StoCretec

Building with conscience.

# Coatings for cleanrooms and clean manufacturing areas

## System solutions for floors, walls, and ceilings

**Floor coating**

**Cleanroom coatings**

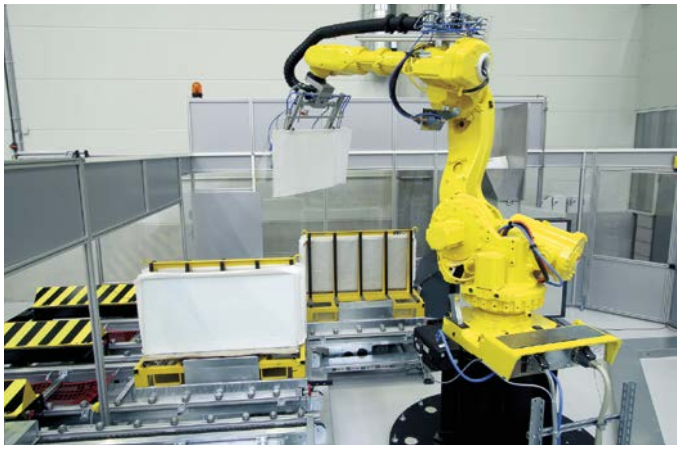
When it comes to the floors, walls, or ceilings of cleanrooms and clean manufacturing areas, StoCretec and Sto offer reliable coating systems to meet any requirement. Delivering a high level of quality, system reliability, and durability is always our top priority.

Cover photo:
**Photo**: Guido Erbring

# Contents

## Basics





## System solutions

# Cleanrooms and clean manufacturing areas in industry

## Stringent requirements ensure quality and safety

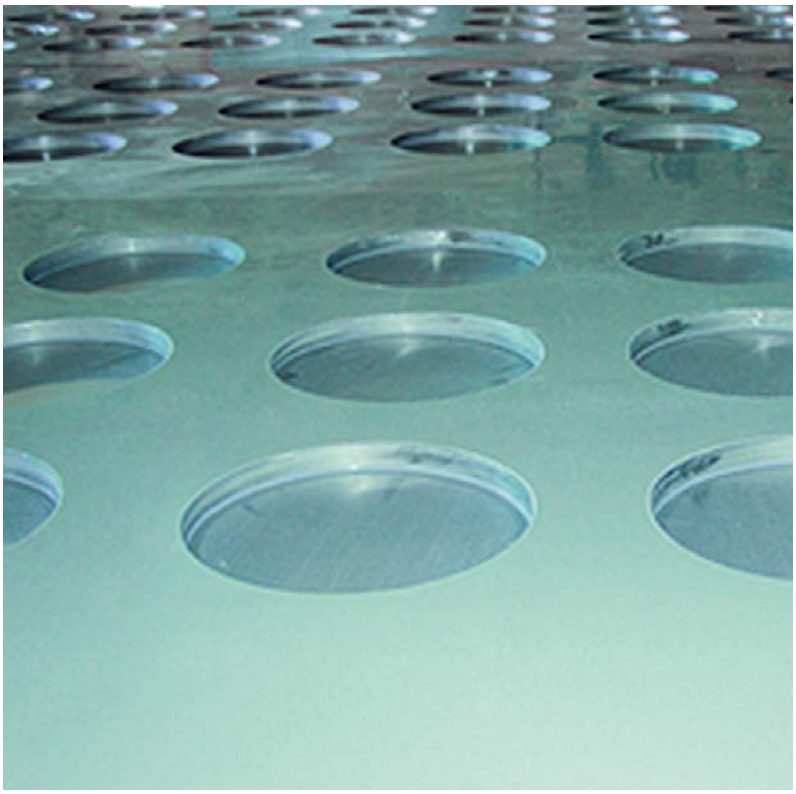
For increasing numbers of companies, clean and hygienic production conditions are absolutely essential, as they are the only way of ensuring the quality of the items being produced and that workflows run smoothly. Industries using cleanrooms and clean manufacturing areas include the following:

Cleanrooms:
- Semiconductor industry
- Precision engineering
- Photovoltaics
- Microsystems engineering
- Aviation and space industry
- Food industry
- Pharmaceuticals
- Medical technology
- Biotechnology

