors that affect the numbers of airborne, microbiological contaminants in one direction or the other.

Please do not hesitate to contact us for further information!

Technical data cleanroom fabrics

Further information under Cleanroom fabric characteristics from page 18.

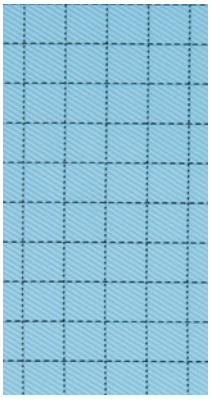
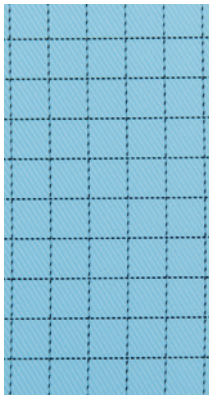
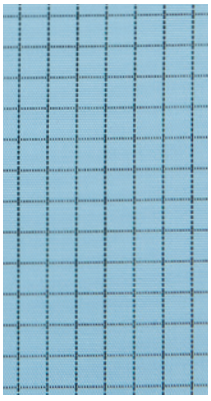
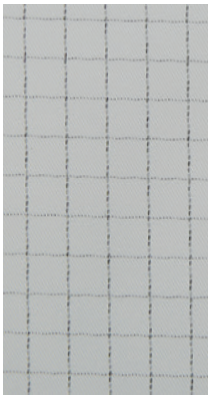





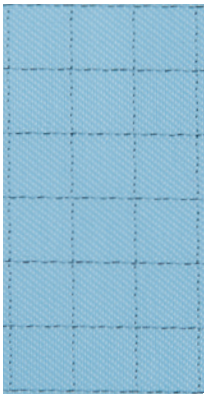
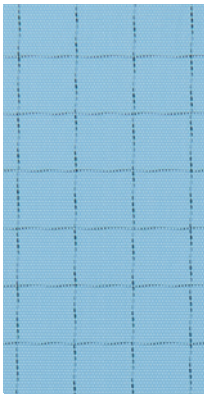
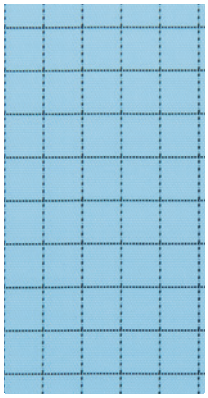
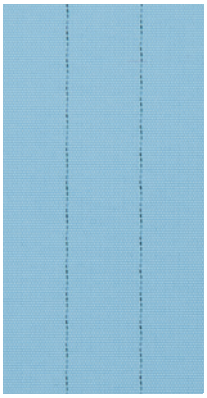
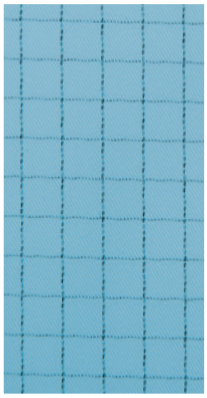
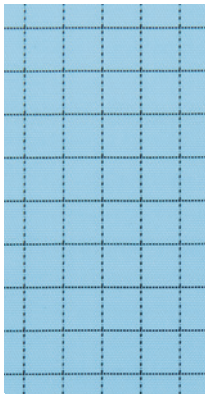
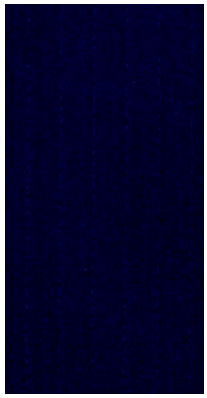
Fabric name	ION-NOSTAT VI.2	ION-NOSTAT VI.2 WA	ION-NOSTAT Plus	ION-NOSTAT Comfort I.2
Art. No.	17	10	68	B08
Fabric	98% PES, 2% carbon	98% PES, 2% carbon	96% PES, 4% carbon	98% PES, 2% carbon
Distance of the electrically conducting yarn	5 mm (K+S)	5 mm (K+S)	3 mm (K+S)	5 mm (K+S)
Weave construction	twill 3/2	twill 3/2	plain	twill 2/1
Surface weight g/m²	113	113	100	105
Air permeability acc. to DIN EN 9237 at 200 PA L/(dm² x min)	29.2	32.7	23	38.7
Water-vapour resistance* DIN EN ISO 11092:2014-12. R_{et} = m² Pa/W	2.83	3.1	2.68	1.95
Particle retention according to VDI 3926 for ≥ 0.5 µm Test duration: 60 min. / raw gas concentration: 25 mg/m³	95%	92%	83%	96%
Particle retention according to VDI 3926 for ≥ 5.0 µm Test duration: 60 min. / raw gas concentration: 25 mg/m³	98%	96%	84%	97%
Triboelectrical behaviour acc. to DIN EN 1149-3 method 1 (ITV Denkendorf-TEV method)	very good	good	very good	good
Surface resistivity in ohm according to DIN EN 1149-1	$10^7 – 10^9$	$10^7 – 10^9$	$10^6 – 10^9$	$10^6 – 10^8$
Roughening disposition referring to DIN EN ISO 12947-4 (Martindale method – assessment of appearance change)	very low – low	very low – low	average	average – adequate

