

Manufacturing in Cleanrooms at PI (Physik Instrumente)

Capabilities and Capacity



1 Introduction

PI has the capability to manufacture and qualify products under cleanroom conditions at a number of production sites. This capability is extended and improved continually according to market needs.

1.1 Standards

Since 2001, classification of cleanrooms no longer takes place according to US FED STD 209E but instead, according to ISO 14644-1. Some of the cleanroom classifications are listed according to both standards in the following tables.

Class	Particle per m ³					
	0.1 µm	0.2 µm	0.3 µm	0.5 µm	1.0 µm	5.0 µm
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

Tab. 1 Clean room classification according to ISO14644-1

Class	Particle per m ³			
	0.2 µm	0.3 µm	0.5 µm	5.0 µm
100	26,486	10,594	3,531	
1,000			35,315	247
10,000			353,147	2,472
100,000			3,531,470	24,720

Tab. 2 Cleanroom classification according to US FED STD 209E

2 Available Cleanrooms / Ultraclean Workplaces

In addition to cleanrooms, PI also has ultraclean workplaces, which are installed either inside or outside of the cleanrooms, and their purpose, when compared to the respective environment, is to achieve a further reduction of particle contamination during certain process steps.

2.1 PI Karlsruhe

PI Karlsruhe is the largest production and development site in the PI Group. Standard and custom products, mainly in the field of piezo-based positioning systems, hexapods, and magnetic drives are assembled and qualified here. All areas for mass production, including incoming goods inspection, are ISO class 8 cleanrooms. In addition, PI Karlsruhe has a newly created ISO class 5 cleanroom that also considers all standards applied to EUV applications. The Special Products Fractal, in addition, has rooms classified according to ISO class 7 as well as ISO class 5 ultraclean workplaces. An ISO class 7 laboratory is available in the Development department.

Cleanroom classification	Available space in m ²
ISO 5	250
ISO 6	-
ISO 7	600
ISO 8	3,000

Tab. 3 Cleanrooms at PI KA



Abb. 1 Manufacturing space in ISO class 5 cleanroom at PI Karlsruhe



Abb. 2 Measuring technology space in ISO class 5 cleanroom at PI Karlsruhe

2.2 PI Ceramic, Lederhose

The entire process chain for multilayer production, beginning with tape casting, is realized at PI Ceramic in cleanrooms according to ISO class 6, 7, and 8; the assembly processes for piezo actuators and sensors of the Building Components product division also take place consistently in ISO class 7 or 8 cleanrooms. Depending on the process requirements, ISO class 7 to 9 cleanrooms are available for further selected processes such as sputtering, screen printing, and dispensing.

Cleanroom classification	Available space in m ²
ISO 6	310
ISO 7	720
ISO 8	620
ISO 9	340

Tab. 4 Cleanrooms at PI Ceramic, incl. building extension (completion in Q3/2020)



Abb. 3 Workplace for manufacturing PICMA® multilayer actuators in an ISO class 6 cleanroom at PI Ceramic

2.3 PI miCos, Eschbach

All assembly areas at PI miCos, including incoming goods inspection, are ISO class 8 cleanrooms. Some of these cleanrooms contain ultraclean workplaces with ISO class 5. The Engineered Systems division also has an ISO class 7 cleanroom.

Cleanroom classification	Available space in m ²
ISO 5	10
ISO 6	-
ISO 7	60
ISO 8	650

Tab. 5 Cleanrooms at PI miCos

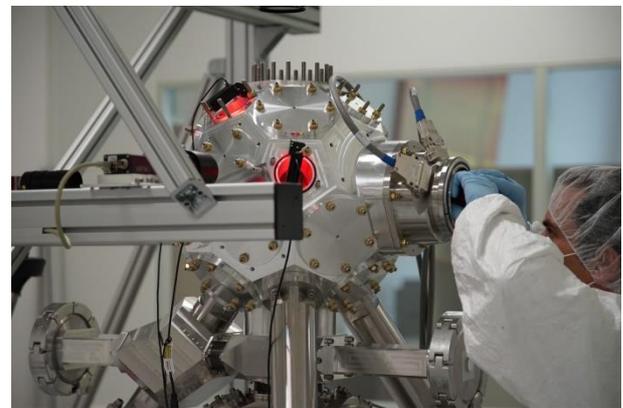


Abb. 4 Multi-axis positioning system for X-ray spectroscopy, manufactured in an ISO class 7 cleanroom at PI miCos in Eschbach, Germany

2.4 PI USA, Hopkinton

PI USA has an ISO class 8 assembly island in the production area, which includes measuring capabilities, cleaning, and packaging under cleanroom conditions.

Cleanroom classification	Available space in m ²
ISO 5	-
ISO 6	-
ISO 7	-
ISO 8	20

Tab. 6 Cleanrooms at PI USA

3 Supporting Processes

Depending on the processes at the respective locations, PI or its partners have the ability to clean parts and products at each location according to the cleanroom classifications and then check the cleaning results for particle contamination and if necessary, for other types of contamination as well.

Calibrated particle measuring devices allow PI to monitor the cleanroom quality according to the specifications of ISO 14644-1. PI also has the ability to measure the quantity of particles that originate from its own products under operational conditions.

To get an insight into the new cleanroom at PI Karlsruhe, please click on the thumbnail:



PI in Brief

For many years, PI (Physik Instrumente), founded in 1970, has been a market and technology leader for high-precision positioning technology and piezo applications in the semiconductor industry, life sciences; photonics, and in industrial automation. In close cooperation with customers from all over the world and for 50 years now, PI's specialists (approx. 1,300) have been pushing, again and again, the boundaries of what is technically possible and developing customized solutions from scratch. Technologies from PI achieve reproducible accuracies in the millionth of a millimeter range. More than 350 granted and registered patents underline the company's claim to innovation.

PI develops, manufactures, and qualifies all core technologies in-house, thereby constantly setting new standards for precision positioning: Piezoceramic patch transducers and actuators, electromagnetic drives, and sensors working in the nanometer range. As the majority owner of ACS Motion Control, PI is also a leading global manufacturer of modular motion control systems for multi-axis drive systems and develops customized complete systems for industrial applications with the highest precision and dynamics.

With six manufacturing sites and 15 sales and service offices in Europe, North America, and Asia, PI is represented wherever high-tech solutions are developed and manufactured.