USG
Ceiling
Solutions

USG CLEANROOM CEILINGS GUIDE

Everything you need to know about cleanrooms for medical environments, data centers, biotechnology, pharmaceutical, microelectronics, military, telecommunications and the food Industry.

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CLEANROOM SYSTEMS

DEFINITION

Per the International Standards ISO 14644, a cleanroom is an enclosed room in which the concentration of airborne particles is controlled, and is constructed and used to minimize the introduction, generation, and retention of particles inside the room, and in which other relevant parameters including temperature, humidity, and pressure, are controlled as necessary. Cleanrooms and associated controlled environments provide for the control of airborne particulate contamination to levels appropriate for accomplishing contamination-sensitive activities.

The cleanliness of a space is defined and tested to ISO Standard 14644, formerly tested to the U.S. Federal Standard 209E. ISO 14644 assigns ISO classification levels to be used for the specification of air cleanliness in cleanrooms and associated controlled environments. It also prescribes the standard method of testing as well as the procedure for determining the concentration of airborne particles.

APPLICATIONS

Products and processes that benefit from the control of airborne contamination include those in such industries as aerospace, microelectronics, pharmaceuticals, medical devices, food, and healthcare. ISO 14644 cleanroom test provide three important details — the ISO Class, the operational state, and the considered sizes.

CLASSIFICATIONS

There are 9 classifications or levels of airborne particulate cleanliness applicable to a cleanroom, Class 1 being the cleanest. Airborne particles are measured in microns. Particle populations in cleanrooms are measured from 0.1 microns to 5 microns. The ISO Class number represents maximum allowable concentration of particles per cubic meter of air for considered sizes of particles.

TYPES OF OCCUPANCY STATES

There are three specific environments as defined by ISO 14644 that can be tested;

- as-built: condition where the installation is complete with all services connected and functioning but with no production equipment, materials, or personnel present
- at-rest: condition where the installation is complete with equipment installed and operating in a manner agreed upon by the customer and supplier, but with no personnel present
- operational: condition where the installation is functioning in the specified manner, with the specified number of personnel present and working in the manner agreed upon