* under stationary conditions (sweating guarded-hotplate test)

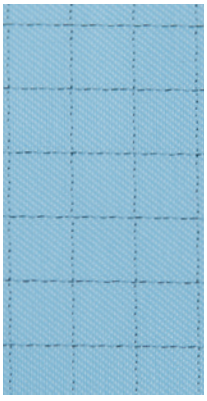
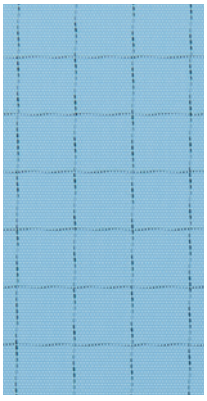
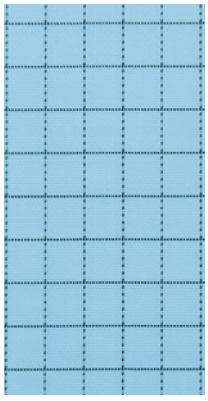
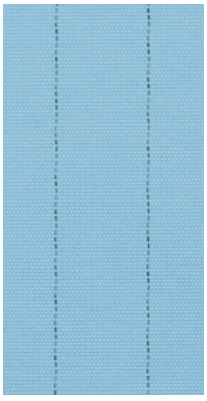
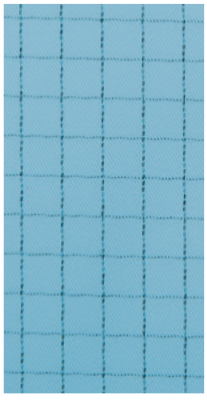
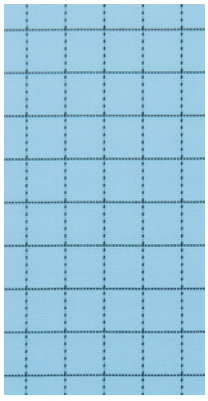
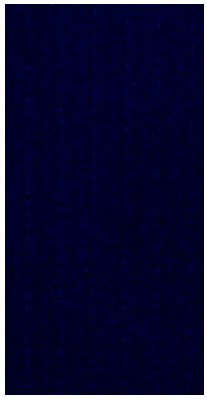
Colours

- white
- grey
- light grey
- dark grey
- car grey
- tretex grey
- elephant grey
- light green
- olive green
- petrol
- nil green
- turquoise
- light red
- red brown
- yellow
- light blue
- aventis blue
- atlantis blue
- bugatti blue
- dark blue
- midnight blue

ION-NOSTAT LS Light 125.2	DASTAT-V.2	DASTAT-EC	DASTAT-C	DASTAT-MF	DASTAT-GR	DASTAT-
B04	64	79	63	B05	11	B07
98% PES, 2% carbon	98% PES, 2% carbon	98% PES, 2% carbon	99% PES, 1% carbon	98% PES, 2% carbon	98% PES, 2% carbon	99% PES, 1% carbon
8 mm (K+S)	5 mm (K+S)	5 mm (K+S)	8 mm (K)	5 mm (K+S)	5 mm (K+S)	5 mm (K)
twill 2/1	plain	twill 2/1	plain	twill 2/1	twill 2/1	plain
123	102	115	121	100	108	88
212	5.2	54.5	36.5	145	23.2	5
2.05	3.29	2.99	2.57	1.34	3.5	n. s.
67%	98%	65%	68%	96%	76%	100%
76%	99%	85%	80%	97%	86%	100%
good	good	good	adequate	satisfying	very good	n. s.
$10^6 – 10^9$	$10^8 – 10^9$	$10^7 – 10^9$	$10^7 – 10^9$	$10^9 – 10^{11}$	$10^7 – 10^9$	$10^6 – 10^8$
adequate	low	low	average	adequate	low	satisfying

K = wrap direction
S = weft direction
PES = polyester
C = carbon
n. s. = not specified

Article number system

Cleanroom garments and undergarments

Because of the modular design principle it is not possible to give each clothing article a distinct article number.

