

The Essential Parts of Designing a Cleanroom

Adding a cleanroom to your facility is more like adding an entirely new facility. And for all intents and purposes, you are.

Your cleanroom will share no actual walls with the rest of your facility and require completely different heating, ventilation and environmental controls.

With so much to consider, today we will examine the essential factors that need to be considered when designing your cleanroom.

Start with a Utility Matrix

This is a document that you will prepare in advance of building/ designing your cleanroom, which will outline all of the equipment that will be used.

Of course, this is a "living document" that will be constantly updated to reflect additions and upgrades to your equipment.

Your UM needs to be completed and has to get approval from stakeholders before it can be submitted to your cleanroom designer. From there, it will very much act as a roadmap for what needs to be done.

HVAC and Airflow

The air quality in your cleanroom is one of the most crucial elements, and one of the most challenging to maintain. This is why it typically accounts for about a quarter of your costs.

Your cleanroom' system will require:

- Air recirculation
- Hot and cold water
- Process exhaust
- Makeup air systems (MUA)

Most notably, your exhaust system must be in line with both your facility's needs and industry regulations for a hazardous production material (HPM) facility to remove any potentially hazardous fumes that may escape from fabrication or support equipment.

Your facility's exhaust flow rates and the MUA quantities are determined to cover the air exhausted from the facility plus surplus air to pressurize the cleanroom ($MUA=EXH+10\%$).

This will impact:

- The volume of heating and chilled water required from chillers and boilers
- The amount of heat that needs to be removed by cooling coils and recirculation
- The level of humidity that needs to be maintained

Your cleanroom will also likely be positively pressurized, whereas the gas and chemical rooms will have negative pressure.

Cleanrooms have a pressure cascade where the highest level cleanroom will have the highest pressure. An adjacent cleanroom with a lower classification would have lower pressure, a growing room would have even lower pressure, and the non-cleanroom area would see the least pressure.

The Recirculation Air system

Any recirculation air system needs to provide clean and conditioned air to your cleanroom.

Starting at the top of the room, your ceiling filter coverage and their efficiency will dictate the cleanliness of the air in your cleanroom, with the continuous dilution and removal of unwanted particles in the cleanroom.

Your MUA units will regulate the moisture removal and pressure control. Elsewhere they are aided by sensible cooling coils to “trim” the temperature to meet the tight tolerances.

Comparing Recirculation Air Handlers, VLF Fan Towers, and Fan Filter Module Units

Recirculation Air Handlers

These are among the most affordable units. However, they do come with a higher operating cost, as they consume more power than other types. They are also among the loudest.

VLF Fan Towers

These use laminar airflow to control particulate contamination through the vertical profile of the cleanroom. There is also a possibility of the gel ceiling grid and a positive pressure plenum-causing particles or gel leaking into the cleanroom.

They do operate at a high energy efficiency level.

Fan Filter Module Units

These are small and are ideal where overhead space may not be abundant. They also operate relatively quietly, efficiently, and are very cost effective for a small to medium-sized space.

However, the bigger your space, the more you will need to add.

The Industry's Leading Cleanroom Specialists

Our company's roots began in 1927 in commercial heating and air conditioning and evolved over the years until our expertise in temperature and humidity control helped us find our calling in cleanrooms in the late 1990s.

Today, Environmental Systems Corporation designs critical environments and builds cleanrooms to ISO 14644 4, 5, 6, 7 & 8 Requirements.

Ready to discuss your project? Click here to [contact us anytime](#).