

High-purity positioning systems for demanding applications

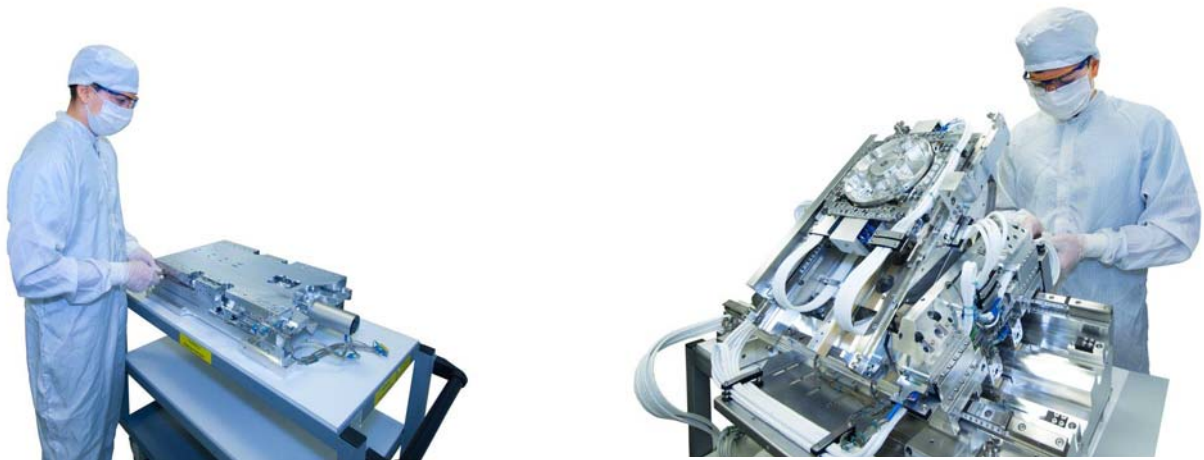
Assembly in Schneeberger's cleanroom

Positioning systems that are used in sectors such as the semiconductor and microelectronics industries must offer absolute precision and reliability. Absolute cleanliness is another requirement, as even the most miniscule impurities can interfere with positioning accuracy when working with tolerances of micrometres and nanometres. In order to satisfy these requirements, leading Swiss innovator Schneeberger AG Lineartechnik has invested in a cleanroom that, if necessary, can even satisfy cleanroom class ISO 4 requirements.

Schneeberger's highly accurate positioning and movement systems are some of the highest quality and most innovative in the world and therefore are used in the semiconductor industry in particular. They form the heart of systems that apply and test the most delicate structures in wafer production. Quality control and installation of systems suitable for mass production demand another important property in addition to absolute precision – the most extreme cleanliness.

Because of increasing miniaturisation of electronic components and the structures to be inserted (data highways) in the semiconductor chips, even the tiniest impurities can disrupt processes and falsify results. In microelectronics, what are known as e-beam wafer inspections are carried out in a vacuum or high vacuum, for example. All the machinery and systems must comply with the cleanliness conditions required in these areas. We can conclude that the same applies to the positioning systems used in the test facilities.

Microelectronics is not, however, the only field in which absolute cleanliness is required. This topic is becoming increasingly important for businesses in other sectors too. Schneeberger's discriminating customers also include energy industry laboratories, precision manufacturers of solar cells, DNA scanners, dental laboratories and other medical engineering enterprises.



In demand in the semiconductor industry: this high-precision positioning system from Schneeberger is in particular used in wafer production. It's about applying and testing the most delicate structures that form the basis for future semiconductor chips.

Years of cleanroom experience

The cleanroom concept is basically nothing new to workers in Schneeberger's development, production and product management departments, as Beat Wälti, Assembly Manager, explains: "We have been operating a cleanroom that meets ISO 7 criteria since 2005. Because we realised two or three years ago that even stricter classes of cleanliness would be required in the near future, we decided to develop a modular cleanroom, which is set up for ISO 6 as standard, and part of which can meet ISO 5 and, if necessary, even ISO 4." No sooner said than done – the new cleanroom was officially opened and commissioned in 2012.