Clean manufacturing areas:
- Automotive
- Mechanical engineering

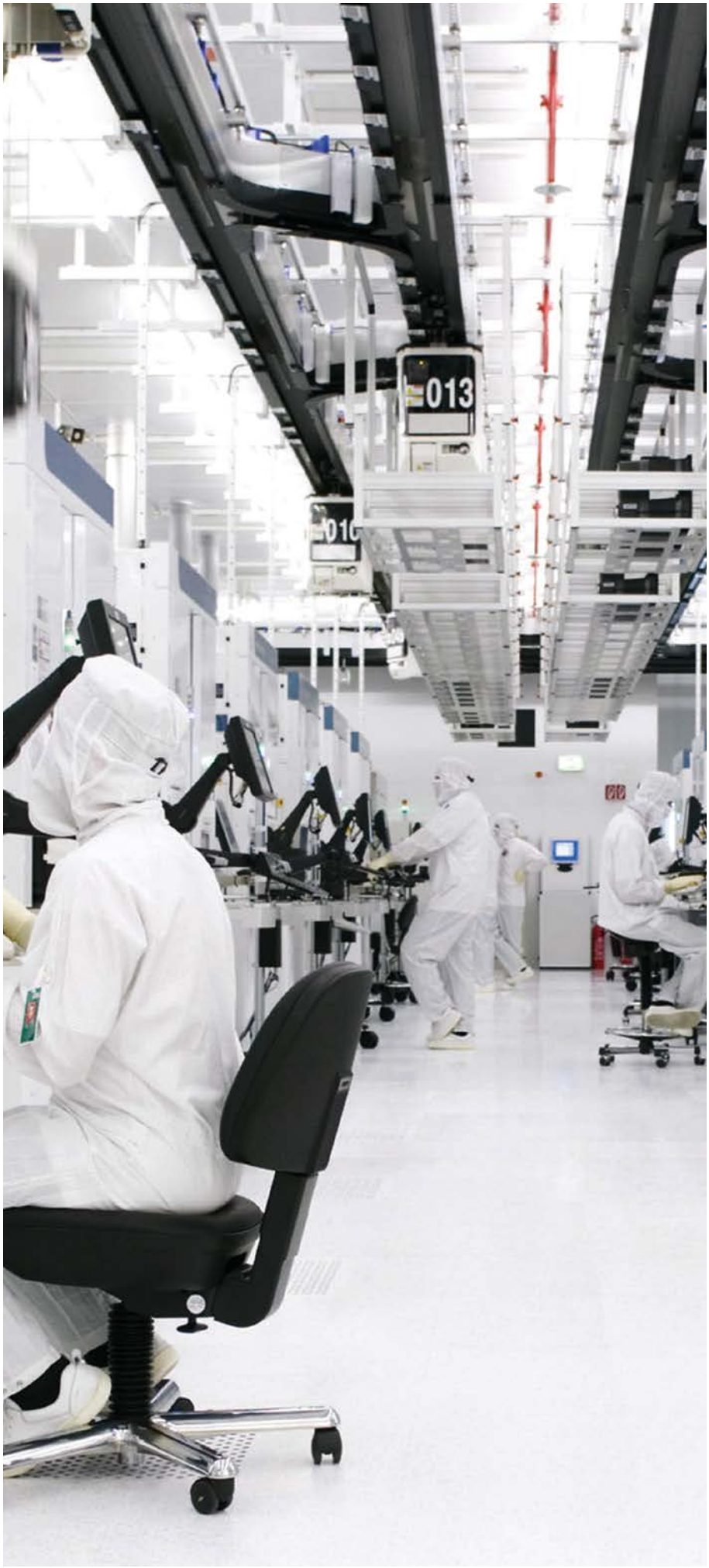
StoCretec and Sto offer high-quality and certified coating systems for the floors, walls, and ceilings of cleanrooms and clean manufacturing areas. What's more, we are continuously working to further develop suitable coating materials, as it is our mission to assist our customers by providing reliable system solutions that are tailored to their individual requirements. This means living up to our values and pursuing our objective of "Building with conscience."

The needs of the various industries can vary significantly. While the semiconductor industry has to ensure that outgassing and the particles that materials generate are kept at low levels, the pharmaceuticals sector, on the other hand, primarily looks for systems providing good cleanability, biological resistance, and resistance to disinfectants. The high-quality and certified cleanroom coating systems offered by StoCretec and Sto can be relied upon to meet these requirements on a lasting basis.