The multiple variation possibilities for pockets, sleeves and trouser ends, logos, flaps, etc. would result in an alphanumeric identification of 10 digits and more.

The first 4 – 6 digits define the textile and the basic model:

- the first two (sometimes three) digits to identify the textile
- the following 2 or 3 digits to identify the model

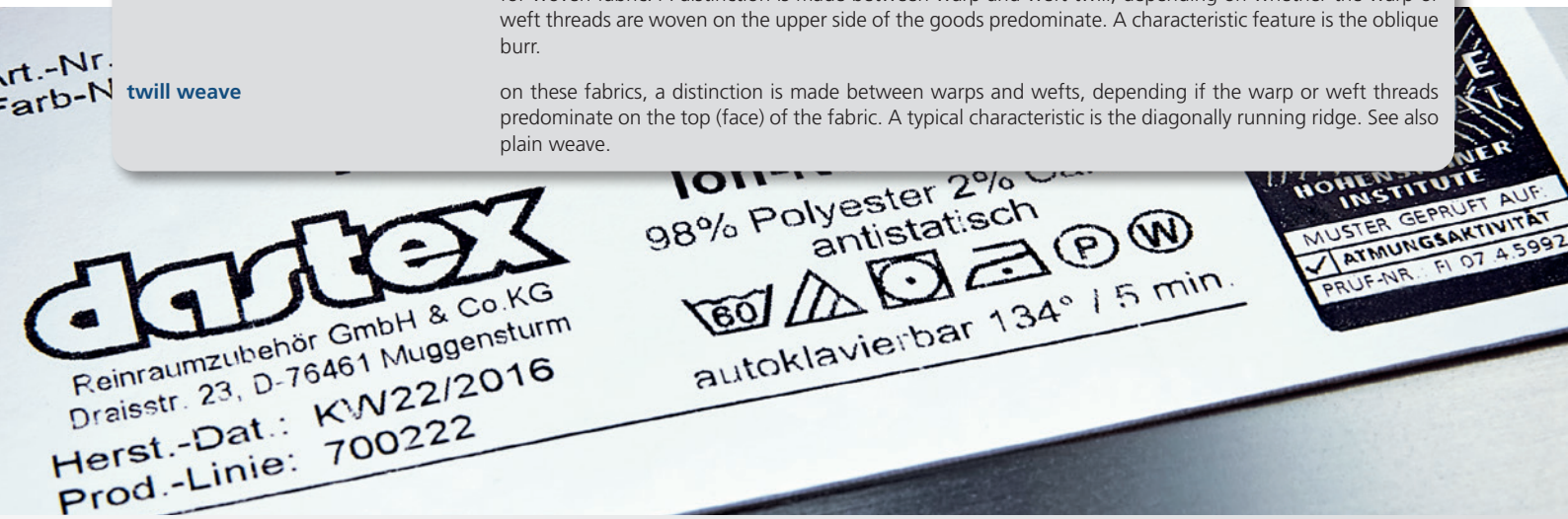
An example: **17** **01**
17 stands for the cleanroom textile ION-NOSTAT VI.2
01 tands for the model 01 Overall – standard

Defining fabric and model ...

	Fabric (not complete, other fabrics available)		Model (not complete, other models available)	
GARMENTS	17	ION-NOSTAT VI.2	01	Overall
	10	ION-NOSTAT VI.2 WA	05	Coverall with integrated hood
	B04	ION-NOSTAT LS Light 125.2	02	Lab coat
	68	ION-NOSTAT Plus	08	Lab coat with integrated hood
	B08	ION-NOSTAT Comfort I.2	03	Jacket
	63	DASTAT-C	06	Trousers
	64	DASTAT-V.2	20	Full cover hood
	B07	DASTAT-P	21	Eye slit hood
	79	DASTAT-EC	62	Bouffant cap
	B05	DASTAT-MF	53	Overboots (sole 53)
	11	DASTAT-GR	56	Overboots (sole 56)
	62	DASTAT-D	S11	Overboots (sole S11)
	B02	DASTAT-RS	50	Overshoes (sole 50)
	B15	DASTAT-REC	40	Face mask, textile (attachable to the hood)
UNDERGARMENTS	05	Light-Tech II	86	Pullover, long sleeve
	75	Light-Tech AS	85	Pullover, short sleeve
	U04	Light-Tech SW	90	Trousers
	77	HT2	83	T-shirt, long sleeve (raglan cut)
	U02	HT3	81E	T-shirt, long sleeve (sleeve head cut)
	U03	HT4	82	T-shirt, short sleeve (raglan cut)
	U01	HAP-Tech	80E	T-shirt, short sleeve (sleeve head cut)
	01	High-Tech	33	Jacket

