Maximum Safety, Minimum Maintenance, Increased Filter Life: TRM FILTER Provides Highest Process Efficiency in Pharmaceutical Dedusting

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Hygiene and safety in pharmaceutical production constitute the most demanding challenges for dedusting filter technology. Dust can lead to contamination, health threats or an increased risk of explosion. Efficient filters are therefore indispensable – but they are usually also maintenance-intensive and prone to wear and tear, often requiring a great deal of time and money. TRM Filter, a Slovenian specialist for pharmaceutical cleaning and dedusting systems, has developed durable filter systems that significantly increase the process efficiency of dedusting systems. In the containment area, the generally complex filter replacement is much less frequent and can be carried out within one hour. The result: Reduced plant down-time and enhanced precision and safety of operations.

High dust loads occur in the production of solida such as tablets or capsules as well as in the refinement of active pharmaceutical ingredients (APIs). These dusts can endanger workers' health or lead to explosions. High tech filter systems must therefore meet the requirements of containment and explosion protection as well as guarantee the highest filtration levels. These three aspects require a central core performance of state-of-the-art dedusting systems: sustained high filtering power with low maintenance requirements. TRM Filter has optimised its active filters (these can be cleaned and do not need to be replaced immediately) in terms of three technological parameters: filter elements, filter cleaning and functional cleaning design and control. Thus, the lifetime of a filter element can be extended to more than a year.

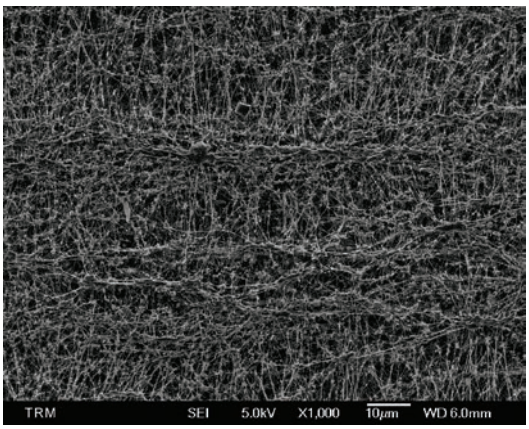
Enhanced containment for higher safety

The benefits of long-lasting filter elements extend well beyond mere cost savings and offer a solution to the ongoing paradigm shift in the field of health and safety at work. Whereas in the past it was assumed that powders could be handled in open systems, we know today that more and more APIs require a comprehensive and measurable containment during processing to protect workers and their environment. Accordingly, it is therefore no longer so easy to change filter elements. This applies not only to the pharmaceutical sector, but increasingly to other process industries, especially as the requirements of the REACH directive (European chemicals regulation for registration, evaluation, authorisation and restriction of chemical substances) have to be implemented by mid-2018.

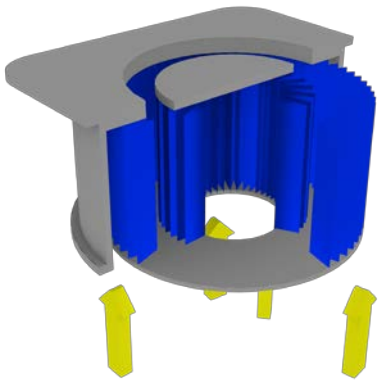
For various reasons, for example due to the powder properties or the adjustment of the tablet press system, high quantities of dust filter flows may be generated during solid refinement, which must be safely separated from the process air. In the context of a well thought-out containment, this requires particularly high care also with regard to the cleaning and replacement of the filter elements. The exchange of filter elements in the more difficult conditions of a contained environment is commonly performed with the aid of bag-in/bag-out safe-bag technology. Two workers need about an hour to replace filters. In this context, the longevity of TRM filters minimizes the cumulative risk associated with incorrect handling. The health risk of the overall process is lessened as the filters need to be exchanged at longer intervals.

Smart filter elements for active explosion protection

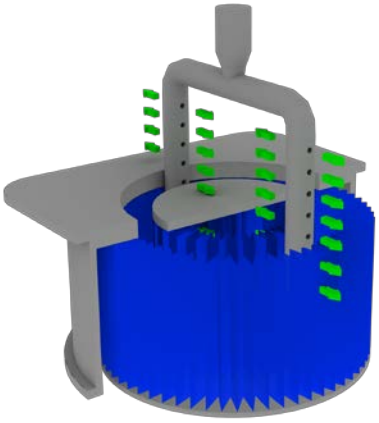
The durable TRM filter elements excel in key technical requirements of constructive explosion protection and filtration levels. The objective: zero emissions from closed systems. This objective shows the necessity for dedusting filter systems. Generally speaking, explosions in the raw gas chamber can occur in dedusting filters before a first filter stage, depending on the dust and accompanying solvents. Based on state-of-the-art technology, dedusting filter systems are built in such a way as to release any occurring explosion pressure safely released into the clean gas chamber of the filter system. In TRM filter systems, the primary filter additionally retains the flame and thereby abolishes any ignition source for solvents that pass the primary filter, thus excluding the ignition of the solvent fraction from hybrid mixtures past the primary stage. The filter elements are provided with dissipative protection to prevent the electrostatic charging of the filter. Even the tiniest residual dust deposit on a filter membrane is sufficiently conductive to effectively prevent the electrostatic ignition of most dusts. By contrast, hybrid mixtures ignite with low minimal ignition energy (MIE), partly with < 1 mJ. The dissipative built of the filter prevents any possibility of their ignition on a filter membrane.