Top image:
Coated wafer table in a semiconductor production facility

Image on right:
Wafer production in a cleanroom




# Success built on partnership

Cleanroom® Suitable Materials

StoCretec GmbH Industrial Alliance Membership

The Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) Stuttgart has initiated an industrial alliance which goes by the name of the Cleanroom Suitable Materials (CSM) alliance. This has developed investigation methods to test the cleanroom suitability of materials.

As an industrial alliance member, StoCretec works continuously to further develop suitable materials for coating walls, ceilings, and floors for cleanrooms and clean manufacturing areas. The IPA institute inspects these systems in line with the CSM test parameters.

We are also a partner of the CleanRoomNet network. This brings together specialist expertise and many years of experience in cleanroom technology and equipment – from planning, construction, and operation, right the way up to consumables. For more information, visit www.cleanroomnet.de.

# Cleanliness areas

## Design based on product-related requirements

Cleanliness areas are set up to protect sensitive surfaces and items. Their aim is to maintain as far as possible the specified cleanliness quality of components, processing aids, and assemblies during processing. The cleanliness level must not be compromised by environmental influences.

In a cleanliness area, contamination should be prevented from being introduced and any that does arise must be reliably contained and removed. The designs, measures, and applications of these areas are guided by product-related cleanliness requirements. The function-critical particle sizes are generally between 5 µm and 1000 µm.

In accordance with VDA 19 Part 2, cleanliness areas are categorised into four levels:
- Cleanliness level 0 (SaS0): non-controlled area
- Cleanliness level 1 (SaS1): clean zone
- Cleanliness level 2 (SaS2): clean manufacturing area
- Cleanliness level 3 (SaS3): cleanroom

In order to meet the requirements of cleanliness level 1 and above, floors must first and foremost demonstrate high abrasion resistance (low particle formation when surfaces are driven over) and good mechanical resistance. In addition, a smooth, easy-to-clean surface is required. Depending on the manufacturing process, further properties such as chemical resistance, slip resistance, electrical dissipative capacity, and crack-bridging ability may also be included. Generally, coating systems made from epoxy resin or polyurethane resin are used up to cleanliness level 2. These are also applied in other areas of industry.

Top image:
Floors for cleanrooms must also demonstrate high abrasion and mechanical resistance when subjected to stresses from office chairs or even pallet trucks, for example.
**Photo:** sebastianreuter/Adobe Stock

Image on right:
**Skoda car factory, Mlada Boleslav, CZ**
**StoCretec expertise:** StoFloor Cleanroom KU 611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# Cleanrooms

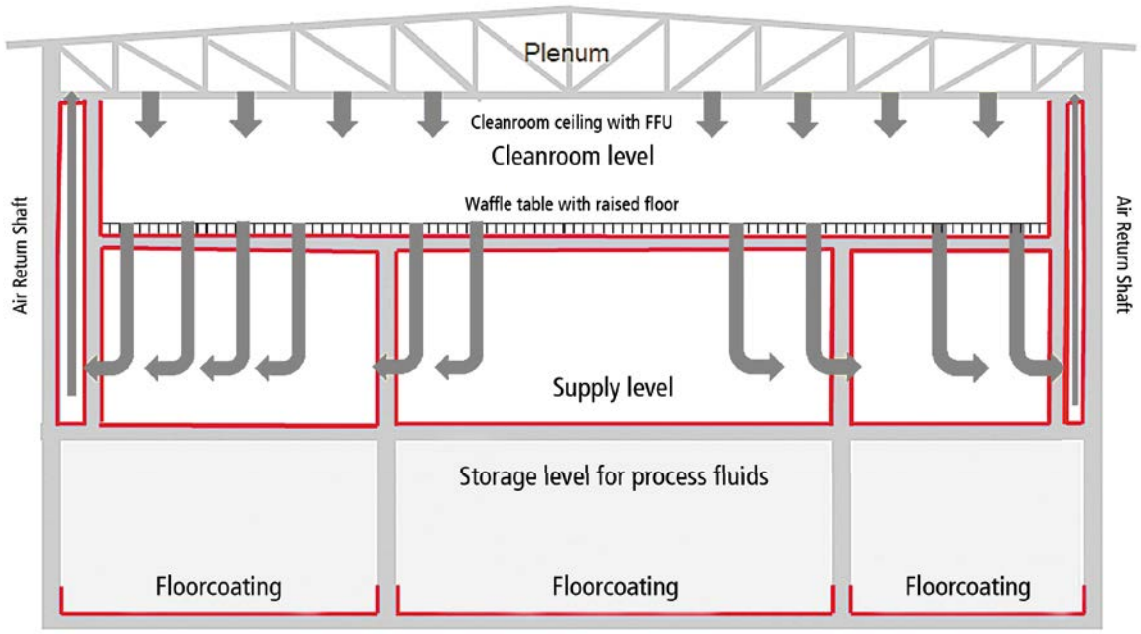
## Materials must be cleanroom-compatible

