Dortek Guide:
Specifying Cleanroom Doors

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Dorteks Guide to Specifying Doors for Cleanroom Environments

Choosing the correct door system is a major factor in maintaining the delicate balance of a cleanroom environment. Dortek's reviews the trends and offers key points to consider when specifying doors.

A cleanroom is defined by ISO standards as 'a room in which the concentration of airborne particles is controlled, and which is constructed and used in a manner to minimise the introduction, generation and retention of particles inside the room'. Keeping airborne contaminants from entering the environment is a primary concern for cleanroom designers. Contaminants come from several sources: air supplied to the room, particles generated within the room and the infiltration of particles from adjacent rooms and corridors. Airborne particles give micro-organisms the opportunity to reproduce and even the smallest particle can cause contamination of product, expensive downtime and costly maintenance.

Particles from supplied air are easily controlled using High Efficient Particulate Air (HEPA) filters. With an efficiency of 99.7%, the air supplied via the filters to the room can be considered 'clean'. However, flushing the cleanroom with highly filtered air is of little effect, if its doors do not appropriately contain and maintain the controlled environment. This is why, whether it's an ISO class 100 or class 100,000 cleanroom, door systems play an essential role in avoiding cross-contamination as well as maintaining correct room pressure, air circulation rates and ensuring optimum operating efficiency.

Regulations:
IS0-1464 44-4 2001 states: "Doors should present as few horizontal ledges as possible with particular attention being paid to the minimisation of steps or ledges in the door surface." With the increased importance of maintaining a functional and economical clean environment, some companies are now going beyond the ISO regulations and defining their own global compliance standards for cleanroom doors. At a recent presentation, one of the world's top 10 pharmaceutical companies defined its own GMP requirement for cleanroom doors: "Doors shall have smooth, non absorbent surfaces and, where appropriate, be self closing and close fitting.

The materials for constmction should be:
• Easy to clean
• Non-fibrousand non-shedding
• Resistant to the accumulation of dirt and debris
• A barrier against the harbourage of dirt
and debris
• lnert and not normally reactive to chemical or other agents used in the environment.

GRP has become the material of choice for modern cleanroom designers **due to its non porpous and inorganic construction.**

With internal contamination the focus of any cleanroom design. Great importance is placed on the materials chosen for construction. Table 1 provides a comparison of some mechanical properties of some commonly used materials.

Many older cleanrooms and laboratories are fitted with stainless steel, aluninium and laminated wooden doors. However, more recently Glass Reinforced Polyester (GRP) has become the material of choice for modern cleanroom designers due to its non porous and inorganic construction. GRP is manufactured from millions of strands of glassfibre and polyester resin.

Doors are produced using a unique closed moulded process, creating a product that has no serons or joins on the door surface and no holes or crevices within. Unlike alternatives, colour is built into the door during the manufacturing process and the outer skin has a gel coat finish that is chemically bonded to the glass fibre, ensuring that they will not require re painting - avoiding any costly shut downs throughout the doors lifetime. Importantly GRP is a non-shed material, ensuring that it is compliant with BS 5295 part O 1989 and is approved for use in class 100,1000, 10,000 and 100,000 cleanrooms.

Cleanability

Doors chosen for cleanrooms must stand up to regular chemical treatment. Any door considered for a clean facility should have a smooth surface which does not harbour bacteria and should be able to tolerate constant cleaning with a number of different chemicals. With no joints or ledges where dirt or germs can gather, GRP doors are ideal where optimum levels of hygiene, ease of cleaning and disinfection are of high importance.

Traditional painted steel or aluminium constructions have been shown to deteriorate and flake once exposed to common cleaning regimes. This can lead to expensive down time due to contamination from shed particles or corrosion of the doors meaning that they have to be replaced.

Cleanability should also be taken into consideration when fitting hardwear or door furnishings. Any hardware to be fixed to our GRP door sets is prepared using CNC controlled routering machines, ensuring the tightest fit.

Table 1: Comparison of mechanical properties of commonly used door materials

Material	Specific strength (Mpa)	Specific gravity	Tensile strength (Mpa)	Compressive strength (Mpa)
Mild Steel	31	7.8	240	240
Aluminium Aloy	154	2.7	417	417
Stainless Steel	30	7.92	241	241
GRP	417	2.16	900	450

Hermetic doors are designed for use in pharmaceutical cleanrooms, production and packing facilities.

Cleanrooms rely on positive or negative pressure to help keep the working environment contamination free. High Efficient Particulate Air (HEPA) Filters can prevent 99.97% of particles measuring greater than 0.3 microns in size, from entering the cleanroom. The doors should work with this system to reduce cross contamination and air handling costs.

With 2 x 6mm thick hardened glass, flush fixed with anodised aluminiumdoor blades, these hermetic sealing glass doors to control air flow, maximise visibility and natural light.

Choosing the correct door system for your facility will contribute to the level of the cleanliness and provide optimum operating efficiency.

Hermetically sealed doors are 99% effective allowing room pressure dilferentials to be accurately calculated and correct pressure maintained. Door interlocks can be found on almost all cleanrooms built today. The basic operation of an interlock system is to prevent two doors being open at the same time, and can be referred to as either a personnel or material transfer airlock.

In a pressurised environment allowing two doors to open at the same time will cause an instant loss of pressure in the cleanroom. Both manual and automated doors can be interlocked and systems can range from simple two-door interlocking to complex locking sequences with fail-safe facilities.

Automations: Cleanroom doors are often manually operated. However, there are cases where automations should be used to ensure operating efficiency and to protect the door itself and ensure if remains damage free. Automations should be used in areas of high traffic flow and where single members of staff may be passing through the area with equipment, which must go through the door. They are also useful in areas, which require access control and where doors must not be held open.

It is important to consider the positioning of the method of actuation, whether it be push button, kick plate or touchless sensor, to maximise the effectiveness of automation.

The chosen door systems should work with the room design. For example, sliding doors are often considered as they not only require less valuable space that hinged doors but also produced far less air disturbance when operated.

Uncontrolled air caused by traditional swing doors during opening and closing can accelerate the spread of airborne micro-organisms.

Flush fitting vision panels should be incorporated into door design. They not only ensure a light and spacious feel to a cleanroom supervising but are also beneficial for personnel and monitoring manufacturing processes. With a lack of natural light in many pharmaceutical facilities there is a growing trend towards larger and larger vision panels and in some cases fully glazed doors.

Making the right choice: Choosing the correct door system for your facility will contribute to the level of the cleanliness and provide optimum operating efficiency. When choosing a supplier ensure that the company has extensive experience and knowledge of working in controlled environments so that itcan designa solution to meet your needs. Considering the points mentioned in this article will ensure your doors havea long, trouble-free lifespan.

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