Some figures might help to explain what cleanliness on this scale means. For ISO 4, just 10,000 particles measuring 0.1 μm can be found in a cubic metre and only 83 particles measuring 1 μm . Adrian Raible, Project Acquisition Manager, makes a good comparison: "Everyone knows that cleanliness is very important in a hospital. Operating theatres in particular must be clinically clean. This would be nowhere near satisfactory for us. Our standard cleanroom is 1,000 times better in terms of particle cleanliness than an operating theatre!"



Even the most minuscule impurities would interfere when the structures (data highways) inserted into semiconductor chips, which are accurate to micro- and nanometres, are tested.

Clearly defined processes matter

The presence of a cleanroom alone does not, however, guarantee that high-purity positioning systems will be turned out. All the employees involved must strictly adhere to specific logistical processes in order to ensure this. This means that everything that goes in and out of the cleanroom must comply with a specific procedure. Employees pass through a double-door airlock, where they put on protective clothing commensurate with the cleanliness class. This means full protection, where only the worker's eyes are visible, for the separate ISO 5 area.

There is also a strict procedure for the parts and modules to be assembled. They are cleaned and double packaged immediately after manufacture according to specific requirements. Another brief clean is required when they reach the materials lock, before individual materials are baked at a defined temperature and under vacuum. "This is necessary to prevent later degassing", explains Markus Kindler, adding: "Then our specially trained employees assemble and test the positioning systems according to ISO conditions and then clean them again in a dark room lit by UV light, which reveals even the most miniscule particles of dust." Before the high-end products leave the cleanroom via the materials lock, they have to be double packed again, this time in a nitrogen atmosphere with anti-static and gas-tight films. The customer can thus be certain that they are receiving a product that fulfils their order in terms of quality, precision and cleanliness.



Schneeberger has invested in a modular cleanroom, which meets Class ISO 6 requirements as standard, to be able to supply ultra-clean positioning systems. Even higher standards according to ISO 5 and ISO 4 can be achieved in a separate sub-area.

Cleanliness during end application

Schneeberger's experienced technicians and engineers are always thinking one step ahead so that customers do not experience cleanliness problems when the positioning systems are in operation. They realise that where there is mechanical movement, there's friction, and where friction occurs, there's dust. It is thus worth reliably removing from the test or production process the miniscule particles generated during operation. The Swiss specialists achieve this, for example, with a static charge at local abrasion points, as can be generated by linear control systems. Schneeberger thus keeps even the finest particles in one place. The innovative company uses PTFE (Teflon) sheathing on another abrasion point, the cable carriers. This significantly reduces particle generation from the outset.



A hood is also part of the standard clothing for specialists working in the ISO 5 and 4 class cleanroom. A filter installed directly over the workstation guarantees optimum air cleanliness.



Adrian Raible (left), Project Acquisition Manager, and Beat Waetli, Assembly Manager for Schneeberger, explain the importance of cleanliness in their company: "Our standard cleanroom is 1,000 times better in terms of particle cleanliness than a hospital operating theatre!"

Cleanroom classes according to ISO 14644-1

Class	(particle per m ³)					
	≥ 0.1 µm	≥ 0.2 µm	≥ 0.3 µm	≥ 0.5 µm	≥ 1.0 µm	≥ 5.0 µm
ISO 1	10	2				
ISO 2	100	24	10	4		
ISO 3	1,000	237	102	35	8	
ISO 4	10,000	2,370	1,020	352	83	
ISO 5	100,000	23,700	10,200	3,520	832	29
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

Boilerplate Schneeberger

Founded in 1923, Schneeberger is now one of the leading names when it comes to ground-breaking innovations in the field of linear technology. Linear bearings, profiled linear guideways, measuring systems, gear racks, slides, positioning systems and mineral casting are all part of Schneeberger's product and manufacturing range. The company serves original equipment manufacturers operating in various industries worldwide – from solar and semiconductor technology to electrical and medical engineering, every field is represented. Schneeberger's distributors and exclusive representatives can be found in all major industrial nations around the world, thereby guaranteeing the best possible proximity to customers everywhere.

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