In accordance with DIN EN ISO 14644-1 and VDI 2083 Sheet 1, a cleanroom is defined as follows: "[a] room in which the number concentration of airborne particles is regulated and classified and which is structurally planned, built and operated accordingly to regulate the introduction, formation and deposition of particles in the room."
In contrast to the particle sizes in cleanliness areas, particles sizes of between 0.1 µm and 5 µm are relevant. As outside air may be contaminated to varying degrees, rooms and storeys outside of the defined cleanroom are usually used to circulate the air and keep the amount of outside air entering the cleanroom as low as possible. Accordingly, floors, walls, and ceilings in these areas must also have a cleanroom-compatible surface. These measures have a significant impact on the service life of the filter elements in a cleanroom.

Besides the quality and delivery of supply air, surfaces, and personnel, the equipment and materials found in the cleanroom play a crucial role in the room's cleanliness. These elements include interior fixtures and fittings such as walls, doors, ceilings, and floors. Key parameters concerning the cleanroom suitability of materials include:

- Emission of airborne particles
- Outgassing behaviour
- ESD properties
- Cleanability
- Resistance to chemicals and disinfectants
- Smooth and crack-free surfaces
- Metabolising potential and microbicidity

Image on right:
**Pharmaceutical production halls, Langenfeld, DE**
**StoCretec expertise:**
StoFloor Cleanroom BB OS
**Photo:** Martin Baitinger




Simplified diagram of a semiconductor production facility

# Standards and regulations

## Varying industry-specific requirements

The requirements for cleanrooms and clean manufacturing areas vary greatly depending on the industry. While keeping material outgassing at low levels is absolutely essential in the production of semiconductors, this has generally not been an important factor to date with respect to the manufacture of pharmaceutical products. What's more, the particle cleanliness classes also vary in the existing regulations.

DIN EN ISO 14644-1 – Cleanrooms and associated controlled environments – Part 1: Classification of air cleanliness by particle concentration – categorises the air particle cleanliness into classes 1 to 9, with class 1 having the lowest maximum permitted particle count.

When it comes to manufacturing human and veterinary medicine products, on the other hand, the GMP (Good Manufacturing Practice) or cGMP regulations apply. These categorise cleanliness into classes A to D, where class A roughly corresponds to ISO class 5.

Airborne particles represent the main problem for the majority of production processes. However, air cleanliness by chemical concentration (ACC) is playing an increasingly important role. These are molecular (chemical, non-particulate) substances in the gaseous or vapour state within the atmosphere of a controlled environment. These may have a deleterious effect on the product, process, equipment, or personnel.

For example, outgassing from coatings on walls, ceilings, and floors can have considerable negative effects:
- Corrosive effects on metallic traces
- Defects in lithography processes
- Shorter service intervals and lifetimes for optics
- Changes to the electrical properties of wafers due to unintentional doping

**ISO-ACC rating levels**

| ISO ACC level | Concentration g/m³ | Concentration µg/m³ | Concentration 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) | $10^{3}$ (1000) |
| -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) |

Source: DIN EN ISO 14644-8: 2022-10 Cleanrooms and associated controlled environments - Part 8: Chemical air cleanliness assessment (ACC)

The existing standards and guidelines for cleanrooms do not contain any test criteria for materials such as coating systems for floors, walls, and ceilings. They only include indirect guidance regarding the composition of the ambient air that must be established and maintained in cleanrooms. In order to devise testing methods for the cleanroom suitability of materials and to develop optimised products in line with these methods, the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) Stuttgart has initiated an industrial alliance – the Cleanroom Suitable Materials (CSM) alliance. Thanks to the knowledge gained in the CSM industrial alliance, test criteria for the cleanroom/cleanliness compatibility of materials were described for the first time in VDI Guideline 2083 Sheet 17 (June 2013).