Glossary

abrasion resistance	determination of the abrasion resistance of textile fabrics using the Martindale method according to ISO 12947; enables conclusions about the self-contamination by textile particles.
Body-Box	an indispensable test cabin for testing the effectiveness of cleanroom fabrics under real environmental conditions.
breathability	after determining the water vapour permeability of the textile, its breathability is assessed.
electrostatic properties	in addition to conductivity, the disposition to electric charge and discharging rate are particularly considered here.
endless filament	a fibre of theoretically unlimited length is often described as continuous or endless filament; counted here are synthetics which are not cut at a specific length but also natural silk thread.
ESD	electrostatic discharge: a voltage breakdown caused by a large potential difference. These breakdowns (possibly visible as sparks) cause a short, high electric current and can lead to the ignition of flammable substances. Under unfavourable circumstances, fire and explosion hazards as well as hazards to persons due to electric shock may occur. Other undesirable consequences of electrostatic discharges are damage to electrical components in equipment.
fabric	textile area-measured material consisting of at least two crossed thread or yarn systems. The threads in the longitudinal direction are called warp threads (warp), the transverse threads are called weft threads (weft). The threads crossing each other regularly (this is called weave type) thus enable a relatively firm structure.
gauze	net-like, lightweight textile.
haptics	feature which is grasped through the tactile sense. The grip of a fabric. An often very subjective judgement, if a piece of clothing/textile feels pleasant or rather is classified as unpleasant.
knitted fabric (knit fabric)	textile area-measured product consisting of knitted or crocheted fabrics obtained by means of one or more threads or yarns using at least two needles. Knitted fabrics are generally more elastic than woven fabrics.
microfibre (microfiber)	the fineness of such a fibre is less than 1 dtex; i.e. 10,000 m of a microfiber weigh <1 g. Microfibre fabrics are very soft and retain their shape.
particle migration behaviour	particles and fibres released by frictional movements move through the textile due to mechanical forces.
particle retention	filtration efficiency against airborne particles.
plain weave	these fabrics show the same fabric appearance on the upper and lower fabric side; each warp thread alternately crosses a weft thread; see also twill weave.
PPE (Personal Protective Equipment)	items such as clothing designed to protect the wearer against risks arising from the working environment.
special accessories / special options	Dastex' cleanroom garments are devised using the modular design principle. Standard models are defined (a sort of basic scaffolding) which, depending on customer requirements, can be extended with additional options (special accessories). Examples: bags, loops, knitted cuffs, logos etc.
textile equipment	garments can be additionally equipped at the end of the manufacturing chain with defined surface finishes, thus to achieve a certain functionality of the fabric. E. g. durable water-repellent equipment and antimicrobial equipment.
triboelectric behaviour	the behaviour of electrical charges on plastic surfaces (here synthetic textile surfaces). Describes how susceptible a textile is to becoming charged by friction and how quickly it discharges again.
twill	also called twill weave, besides the plain weave and the satin weave, one of the three basic bonding types for woven fabric. A distinction is made between warp and weft twill, depending on whether the warp or weft threads are woven on the upper side of the goods predominate. A characteristic feature is the oblique burr.
twill weave	on these fabrics, a distinction is made between warps and wefts, depending if the warp or weft threads predominate on the top (face) of the fabric. A typical characteristic is the diagonally running ridge. See also plain weave.