CLEANROOM FILTERS, AIRFLOW AND PRESSURE

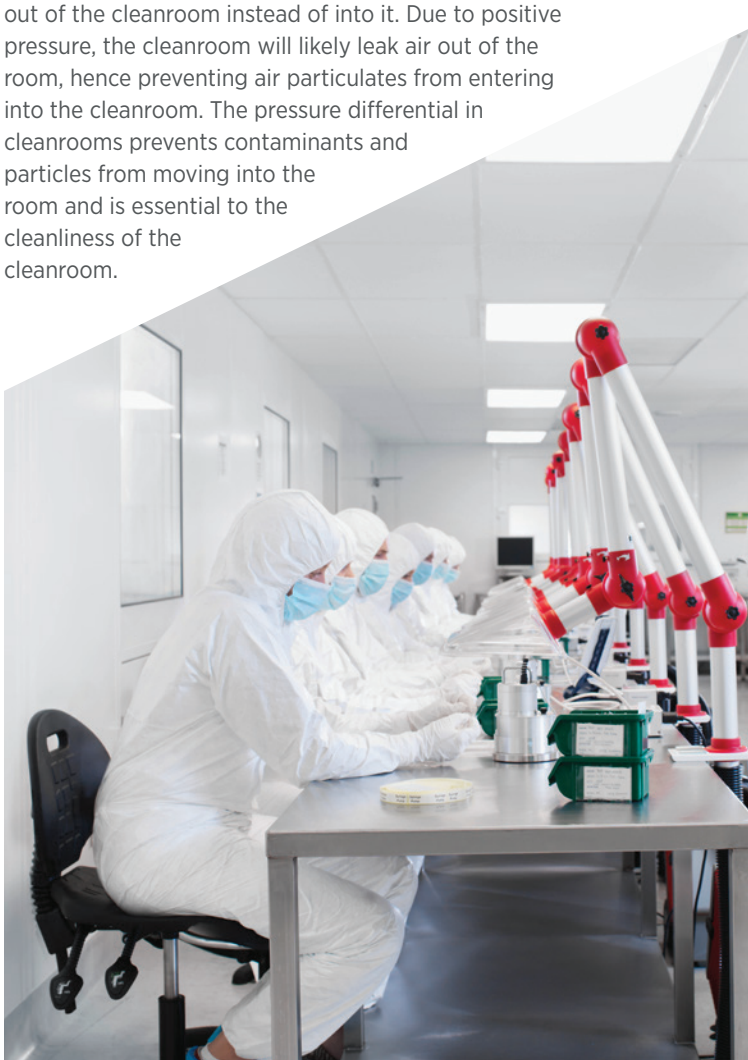
FILTERS AND AIRFLOW

The higher the cleanroom classification, the more stringent the demands on air quality. The air filter can be considered the heart of the cleanroom. Cleanroom filters are designed to filter out particulates to achieve specified particulate levels. There are two types of filtering systems — ULPA- Ultra Low Particulate Air designed for Class 4 and lower (more stringent) and HEPA- High Efficiency Particulate Air designed for Class 5 and higher (less stringent).

Both filters contribute to holding minimum pressure drop and maximum airflow in operation. Air moves easily through them and relatively little power is needed to overcome restrictions. The lower the ISO class, the more often you will need to pass the air through the HEPA filter. This is what we call air change per hour (ACH). In order to reach a desired cleanliness level inside the cleanroom, one must account for air changes per hour (ACH) with filtered air circulating into the cleanroom multiple times per hour.

PRESSURE

Most cleanrooms are held in positive pressure, except when dealing with hazardous materials, which must be held in negative pressure. Positive pressure forces air flow out of the cleanroom instead of into it. Due to positive pressure, the cleanroom will likely leak air out of the room, hence preventing air particulates from entering into the cleanroom. The pressure differential in cleanrooms prevents contaminants and particles from moving into the room and is essential to the cleanliness of the cleanroom.



CLEANROOM TESTING

USG cleanroom ceiling system are tested for particulate control capability by Acorn Industries, Inc. or by UL Environment (a business division of Underwriters Laboratories), depending on the intended purpose of the ceiling system. The following table compares the key differences in companies and test methods.

USG cleanroom ceiling system, tested by either Acorn Industries, Inc. or UL Environment, are an appropriate choice when general cleanliness is a concern. **The Acorn Industries, Inc. tested panels are an appropriate choice for use in an actual HEPA filtered cleanroom.**

ATTRIBUTE	ACORN INDUSTRIES, INC.	UL ENVIRONMENT
Company expertise (with respect to cleanrooms)	Contamination control engineering Design and test of cleanrooms and cleanroom components Particulate measurement	Particulate measurement
Method of particulate measurement per volume of air	ISO 14644: Cleanrooms and Associated Controlled Environments	ISO 14644: Cleanrooms and Associated Controlled Environments
Purpose of testing	Simulate long term conditions of a HEPA filtered cleanroom including impact, vibration and pressure testing, and perform particulate tests to determine the compatibility of ceiling systems with these conditions	Perform particulate tests to determine the compatibility of ceiling systems with a cleaner environment
Air changes per hour during particulate test	360 ACH - typical of an ISO 5 HEPA filtered cleanroom	1 ACH
Other conditions applied during testing	Pressure fluctuations typical of a HEPA filtered cleanroom Impact and vibration typical of a HEPA filtered cleanroom	Steady state conditions

SELECTING AND INSTALLING USG CLEANROOM PRODUCTS

USG CEILING PANELS

USG offers four families of cleanroom panels, with varied materials of construction and cleanroom capabilities, as described in the table below:

