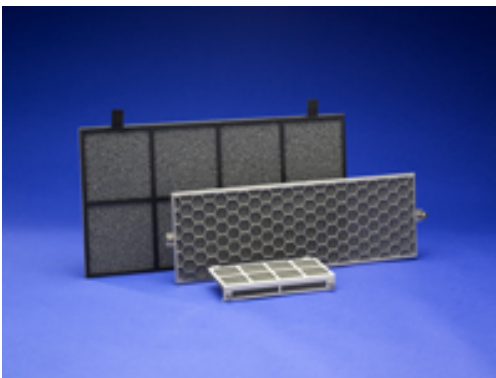


# Filtering the Options

**Air filter customization involves a number of variables for medical device designers to consider. From materials to size to standards compliance, the options available can enable a designer to customize a filter that will be perfectly suited for his specific application. This article reviews the details that need to be examined prior to deciding on the final air filter product.**

**By Mike Miano**



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Selecting the proper air filter for medical applications is an important aspect of the design process. Due to the recent trend of decreasing medical equipment size, it is now more important than ever for design engineers to examine certain details in the beginning of the design process in order to avoid a costly, time-consuming mistake. Besides enclosure size, thermal management and flame safety are crucial components that can sometimes be overlooked during a fast-tracked product design phase.

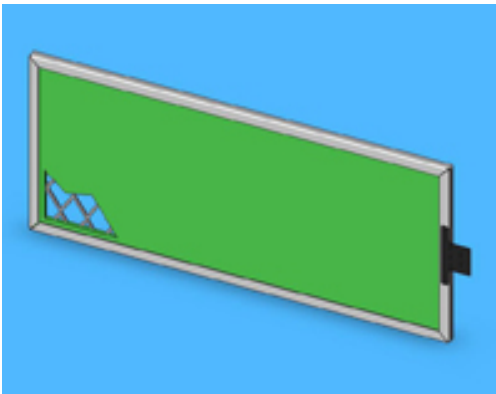
In response to the shrinking size of medical equipment, innovative air filter solutions such as low profile and edge-to-edge air filter configurations have surfaced. Low profile air filters are ideal for medical equipment because they can be specified in thicknesses less than a quarter of an inch, which is significantly thinner than standard air filters. Edge-to-edge filters allow clean, cooler air to reach printed circuit cards located along the interior walls of the chassis by framing filters with less intrusive channel housings. Low profile and edge-to-edge lines comply with UL 60950 and other medical standards established for electronics equipment and are also CE compliant. They also meet UL 94 HF-1 flammability resistance requirements. When used as part of a fire enclosure, they may be configured to comply with the flame-drip requirements described in UL 60950 and EN 60950.

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Other effects of more compact medical equipment are smaller chassis and more powerful heat producing components, resulting in a need for proper thermal management. Thermal analysis software lets users predict pressure drop through air filter elements quickly and accurately. Engineers can improve design efficiency by using thermal software packages at the beginning of the product development process. This will help factor in the effect an air filter will have on overall system pressure drop and reduce design time and cost.



Certain media, such as polyester air filters, offer high dust arrestance and low resistance when installed in medical equipment where disposable filters are most appropriate. They are available in framed filter assemblies or cut-to-size filter pads. Polyester media is a non-woven, non-migrating, synthetic material with ASHRAE dust arrestance to 90%. Advanced technology manufacturing equipment is used to produce a media of high quality, uniformity, and excellent filtering performance. Polyester media is flame retardant and listed UL 94 HF-1 and UL 900 Class 2.

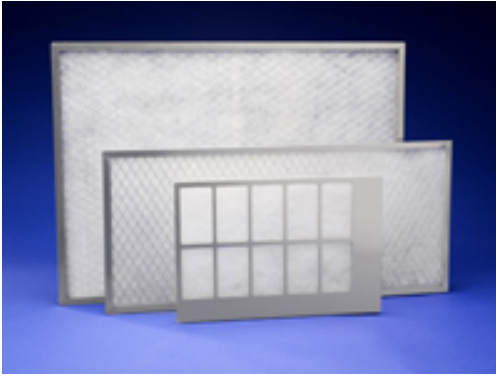
Quadrafoam air filters, which offer high dust arrestance and low resistance, are best where permanent, cleanable filters are most appropriate. Quadrafoam is an open-cell polyurethane foam specially coated to provide improved fire retardation and fungi resistance. It features deep loading, large dust holding capacity and low air resistance for use in extremely wide climatic conditions.

Quadrafoam is also used as the filtering media in dual honeycomb air filters, which provide superior shielding against electromagnetic interference. The filter performs three distinct functions: EMI/RFI shielding with positive grounding, air straightening for maximum cooling efficiency, and high dust arrestance with low pressure drop. These filters reduce EMI/RFI noise with the addition of EMI shielding aluminum honeycomb. Stainless steel mesh may also be included and bonded to the aluminum filter frame with a conductive silver/copper adhesive caulk. In addition, an EMI shielding gasket is installed around the frame perimeter to ensure full conductivity of the frame to the equipment. Moreover, the honeycomb structure provides “cells” that are designed to reflect and absorb EMI noise. The honeycomb pattern maintains minimal airflow impedance, and provides a “straightening” effect for even air distribution.

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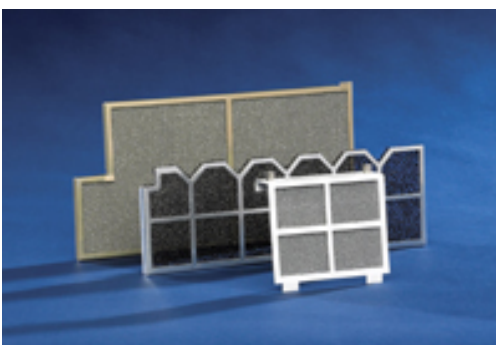
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Another important and beneficial design tool consideration when evaluating and selecting air filter manufacturers is 3D CAD capabilities. It is especially important early in the design phase as it allows for fit checks and speeds up the design cycle. Previously, engineers had to recreate 3D air filter models from scratch, but with 3D CAD, engineers can configure custom air filters and visualize them from all angles before downloading models into their final designs. This process also creates an extremely accurate fit and tolerance stack-up evaluation for the air filters.

Even filter accessories can be a great help in cutting down on cost and time. Features such as tabs, handles, and gaskets make for a better fit and improve the ease of filter installation or removal. Spring clips provide positive grounding of air filters to electronics chassis for more effective EMI shielding while simultaneously helping to reduce vibration and chatter, and special installation requirements. Precision-fabricated custom flanges and handles can be used for alignment with equipment mounting provisions, or to ease installation and removal.

Low profile, flexible frames would be a great alternative for the designer seeking non-conductive, contour-capable frames for small medical devices and bezels.



Selecting the right air filter for medical electronics cooling applications is an important task that can be frustrating if proper attention isn't given at the beginning of the design process. Consulting an air filter expert can save the designer time and money by addressing issues before potential hurdles and inefficiencies are locked in. Air filter specialists also are able to provide applications expertise and proven solutions to issues that have previously surfaced in medical equipment thermal management design.

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### Online

For additional information on the technologies and products discussed in this article, see *MDT* online at [www.mdtmag.com](http://www.mdtmag.com) [2] or Universal Air Filter at [www.uaf.com](http://www.uaf.com) [3].

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[1] <mailto:mikemiano@uaf.com>

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