Depending on the field of application, the following requirements are defined for coating systems:

- Good abrasion resistance (low particle formation)
- Good mechanical resistance
- High resistance to chemicals
- Low outgassing
- Smooth, easy-to-clean surface
- Resistance to disinfectants
- Biostatic/microbicidal
- Dissipative capacity
- bridging of cracks

Special test methods confirm the cleanroom suitability of coating systems, offering building owners and operators of cleanrooms a much higher level of safety.

**New production and logistics building, Eduard Gerlach GmbH, Lübbecke, DE**
**StoCretec expertise:** StoFloor Cleanroom KU 601, StoFloor ESD KU 611
**Photo:** MT-Fotos

# Standards and regulations

## Supplementary requirements for biotechnology

Additional requirements are placed on laboratories for research, development, and microbiological analysis which deal with microorganisms in the fields of bacteriology, mycology, virology, and parasitology or which carry out genetic work. Here, the main focus is on ensuring that no microorganisms that would be hazardous to people, animals, plants, or the environment can escape from the laboratory.

The DIN EN 12128 standard categorises these laboratories into the four safety levels S 1 to S 4, where S 1 represents the lowest safety level and S 4 the highest. At level S 3 and above, the surfaces of the workbenches, floors, walls, and ceilings must be easy to clean and easily accessible for maintenance work. They should be impermeable to water and resistant to disinfectants, cleaning agents, acids, alkaline solutions, and other chemicals that are commonly used.

The crack-bridging ability of coating systems also plays a role. It must not be possible for microorganisms to take hold in any cracks that subsequently appear in the building if they cannot be reached by wiping with disinfectant.

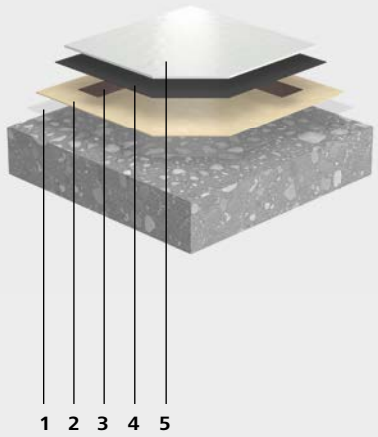
There are additional requirements for biotechnology laboratories which should prevent microorganisms from escaping.
**Photo**: Merckle Biotec GmbH, Ulm, DE

# Coating systems for floors, walls, and ceilings

## Smooth surfaces, low particle formation

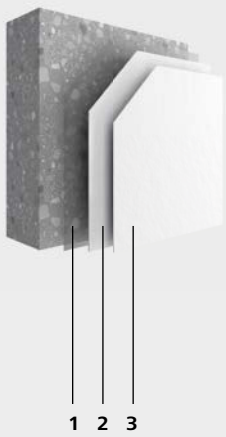
StoCretec and Sto offer a high-quality and certified range of cleanroom coating systems. Our epoxy resin-based StoFloor Cleanroom systems for floors and StoWall Cleanroom systems for walls and ceilings are a superb choice to meet the high requirements of each specific application. The systems are characterised in particular by their smooth surfaces and excellent chemical resistance. The StoFloor Cleanroom systems also demonstrate excellent abrasion resistance, meaning that only low levels of particles form, when subjected to mechanical stress, such as when surfaces are walked or driven over. By optimising the ingredients, we have been able to further improve the outgassing behaviour of our coating systems.

