

Intuitive containment solutions to reduce operational errors

# Safe, reliable, and ergonomic containment

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Containment solutions in dedusting filter systems provide reliable protection of the personnel working with them. There are many well-known principles on the market, but the 'X-factor' that separates the best from the average is user-friendliness. Only intuitive and ergonomic containment solutions can ensure consistent protection within the allowed dust emissions.



System with five ECR dedusting units, with an automatic dust collection system for the most demanding HSE requirements

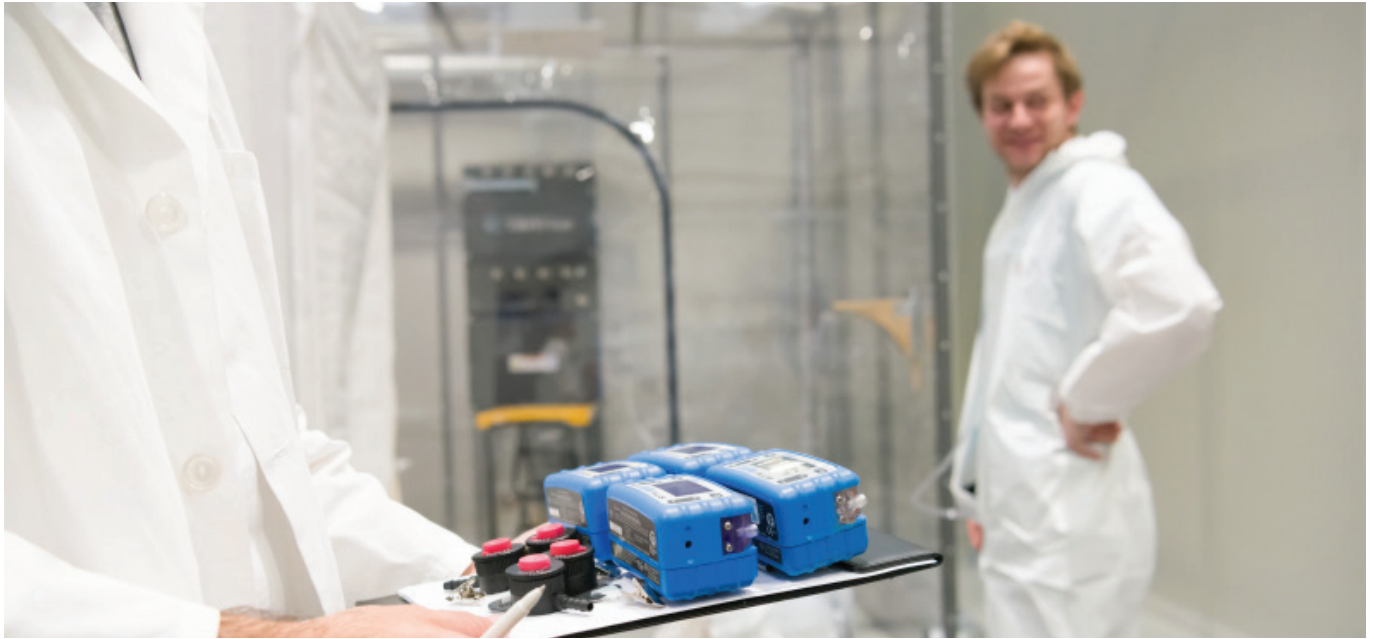
The toxicological effects of the exposure to active substances are particularly well known in the pharmaceutical industry, where precise limit values for permissible emissions (OEL - Occupational Exposure Limit) in operational plant areas were first laid down. But also, in other branches of industry, such as the chemical industry, biotechnology, and other sectors, the awareness of occupational hygiene is increasingly gaining ground.

