HEPA Fan Filter units

Since their initial introduction in the early 80s FFUs have proved a popular choice for cleanrooms and continue to be so today. Initially used in ISO Class 5 cleanrooms and above, FFU requirements quickly grew and matured into a global market that saw a range of manufacturers and brands emerging in the sector. These were followed by new FFU products to meet changing cleanroom requirements.

The technology is undeniably simple – little more than a HEPA or ULPA filter attached to a ‘plug’ fan installed within a standard suspended ceiling grid on 1,200 x 600mm centrelines to offer high efficiency filtration for the space.

The attraction of this simplicity of operation and installation is compelling; so too are the significant additional benefits the FFU provides. Fundamentally, it offers a low capital cost, low noise filtration solution that is easy to service and maintain.

But there are other advantages too. Most obviously, incorporating FFUs within plenum designs enables smaller air handling units (AHUs) to be specified for a particular cleanroom installation, saving space and cost. In such an application, the plenum becomes a mixing chamber for the conditioned make up air that is needed for exhaust, pressurisation and to satisfy temperature and humidity demands, as well as for the recirculated air from the cleanroom.

By using FFUs to handle the recirculation requirements, the AHUs can be reduced in size to handle a smaller percentage of the total filtered air necessary to satisfy the cleanliness classification of the room.

Using FFUs in this type of recirculating design also helps prevent by-pass leakage, which can cause harmful turbulence in the room and contribute to particulate suspension. The plenum space above the ceiling becomes negative relative to the room. This reversal of the air pressure relationship ensures that any leakage through the ceiling grid will be into the negative plenum. In contrast, with installations that have a pressurised space above the ceiling grid with panel filters (or alternatively ducted terminal filters supplied by an AHU) any leakage will ingress into the clean area with more harmful results.

The methods for sealing the filter to the grid and the grid to the walls and individual components are also more straightforward with a negative plenum design, helping to reduce grid costs. Meanwhile, cleanroom integrity is likely to be preserved in larger facilities where the failure of one or more FFUs can be easily contained compared with the threat created by the loss of an AHU in a positive pressure installation.

FFUs have also proved themselves perfectly adaptable to the soft and hard-wall cleanrooms that grew in popularity from the late 1980s onwards, providing greater choice in versatile, cost-effective and localised clean environments.

In these room-in-room designs, FFUs are fitted on top of a localised, modular structure to upgrade the existing room classification from ISO 8 or 7 to ISO 6 and better. Installation is quick, easy and effective and this type of cleanroom brings the added advantage of easy upgrading down the line with the addition of extra FFUs.

Future drivers

Energy efficiency is an important driver. The European Union is committed to reducing projected energy use by 20% by 2020, with anticipated energy savings allowing Europe to reduce its CO_2 emissions by 780 million tonnes and save €100bn in fuel costs. As a result, the legislative framework is tightening to encourage all businesses to achieve more with less energy.

In Europe, the Energy Performance of Buildings Directive and the Eco-design Directive, backed by supporting programmes such as Intelligent Energy-Europe, help to implement policies in the field.

More specifically within the cleanroom sector, it is entirely right that operators should be encouraged to meet carbon efficiency targets, save energy and reduce cost where they can. A cleanroom can be up to 50 times more energy intensive than an office building because of the several hundred air changes per hour required for Class ISO 6 rooms and above, alongside the associated air filtration and conditioning. The energy cost of HVAC plant typically represents more than 50% of the total amount of energy used by a cleanroom.

Permanent air-change rate reductions, temporary set-back and switching off uni-directional airflow (UDAF) units in “out-of-hours” periods, greater use of variable speed drives on fans, out-of-hours, widening of temperature and humidity control ranges, and reducing pressure drops by installing increased capacity filters for the first and second stages of supply air filtration. In new facilities, there are great opportunities to optimise systems and layouts to minimise pressure drops and capital cost.

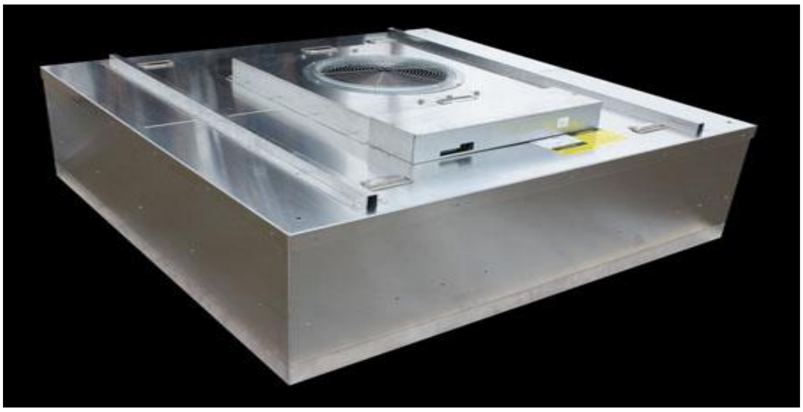
Efficiency gains

Optimising the performance of an FFU-based system offers significant energy-saving potential, and improving control regimes can make an especially significant difference. Historically, the energy efficiency of air handling systems using FFUs can vary significantly from system to system because of the difference in energy performance, airflow paths and the operating conditions of the FFUs themselves. Operating parameters can be more closely controlled and, using a range of control and monitoring systems, we can manage FFU performance much more efficiently.

FFU Touch Screen Controller

At the same time, FFU manufacturers are rising to the challenge with the development of much more efficient units. High efficiency EC motor technology is at the heart of these innovations.

FFUs can operate at only 50W / 0.45m/s outlet velocity with an H13 filter, the new EC unit is several times more efficient than earlier FFUs on the market. It incorporates energy-saving DC motor technology with a proprietary baffling system and backward curved fans to ensure low-energy performance. The electronically commutative motor features an internal micro-computer for optimum operating efficiency at all speeds.



600 x 1200 std Fan Filter Unit

In addition, low-energy FFUs can operate at sound levels as low as 45dBa, especially important in confined cleanroom spaces, and offers 250Pa of external static pressure capability. This ensures the unit can deliver high efficiency filtration, even when using very high grade ULPA filters (U15, U16 and U17). The result is a high spec FFU that lends itself to ISO Class 5 rooms and above, which typically have larger pressure drops across the system.

The broad pressure range, combined with the backward curved fan design, greatly extends the lifetime of the unit's filter. This has the effect of reducing ongoing maintenance costs and contributing again to a rapid payback on the increased initial capital expenditure when compared with FFUs with AC motors.

Extensive control options are available. Complete systems can be controlled and monitored via Touchscreen & wall-mounted control consoles, PC and PLC platforms.

The FFU has come a long way in delivering efficient filtration for cleanrooms. As energy efficiency becomes more important, these latest technology developments demonstrate that FFUs are continuing to live up to their reputation for supreme adaptability. In fact, the energy cost savings are so significant with this new breed of unit that payback on the initial higher capital outlay for a low energy FFU can be much shorter than expected. And there is no sign of compromise on the trademark benefits that have sustained the FFU since its inception – high efficiency filtration, low noise, ease of installation and servicing and value for money.

Picture showing a recently installed Fan Filter Unit project walk on ceiling (Plenum side view)

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