12 Tips for Lab Architects Designing Cleanrooms

Are you interested in clean room design? Here's an A to Z clean room design orientation prepared for lab architects.

Clean room design

AUSTIN, TEXAS, UNITED STATES, March 13, 2017 /EINPresswire.com/ -- We met a group of architects at a large regional lab design conference, and they brought up an unexpected topic. As laboratory architects, they were not entirely confident in designing cleanrooms. To get a basic orientation on the practice of designing cleanroom facilities, they came to FORMASPACE for expert advice. We've prepared this introductory guide in response to help those of you who are new to this specialized practice area.

> When designing the clean room layout keep the most critical areas away from high traffic areas, especially the entrances and exits, to minimize exposure to contaminants."
>
> *Formaspace*

TIP 1: Cleanrooms are designed with specific industrial applications in mind

As a rule, your project's industrial category will determine which cleanroom design requirements are in effect. Here are four of the most common categories:

Healthcare product manufacturing (includes pharmaceuticals and medical devices)
Electronic semiconductor manufacturing
Food manufacturing
Biological and chemical research laboratories

Each of the above has their own unique design requirements.

Cleanroom designs can be further segregated into two groups: those that work with hazardous materials and those that do not.

TIP 2: Become familiar with the cleanroom standards that govern your application

You'll see a lot of references to Federal Standard 209E. This standard was in effect for many years but has been superseded by ISO Standard 14644.

Architects and designers will want to pay special attention to ISO 14644 Part 4: Design, Construction,

and Startup, which gives guidance on how to design a cleanroom. If you need to familiarize yourself with industry terminology, read ISO 14644 Part 6: Terms and Definitions. Finally, check out ISO 14644 Part 7: Separative Enclosures. This covers approved designs for clean air hoods, gloveboxes, isolators, and mini-environments.

In addition, you may notice the ISO 14644 standard refers to Classes 1 through 9. Class 1 is the 'cleanest': It has the most stringent requirements for particle size and airborne particulate concentration. Class 9 is the least restrictive: This standard allows larger particle sizes at higher airborne concentrations.

Finally, if your application is pharmaceutical manufacturing, there are two more standards to know about. The Federal "Guideline on Sterile Drug Products Produced by Aseptic Processing" governs pharmaceutical manufacturing cleanrooms in the USA. If you are manufacturing pharmaceuticals for Europe, the "European Union Guide to Good Manufacturing Practices" (EU GGMP) will apply.

Clean room with a fumehood


stainless steel gowning bench

TIP 3: Cleanrooms fit within a larger air purifying system
When you are designing a standard office space or a typical laboratory, proper heating and cooling are one of many considerations you take into account to create a balanced, functional building design.

Cleanroom design is very different. It's ALL ABOUT the HVAC system. So much so that it's a useful mental exercise to imagine placing the working part of a cleanroom inside the ducting of the HVAC system.

In most modern cleanroom designs there is an enormous air plenum in the ceiling that directs purified air into the room at high velocity. The air flows straight downward toward an elevated floor, where it exits via return air flow grates. Large air conditioners kitted out with HEPA filters process the return air — adding additional fresh 'make up' as needed — and the cycle starts again.

TIP 4: Cleanrooms are VERY energy intensive due to enormous airflow requirements
While a typical office might have between two and ten air changes per hour, turbulently ventilated cleanrooms will require anywhere from ten to 100 air changes per hour.

This means the HVAC systems for cleanrooms will need to be upsized considerably compared to normal systems. It also means cleanrooms consume vast amounts of energy. No LEED certification here!

As a result, not only will you need to provide more room than normal for cooling unit components, everything else will need to be upsized as well, including:

Provisions for larger air passageways
Noise and vibration-suppression elements
Dedicated bus for electric power
Backup electric generator
Larger exterior intake and exhaust stacks, etc.

TIP 5: Designing proper cleanroom airflow is critical
Oftentimes architects describe their design process as one of developing an aesthetically pleasing, functional progression of volumetric shapes. Others will describe their process as one of designing with light (and dark) visual elements.

For cleanroom design, the process could be described as one where you design how the air moves through the facility.

It’s not a simple process.

The requirements can be complex. For typical cleanrooms (e.g. those not handling hazardous materials), the innermost space (where the most critical work is done) has the highest air pressure — moving at the highest velocity — to flush out particulates that could contaminate the room. Airlocks (hatches) allow people and equipment to access the cleanroom without disturbing the positive air pressure.

TIP 6: Use an Onion Layer design philosophy: Surround cleanrooms with cleanzones

Read more... https://formaspace.com/articles/architect/12-tips-lab-architects-designing-cleanrooms/?utm_source=einpresswire&utm_medium=content&utm_campaign=article-061817

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