USG CLEANROOM PANELS	PANEL CONSTRUCTION	ISO PARTICULATE RATING	TESTED BY	TEST CONDITIONS
USG Sheetrock® Brand Lay-In Ceiling Panels Clean Room™	Gypsum panel substrate with vinyl laminated face with encapsulated edges	ISO 5	Acorn Industries, Inc.	360 ACH with pressure fluctuations, vibration, & impact
USG Clean Room™ Class 100 (ISO 5) Panels	Wet-formed mineral fiber substrate with vinyl laminated face with encapsulated edges	ISO 5	Acorn Industries, Inc.	360 ACH with pressure fluctuations, vibration, & impact
USG Clean Room™ Class 10M-100M (ISO 7) Panels	Wet-formed mineral fiber substrate with vinyl laminated face, acoustical perforations, and encapsulated edges	ISO 7-8	Acorn Industries, Inc.	360 ACH with pressure fluctuations, vibration, & impact
USG Mars™ Healthcare Clean Room™ Panels	Wet-formed mineral fiber substrate with glass mat laminated face with healthcare coating and encapsulated edges	ISO 5	UL Environment	≤1 ACH with otherwise steady state conditions

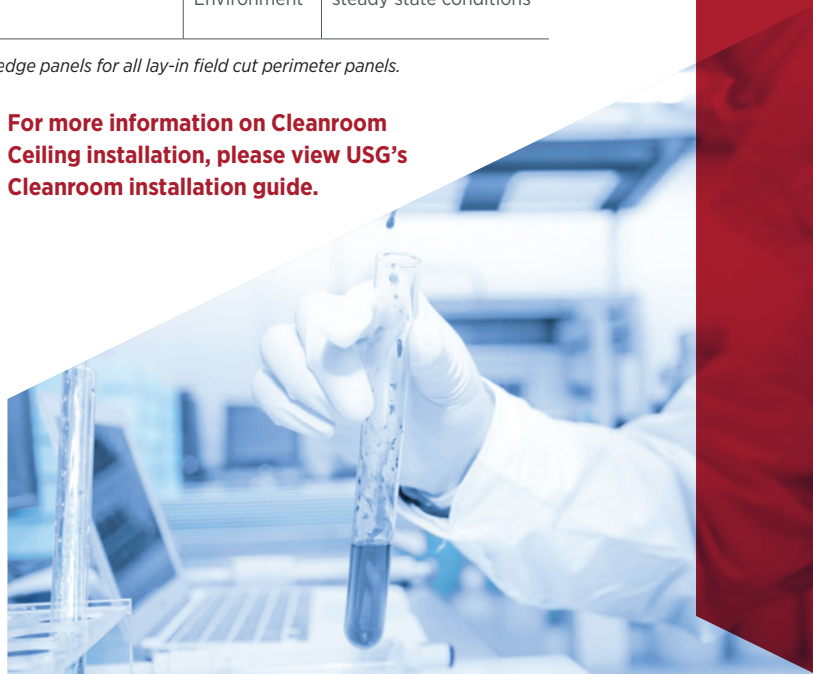
Field cut edges of ceiling panels must be sealed with a white latex paint. Use square edge panels for all lay-in field cut perimeter panels.

USG GRID

USG cleanroom panels must be used with the following USG materials to form a USG cleanroom ceiling system, and to achieve the ISO ratings shown above. The full system of components is required to create the proper seal. Usage of Donn® Brand CE™ Acoustical Suspension Systems with factory applied gaskets on the flange, U-shaped wall channel, and hold down clips ensures the proper seal between the plenum and cleanroom to hold pressure and prevent particulate ingress. The level of particulate control required depends on the application.

- Gasketed USG Suspension System
- U-Shaped Wall Molding
- Hold Down Clips

For more information on Cleanroom Ceiling installation, please view USG's Cleanroom installation guide.



PRODUCT INFORMATION

For the most up-to-date product information, visit usg.com or cgcinc.com

CUSTOMER SERVICE

USG: 800 950-3839
CGC: 800 387-2690

TECHNICAL SERVICE

800 USG.4YOU (874-4968)
WEBSITES usg.com cgcinc.com

SOURCES International Standard ISO14644

LIMITATIONS Interior applications only

NOTICE We shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods not in accordance with current printed instructions or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

SAFETY FIRST! Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protective equipment. Read SDS and literature before specification and installation

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