**Build-up of the StoFloor Cleanroom system (example)**




**1** — Primer
**2** — Levelling coat
**3** — Conductive strip
**4** — Conductive layer
**5** — Coating

**Build-up of the StoWall Cleanroom system (example)**




**1** — Primer
**2** — Levelling coat (2 layers)
**3** — Sealing coat (2 layers)

# StoFloor Cleanroom coating systems for floors

## Properties and test certificates

### StoFloor Cleanroom coating systems

| | StoFloor Cleanroom BB OS System 1 | StoFloor Cleanroom KU 601 System 2 | StoFloor Cleanroom KU 611 System 3 | StoFloor Cleanroom Elastic WHG Deck 100 System 4 |
|---|---|---|---|---|
| **Properties** | Industrial and cleanroom coating, medium compressive strength, medium resistance to chemicals, e. g. for installations rooms | High-quality cleanroom coating, high compressive strength, good resistance to chemicals, very low particle abrasion | High-quality cleanroom coating, high compressive strength, good resistance to chemicals, dissipative | High-quality cleanroom coating, high crack-bridging ability, excellent resistance to chemicals, very low particle abrasion, German Federal Water Act (WHG) approval |
| **Elasticity** | Rigid | Rigid | Rigid | Crack-bridging |
| **Suitable for vehicle traffic with polyurethane and polyamide wheels** | ■ | ■ | ■ | ■ |
| **System layer thickness** | Approx. 1.5 mm | Approx. 1.5 mm | Approx. 1.5 mm | Approx. 2.0 mm |
| **Surface** | Smooth, gloss | Smooth, gloss | Smooth, gloss | Smooth, gloss |
| **Electrically conductive** | | | ■ | |
| **Water vapour permeability (EN 1504-2)** | | | | |
| **Substrate** | | | | |
| **Dry concrete** | ■ | ■ | ■ | ■ |
| **Dry cementitious screed** | ■ | ■ | ■ | ■ |
| **Concrete with increased levels of moisture** | ■ | ■ | ■ | ■ |
| **Cementitious screed with increased levels of moisture** | ■ | ■ | ■ | ■ |
| **Calcium sulphate and magnesite screed** | | | | |
| **Test certificates** | | | | |
| **Ease of decontamination** | ■ | ■ | ■ | ■ |
| **CSM outgassing test** | ■ | ■ | ■ | ■ |
| **CSM particle test** | ■ | ■ | ■ | ■ |
| **Resistance to disinfectants** | ■ | | | |
| **Metabolising potential** | ■ | ■ | | ■ |
| **Cleanability** | ■ | ■ | | ■ |
| **$H_2O_2$ absorption/ desorption** | ■ | ■ | | ■ |
| **Suitability for indirect contact with food** | ■ | ■ | ■ | ■ |

| **StoFloor Cleanroom Elastic WHG Deck 110 System 5** | **StoFloor Cleanroom WB 100 System 6** | **StoFloor Cleanroom WB 110 System 7** | **StoFloor Cleanroom KU 614 System 14** |
|---|---|---|---|
| High-quality cleanroom coating, high crack-bridging ability, excellent resistance to chemicals, very low particle abrasion, dissipative, German Federal Water Act (WHG) approval | High-quality cleanroom coating based on water-based epoxy resins, very low-emission | High-quality cleanroom coating based on water-based epoxy resins, very low-emission, very low particle abrasion, dissipative, very good conductivity | High-quality cleanroom coating, very low particle abrasion, dissipative, very good conductivity |
| Crack-bridging | Rigid | Rigid | Rigid |
| ■ | ■ | ■ | ■ |
| Approx. 2.0 mm | Approx. 2.0 mm | Approx. 2.0 mm | Approx. 1.5 mm |
| Smooth, gloss | Smooth, gloss | Smooth, gloss | Smooth, gloss |
| ■ | | ■ | ■ |
| | ■ | ■ | |
| | | | |
| ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ |
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| ■ | ■ | ■ | ■ |
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| | ■ | | |
| | ■ | | |
| | ■ | | |
| ■ | ■ | | |

# StoFloor Cleanroom coating systems for floors

## System build-ups

Image on right:
In cleanrooms and clean manufacturing areas, surfaces and materials also need to be cleanroom-compatible.
**Photo:** Guido Erbring