PICTURE 1: **Poyestzer with ePTFE membrane**



PICTURE 2: **Airflow through the filter cartridge**



PICTURE 3: **Vertical rotating nozzle fork eases dust removal**

Maximum filtration level, optimised filter cleaning control

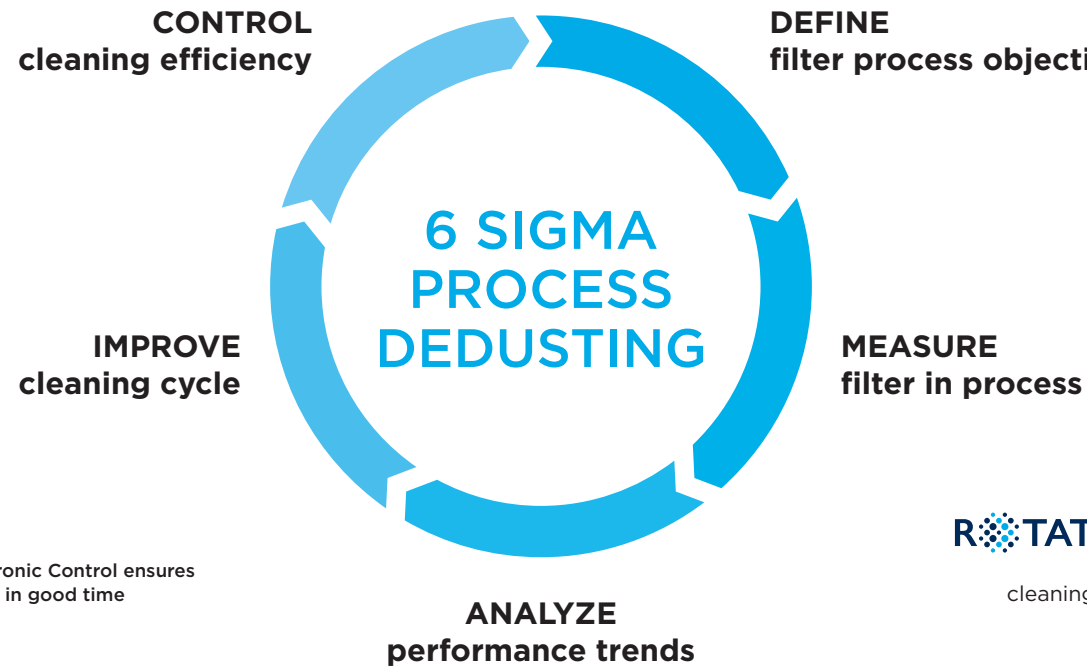
Smart filter systems for pharmaceutical processing should not only yield maximum filtration levels – they should also be extremely simple to clean, to keep maintenance at a minimum. Dust particles should be retained on the filter surface. In TRM Filter's high performance threesome of optimised filter elements, best filter cleaning and functional filter cleaning control, the design and the construction of filter elements are the first aspects described below:

TRM Filter has developed multi-layered filter media. The fine pore structure of the first ePTFE membrane (picture 1) determines the filtration level H13 for the primary filter stage. The design as a thin-layer membrane enables surface filtration and prevents dust from penetrating into deeper layers of the filter medium. It thus enables the smooth cleaning of the active filter surface with a blast of compressed air. Further layers of the filter media provide stability, unhindered and effective cleaning air flow and dissipative electrical discharge from the filter media in a coarser pore structure. The optimised filter material is placed into a filter cartridge for an overall vertical filtration air flow (picture 2). Multiple folding of the filter medium increases the filter surface area with respect to the volume of the filter element. The vertical arrangement of the filter surface promotes the passage of filter dust towards dust collectors lower down in the filter system.

Tried & tested in hundreds of installations

TRM Filter has developed Rotatronic mechanics for particularly smooth and extensive filter cleaning. A rotating fork with nozzles rounds off the cleaning efficiency of TRM Filter products. The nozzles are guided along the entire inner filter surface. The nozzles deliver the cleaning air stream rapidly and directly, and transport the dust away from the filter to the dust collectors. This design has been tried and tested in over a hundred installations. Examples include the removal of high dust loads from a fluid bed granulator in an intermediate custom manufacturing operation with frequent product changes. Despite the high dust load, filters from TRM Filter have continued to perform for more than 18 months there. The rotating nozzle fork has been used in horizontal array for several years. Now, TRM Filter has further enhanced its functionality by developing a vertical design with more compact filter elements and even easier filter exchange. (picture 3).

Rotatronic Mechanic works hand in hand with Rotatronic Control, a functional control programme for filter cleaning. This process control system is self-learning and achieves a dynamic filter equilibrium at the ideal operating point of the filter – even under changing and usually unknown conditions. Rotatronic Control effectively and iteratively approaches the filter equilibrium (picture 4) by analysing and reconstructing the process conditions. Rotatronic Control triggers filter cleaning, provides status reports at relevant operating points and indicates the need to change filter elements in good time.



PICTURE 4: **Rotatronic Control ensures filter exchange in good time**

ROTATRONIC
Smart filter
cleaning technology

In summary, TRM Filter boosts the efficiency of the dedusting process by three key factors: optimised filter elements provide maximum filtration levels over a significantly increased operating period. They achieve the highest possible level of working hygiene as well as explosion protection. In a matter of seconds, Rotatronic Mechanic cleans the entire filter surface with its rotating nozzle fork. And the self-learning Rotatronic Control guarantees best operating performance and prevents extensive or unscheduled downtimes.

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Established in 1982, TRM Filter is based in Ljubljana, Slovenia. The company focuses on the development and production of innovative pharmaceutical dust removal systems in the domains of pharmacy, chemistry and food industry. Rotatronic Technology developed by TRM Filter meets the high requirements for explosion-protected High Containment filter systems, offering the best filter performance while also being low-maintenance. TRM Filter's solutions are implemented by leading pharmaceutical companies. The company is run by Peter Tomšič.