Cleanroom Basics

Columbia LIGHTING

COLUMBIA LIGHTING'S SUITABLE LUMINAIRES	
PRODUCT	**CLASSIFICATION**
CFP Edge-Lit Flat Panel	5–9 (positive pressure spaces)

Cleanroom Basics

WHAT IS A CLEANROOM?

Certain manufacturing, research labs or material processing environments require enclosed rooms where the airborne particulates, temperature, humidity, air pressure, airflow, and other environmental variables are tightly monitored and controlled; these are generally referred to as "cleanrooms." Requirements for the construction of the cleanroom, equipment used, and practices of the room occupants are all defined based on the level of control required.

HOW ARE DIFFERENT LEVELS OF CLEANROOMS DEFINED?

Depending on the required particulate count and allowable particulate size (measured in microns), a clean room can be designed to an ISO 1 through ISO 9 classification, as outlined in the ISO 14644-1 standard. The ISO system was adopted in 2001 to replace the previous room rating system described in Federal Standard 209E. Table 1 below defines the different ISO classifications and corresponding requirements, and shows the equivalent Federal Standard 209E levels. Table 2 provides general guidance on the level of cleanroom required for different applications.

ISO 14644-1 CLEANROOM STANDARDS							
CLASSIFICATION	**MAXIMUM PARTICLES/M³**						**FED STD 209E EQUIVALENT***
	≥0.1µm	**≥0.2µm**	**≥0.3µm**	**≥0.5µm**	**≥1µm**	**≥5µm**	
ISO 1	10	2.37	1.02	0.35	0.083	0.0029	
ISO 2	100	23.7	10.2	3.5	0.83	0.029	
ISO 3	1,000	237	102	35	8.3	0.29	**Class 1**
ISO 4	10,000	2,370	1,020	352	83	2.9	**Class 10**
ISO 5	100,000	23,700	10,200	3,520	832	29	**Class 100**
ISO 6	1.0 x 106	237,000	102,000	35,200	8,320	293	**Class 1,000**
ISO 7	1.0 x 107	2.37 x 106	1,020,000	352,000	83,200	2,930	**Class 10,000**
ISO 8	1.0 x 108	2.37 x 107	1.02 x 107	3,520,000	832,000	29,300	**Class 100,000**
ISO 9	1.0 x 109	2.37 x 108	1.02 x 108	35,200,000	8,320,000	293,000	**Room Air**

TABLE 1: CLEANROOM CLASSIFICATIONS DEFINED

*Federal Standard 209E Class levels based on maximum limits of ≥0.5µm sized particulates in a cubic foot of air.

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ISO 14644-1 CLEANROOM CLASSIFICATIONS	APPLICATIONS**								
	NANOTECH & MICROELECTRONICS	MEDICAL IMPLANTS PRODUCTION	PHOTO LABS	BIOTECHNOLOGY	PHARMACEUTICAL	OPERATING ROOMS	MEDICAL DEVICES	AUTOMOTIVE (PAINTING & ELECTRONICS)	PLASTIC INJECTION MOLDING
ISO 1	●								
ISO 2	●								
ISO 3	●								
ISO 4	●								
ISO 5	●	●	●	●	●				
ISO 6	●			●	●				
ISO 7				●	●	●	●	●	
ISO 8				●	●	●	●	●	
ISO 9									●

TABLE 2: CLEANROOM APPLICATIONS

**The classifications shown are for general guidance only. An evaluation of the specific process requirements should be done to arrive at the appropriate cleanroom classification.

WHAT IS A MICRON?

The term micron (µm) is used in the cleanroom industry in place of micrometer (which is one-millionth of a meter). 1 micron is approximately one-hundredth the width of a strand of human hair. A 10 micron particle is smallest particle that can be seen by the naked eye. The most demanding cleanrooms can control 0.01 and 0.05 particles.

The design of the cleanroom can effectively manage the introduction of particulates from the incoming air, but people in the room and processes can also bring in or create particulates that have to be addressed.

WHAT IS A POSITIVE PRESSURE CLEANROOM?

The design of the HVAC system is a critical element of any cleanroom. Solutions utilize high efficiency filters to remove particulates from entering the room and provide a higher number of air changes (compared to normal spaces) to eliminate the settling of particulates in the room.

Positive pressure cleanrooms are the most common and involve a design where air is constantly flowing out of the room. The positive pressure is achieved by supplying a greater volume of filtered air than is extracted from the room through air returns. This helps force any particulates out of the room and limits particulates from being drawn into the room from adjacent spaces when people enter the room. The CFP luminaire is suitable for positive pressure cleanrooms.

While less common, negative pressure rooms are utilized where dangerous contaminants must be contained like hazardous fumes or infectious diseases. These spaces work opposite of a positive pressure room. The air is pulled in from outside the room, filtered and then returned to the outside.

TESTING THE CLEANROOM

A cleanroom is tested and certified at the conclusion of the construction based on the ISO 14644-1 standard with annual follow-up testing. On-going monitoring equipment provides particulate measurements regularly between formal testing.