**StoFloor Cleanroom coating systems – system build-ups**

| | Primer | Levelling coat | Conductive layer | Coating | Sealing coat |
|---|---|---|---|---|---|
| **StoFloor Cleanroom BB OS System 1** | StoPox GH 205 | StoPox GH 205 + StoQuarz | | StoPox BB OS | |
| **StoFloor Cleanroom KU 601 System 2** | StoPox GH 205 | StoPox GH 205 + StoQuarz | | StoPox KU 601 | |
| **StoFloor Cleanroom KU 611 System 3** | StoPox GH 205 | StoPox GH 205 + StoQuarz | StoPox WL 110/118 | StoPox KU 611 | |
| **StoFloor Cleanroom Elastic WHG Deck 100 System 4** | StoPox WHG Grund 100 | StoPox WHG Grund 100 + StoQuarz | | StoPox WHG Deck 100 | |
| **StoFloor Cleanroom Elastic WHG Deck 110 System 5** | StoPox WHG Grund 100 | StoPox WHG Grund 100 + StoQuarz | StoPox WHG Leit 110 | StoPox WHG Deck 110 | |
| **StoFloor Cleanroom WB 100 System 6** | StoPox WG 100 | StoPox WG 100 + StoQuarz | | StoPox WB 100 | StoPox WL 100 |
| **StoFloor Cleanroom WB 110 System 7** | StoPox WG 100 | StoPox WG 100 + StoQuarz | StoPox WL 110/118 | StoPox WB 110 | StoPox WL 113 |
| **StoFloor Cleanroom KU 614 System 14** | StoPox GH 205 | StoPox GH 205 + StoQuarz | StoPox WL 110/118 | StoPox KU 614 | |

# StoWall Cleanroom coating systems for walls and ceilings

## Properties and test certificates

Image on right:
**ÉMI-TÜV SÜD Kft., Szentendre, HU**
StoCretec expertise:
StoFloor Cleanroom KU 601, StoFloor Cleanroom BB OS
**Photo:** Value 4 U Real Group, Budapest

### StoWall Cleanroom coating systems

| | StoWall Cleanroom WL 100 System 1 | StoWall Cleanroom WL 100 System 2 | StoWall Cleanroom WL 100 System 3 | StoWall Cleanroom WL 100 System 4 | StoWall Cleanroom WL 100 System 5 |
|---|---|---|---|---|---|
| **Properties** | | | | | |
| **Elasticity** | Rigid | Rigid | Rigid | Crack-bridging | Rigid |
| **System layer thickness without filler and levelling coat** | ≤0.5 mm | ≤0.5 mm | ≤0.5 mm | ≤0.5 mm | ≤0.5 mm |
| **Surface** | Smooth, gloss | Smooth, gloss | Smooth, gloss | Smooth, gloss | Smooth, gloss |
| **Water vapour permeability (EN 1504-2)** | ■ | ■ | ■ | ■ | ■ |
| **Substrate** | | | | | |
| **Dry concrete** | ■ | ■ | ■ | ■ | |
| **Concrete with increased levels of moisture** | ■ | ■ | ■ | ■ | |
| **Plaster: mortar group 2** | | ■ | ■ | ■ | |
| **Plaster: mortar group 3** | ■ | ■ | ■ | ■ | |
| **Gypsum plasterboard** | | | | | ■ |
| **Test certificates** | | | | | |
| **Ease of decontamination** | ■ | ■ | ■ | ■ | ■ |
| **CSM outgassing test** | ■ | ■ | ■ | ■ | ■ |
| **CSM particle test** | ■ | ■ | ■ | ■ | ■ |
| **Resistance to disinfectants** | ■ | ■ | ■ | ■ | ■ |
| **Resistance to fungi and bacteria** | ■ | ■ | ■ | ■ | ■ |
| **Suitability for indirect contact with food** | ■ | ■ | ■ | ■ | ■ |


## StoWall Cleanroom coating systems – system build-ups

| | StoWall Cleanroom WL 100 System 1 | StoWall Cleanroom WL 100 System 2 | StoWall Cleanroom WL 100 System 3 | StoWall Cleanroom WL 100 System 4 | StoWall Cleanroom WL 100 System 5 |
|---|---|---|---|---|---|
| **Primer** | StoPox WG 100 | StoPrim Plex | StoPrim Plex | StoPrim Plex | |
| **Levelling coat** | StoPox WB 50 | StoLevell In RS | StoLevell In RS | StoLevell In RS | StoLevell In Fill |
| **Full-faced levelling coat** | StoPox WB 50 | StoLevell In XXL | StoLevell In RS | StoLevell In RS | |
| **Primer** | | StoPrim Plex (optional) | StoPrim Plex (optional) | StoPrim Plex | StoPrim Plex |
| **Glass-fibre nonwoven** | | | | StoTap Pro 100 P, StoColl Tex | StoTap Pro 100 P, StoColl Tex |
| **Primer** | | | | StoPox WL 100 | StoPox WL 100 |
| **Sealing coat 1** | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 |
| **Sealing coat 2** | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 | StoPox WL 100 |

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Art.-no. 005430 rev.-no. 06/07.24 Printed in Germany