Tables of cleanroom classes and further literature

Cleanroom Classification according to EN ISO 14644-1 – particles per m³ (maximum limit)						
class	**≥ 0.1 µm**	**≥ 0.2 µm**	**≥ 0.3 µm**	**≥ 0.5 µm**	**≥ 1.0 µm**	**≥ 5.0 µm**
ISO 1	10					
ISO 2	100	24	10			
ISO 3	1 000	37	102	35		
ISO 4	10 000	2 370	1 020	352	83	
ISO 5	100 000	23 700	10 200	3 520	832	
ISO 6	1 000 000	237 000	102 000	35 200	8 320	293
ISO 7				352 000	83 200	2 930
ISO 8				3 520 000	832 000	29 300
ISO 9				35 200 000	8 320 000	293 000

Cleanroom Classification acc. to US-FED-STD 209E – particles per ft³ (maximum limit)					
class	**≥ 0.1 µm**	**≥ 0.2 µm**	**≥ 0.3 µm**	**≥ 0.5 µm**	**≥ 5.0 µm**
1	35	7	3	1	
10	350	75	30	10	
100		750	300	100	
1 000				1 000	7
10 000				10 000	70
100 000				100 000	700

Note:
The US-FED-STD 209E has been withdrawn on 29/11/01 and hence is no longer valid!
1 ft^3 = 0.0283168 m^3

GMP Classification – particles per m³ (maximum limit)				
	At rest		**In operation**	
class	**≥ 0.5 µm**	**≥ 5 µm**	**≥ 0.5 µm**	**≥ 5 µm**
A	3 520	20	3 520	20
B	3 520	29	352 000	2 900
C	352 000	2 900	3 520 000	29 000
D	3 520 000	29 000	– not defined –	

GMP stands for Good Manufacturing Practice according to Directive (EU) 2003/94/EC, the so-called EU-GMP guideline, supplemented by Directive (EU) 2017/1572

ISO-ACC-classes according to EN ISO 14644-8			
ISO-ACC-	**concentration**		
class	**g/m³**	**µg/m³**	**ng/m³**
0	10^{0}	10^{6} (1 000 000)	10^{9} (1 000 000 000)
-1	10^{-1}	10^{5} (100 000)	10^{8} (100 000 000)
-2	10^{-2}	10^{4} (10 000)	10^{7} (10 000 000)
-3	10^{-3}	10^{3} (1 000)	10^{6} (1 000 000)
-4	10^{-4}	10^{2} (100)	10^{5} (100 000)
-5	10^{-5}	10^{1} (10)	10^{4} (10 000)
-6	10^{-6}	10^{0} (1)	10^{3} (1 000)
-7	10^{-7}	10^{-1} (0.1)	10^{2} (100)
-8	10^{-8}	10^{-2} (0.01)	10^{1} (10)
-9	10^{-9}	10^{-3} (0.001)	10^{0} (1)
-10	10^{-10}	10^{-4} (0.0001)	10^{-1} (0.1)
-11	10^{-11}	10^{-5} (0.00001)	10^{-2} (0.01)
-12	10^{-12}	10^{-6} (0.000001)	10^{-3} (0.001)

Note:
ACC means here air cleanliness by chemical concentration

Limits for microbiological contamination (operational)* according to GMP Classification				
class	**air germ collector CFU/m³**	**contact plates Ø 90 mm CFU/4 hours****	**contact plates Ø 55 mm CFU/plate**	**glove print 5 fingers CFU/glove**
A	<1	<1	<1	<1
B	10	5	5	5
C	100	50	25	-
D	200	100	50	-

Notes
(*) these are average values
(**) single sedimentation plates can be exposed less than 4 hours
CFU: colony-forming unit

SCP classification (surface cleanliness) according to EN ISO 14644-9 – particles per m² (maximum limit)									
class	**≥ 0.05 µm**	**≥ 0.1 µm**	**≥ 0.5 µm**	**≥ 1.0 µm**	**≥ 5.0 µm**	**≥ 10.0 µm**	**≥ 50.0 µm**	**≥ 100.0 µm**	**≥ 500.0 µm**
SCP-class 1	(200)	100	20	(10)					
SCP-class 2	(2 000)	1 000	200	100	(20)	(10)			
SCP-class 3	(20 000)	10 000	2 000	1 000	200	(100)			
SCP-class 4	(200 000)	100 000	20 000	10 000	2 000	1 000	(200)	(100)	
SCP-class 5		1 000 000	200 000	100 000	20 000	10 000	2 000	1 000	(200)
SCP-class 6		(10 000 000)	2 000 000	1 000 000	200 000	100 000	20 000	10 000	2 000
SCP-class 7				10 000 000	2 000 000	1 000 000	200 000	100 000	20 000
SCP-class 8						10 000 000	2 000 000	1 000 000	200 000

Note:
Values in brackets should not be used for classification purposes – they only serve for orientation.
SCP stands for surface cleanliness by particle concentration.

