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Cascading Cleanroom Pressure: Explained

You probably already know how important proper air filtration is in meeting your cleanroom's ISO requirements. But what you may not realize is how important some other environmental factors are as well. Things like temperature, humidity, static, and pressure all need to be controlled in order to ensure a clean, hazard-free space for your sensitive operations.

In this article, let's take a closer look at airflow design and pressure — specifically cascading pressure. We'll discuss what it is, why it matters, and when it's needed.

An Overview of Cleanroom Airflow Design & Pressure

If you have a baseline knowledge of cleanrooms, you may already know about airflow design and the two most common types of cleanroom pressure: positive pressure and negative pressure. If you don't, we'll break these concepts down for you:

- **Positive pressure** means the air pressure inside your cleanroom is *greater* than the pressure outside of it. Achieved by pumping filtered supply air into your cleanroom, this helps prevent harmful particles from entering and disturbing sensitive applications. The general rule of thumb here is that more supply air is coming into the cleanroom than is being exhausted out of it.

- **Negative pressure** means the air pressure inside your cleanroom is *lower or less positive* than the pressure outside of it. This prevents harmful particles from escaping or exiting to other critical spaces and damaging external environments. The general rule of thumb here is that more air is being exhausted out of the cleanroom than is being supplied and coming into it. You may think of it like a vacuum working to remove hazardous particles.

Find more details on the difference between positive and negative cleanroom pressure here.

What Is Cascading Pressure in a Cleanroom?

Most facilities and cleanroom suites require a specific airflow design, specifically known as cascading pressure. **Cascading pressure means the most stringent cleanroom zone has the highest level of pressure, and the least stringent cleanroom zone has the lowest level of pressure. This is to ensure the flow of contamination is from clean to less-clean.** In other words, there are pressure differentials in each of the zones within a cleanroom suite, based on how strict their cleanliness requirements are.

Why Is Cascading Pressure Needed in a Cleanroom?

Proper airflow design and pressurization is essential for facilities with cleanroom suites, or cleanrooms that have multiple rooms and/or zones within them, to control contamination. Typically, the tasks that are carried out within these zones require different levels of cleanliness and environmental control. Therefore, cascading pressure is needed to ensure air flows in a way that prevents particles from entering the cleaner zone, or most controlled space, in the suite.

That said, airflow design is an important consideration for you to make *before* your cleanroom and associated technologies are installed. Talk with your cleanroom manufacturer to figure out the most effective, safe process flow for your applications and how best to monitor the airflow within the cleanroom. They'll work with you to determine which zones should accommodate certain tasks, and how pressure should flow throughout them to best protect personnel and material processes.

How to Monitor Cleanroom Airflow and Pressure in Between Zones

So you've designed your cleanroom suite to accommodate optimal airflow and pressure — but your work isn't over yet. In order to ensure consistently controlled operations, you need to regularly measure and monitor airflow and pressure levels.

Luckily, there are a few tools and technologies that make this process an easy one, including:

- **Differential pressure gauges**, which measure and visualize the difference between two pressure points within your cleanroom suite.
    - **Magnehelic or analog gauges**, which have a needle pointer or dial that senses the differential in air pressure and responds to the change in pressure between the adjacent spaces. The pressure reading is displayed.
    - **Digital pressure gauge**, which senses the differential in air pressure and responds to the change in pressure between the adjacent spaces, and is then converted to an electronic signal, shown using a digital display.

- **Distributed sensor modules (DSMs)**, which are network-accessible modules used to monitor room differential pressure, and in some cases temperature and humidity as well. The output of the sensor is an analog signal that can be fed to a console or interface card for monitoring and control. One great benefit of these modules is that they can be connected to your building management system (BMS), so measuring and monitoring cleanroom airflow and pressure is in one cohesive system where all the readings are in one place.

Need Help With Your Next Cleanroom Project? Contact Us

If you have questions related to pressure or any other cleanroom-related topic, don't hesitate to contact us at Angstrom Technology. Our team is full of skilled, friendly experts who are happy to provide the answers you need. And as an industry leader in cleanroom design and installation, we're able to tackle whatever specifications your cleanroom project may require.