VDI Guidelines 2083 – Cleanroom technology (status February 2020) – Active[1] / Active, checked[2] / Active, checked, draft[3] (German / English version)	
Part 1	Particulate air cleanliness classes[3]
Part 2	Stipulations regarding the checking and monitoring of continued compliance with specifications[1]
Part 3	Metrology and test methods of cleanroom air[3]
Part 3.1	Metrology in cleanroom air – Monitoring[2]
Part 4.2	Energy efficiency[2]
Part 5.1	Cleanroom operation[2]
Part 7	Ultrapure media – Quality, supply, distribution[1]
Part 8.1	Air cleanliness chemical concentration (ACC)[1]
Part 9.1	Compatibility with required cleanliness and surface cleanliness[2]
Part 9.2	Consumables in the cleanroom[1]
Part 12	Safety and environmental aspects[2]
Part 13.1	Quality, production and distribution of ultrapure water; Fundamentals[2]
Part 13.2	Quality, production and distribution of ultrapure water; Microelectronics and other technical applications[2]
Part 16.1	Barrier systems (isolators, mini-environments, cleanroom modules) – Effectiveness and certification[2]
Part 17	Compatibility of materials with the required cleanliness[2]
Part 18	Bio contamination control[2]
Part 19	Tightness of containments, classification, planning and testing[1]
Part 20	Determination of desertions kinetic of materials after gassing[1]
Part 21	Cleaning validation[1]
Current projects[1] / Draft in preparation[2] / Active, reviewed, revision in progress[3] / Active, reviewed, revision draft[4]	
Part 1.1	Purity in regards to nanoparticles)[2]
Part 4.1	Planning, construction and start-up of cleanrooms[3]
Part 13.3	Quality, production and distribution of ultrapure water; Pharmacy and other life-science applications[4]
Part 15	Personnel at the clean work place[3]
Part 16.2	Barrier systems; Mini-environments[2]
Part 22	Measurement of condensing airborne substances[1]
Part 23	Measurement /determination of film-like chemical contaminations, definition of criteria for supplied parts[1]
IEST (Institute of Environmental Sciences and Technology) Recommended Practices on non-durable products for cleanrooms and other controlled environments (in English)	
IEST-RP-CC003.4	Garments
IEST-RP-CC004.4	Wiping materials
IEST-RP-CC005.4	Gloves and Fingercots

Additionally further recommended practices (RPs) of the IEST exist on the subject of cleanroom/cleanroom technology.

Standard BS EN ISO 14644 – Cleanrooms and associated controlled environments (status May 2021)	
Part 1	Classification of air cleanliness based on particle concentration
Part 2	Monitoring to provide evidence of cleanroom performance related to air cleanliness by particle concentration
Part 3	Test method
Part 4	Design, Construction and Start-up
Part 5	Operations
Part 6	Vocabulary
Part 7	Separative devices (clean air hoods, gloveboxes, isolators and mini-environments)
Part 8	Classification of air cleanliness by chemical concentration (ACC)
Part 9	Classification of surface cleanliness by particle concentration
Part 10	Classification of surface cleanliness by chemical concentration
Part 12	Specifications for monitoring air cleanliness by nanoscale particle concentration[2]
Part 13	Cleaning of surfaces to achieve defined levels of cleanliness in terms of particle and chemical classifications
Part 14	Assessment of suitability for use of equipment by airborne particle concentration
Part 15	Assessment of suitability for use of equipment and materials by airborne chemical concentration
Part 16	Energy efficiency in cleanrooms and separative devices
Part 17	Particle deposition rate applications
	BS ISO 14644-12[2]

Book recommendations

Cleanroom Technology (2nd Edition, August 2011)	William Whyte	John Wiley & Sons, Inc.	ISBN 978-1-119-96559-6
GMP-Berater – Kapitel „Hygiene"	Gausepohl/Seyfarth	Maas & Peither GMP Verlag	ISBN 978-3-934971-03-5
Gute Hygiene Praxis (3rd revised and extended edition 2019)	Concept Heidelberg (Ed.)	Editio Cantor Verlag	ISBN 978-3-87193-465-0
Projektplanung Reinraumtechnik	Gail/Gommel/Weißsieker	Hüthig Verlag	ISBN 978-3-7785-4004-6
Reinraum in der pharmazeutischen Industrie (1st edition 2019)	Krebsbach (Ed.)	Editio Cantor Verlag	ISBN 978-3-87193-473-5
Reinraumtechnik (4th edition 2018)	Gail/Gommel/Hortig	Springer Verlag	ISBN 978-3-662-54914-8