In these industries, there are various production processes that lead to the formation of dust particles. Where the residual dust is not appreciated (process- or health-wise), it must be removed. The most commonly used and most practical way to do that is with the air flow. Before this air can be released into the environment, it must pass through a dedusting filtration system. Its consistent and continuing functioning is of the utmost importance for a safe workplace and for keeping our environment clean. So, it should be considered an indispensable and integral part of the production line. Regardless of the amount of dust present in the processed air, filtration systems require some periodic activities during which the operator can be exposed to potentially hazardous substances. The most important of these activities are the *dust discharge* (emptying the dust container) and the *replacement* of the clogged *filter elements*.

## The “weak link”

As allowable OEL values decrease, the solutions that provide an appropriate level of containment when handling the filtration system are becoming increasingly complex. Especially when the requirements approach the range of  $10 \mu\text{g}/\text{m}^3$  and below, it is technically very challenging to design and implement a reliable containment solution. But this is not the end of a story! The chain is always only as strong as its weakest link, and the same applies to the containment. Ultimately, it is the end users (technicians and maintenance personnel) who must ensure that the containment provision performs as intended.

When discharging dust or replacing the filter element, **several steps** must be carried out in the **correct sequence**. Doing this with the containment system in place (e.g. with the Bag-In/Bag-Out system) only increases the complexity of the tasks. Training is an important factor to ensure that such tasks are performed correctly. However, there is only so much that one can permanently learn to repeatedly perform more complex procedures. Therefore, containment solutions must be designed intuitively in order to work in real life applications.



Samples taken during APCPPE with the ECR dust collector inside a test facility

## “Our Solution”

Our ECR dedusting filter systems have been present on the global market for several years for the most demanding pharmaceutical applications. Among other things, they have been specially developed to reliably protect operators and repeatedly stay below the OEL limits. With the considerations described above, we at TRM Filter have decided to optimize and improve containment solutions for ECRs. During the development process we implemented many ideas that came directly from our end users – people who work with dust collectors every day in the production process. In the working sessions, they were presented with various options in the form of mock-up models and prototypes. The result of several sessions and iterations is a design perfected down to the smallest detail that ensures the best possible user experience, even with the most demanding HSE requirements.

Containment solutions used in our ECR dedusting filter systems now require fewer steps, are more intuitive, and easier to perform. In short, they reduce downtime for maintenance and decrease the likelihood of making mistakes that could lead to potential exposure to harmful substances.

### The most important upgrades are:

- The Bag-In/Bag-Out system for filter replacement and dust extraction no longer requires additional safety belts when handling safety bags.
- The WIP (Wash in Place) provision for the filter element is now particularly efficient due to the optimized wash nozzle design.
- The continuous liner system for the central dust collection has an improved holder system with Push-Push breather filter system for easier handling.
- We have gone one step further and have also significantly improved the graphical user interface of our ROTATRONIC Control system, to reliably guide end users to execute the protocols as required each time.

## “Our Follow-Through”

In order to validate the containment performance of ECR dedusting filter systems, we decided to obtain measurable, quantitative data for containment solutions on ECR systems. We simulated typical operating conditions during filter element replacement and dust extraction, while the accredited third party performed APCPPE (Assessing the Particulate Containment Performance of Pharmaceutical Equipment), better known in this context by its predecessor's name 'SMEPAC' (Standardized Measurement of Particulate Airborne Concentration).

A prerequisite for a valid APCPPE result is a proper test facility with low background “contamination” relative to the desired detection limits. The facility must also have temperature and relative humidity within tolerances and an adequate air exchange rate. To meet all requirements, we have built an enclosure to isolate both the ECR and the operators who simulate filter replacement and dust discharge activities. The enclosure had a specially designed air conditioning system with H14 HEPA filtration at the inlet to ensure an uncontaminated air supply with constant positive pressure.

All this preparation was worth it! The APCPPE testing confirmed that our optimized containment solutions provide a safe workplace for the end user. ECR dedusting filter systems have consistently achieved exposure limits well **below 1 µg/m<sup>3</sup>**. This, from an investor's perspective, is certainly a big advantage. Before ECR, to be on the safe side when handling substances in OEB 5 (Occupational Exposure Band), it was necessary to use cumbersome and expensive solutions (such as glovebox isolators). With ECR systems, additional protective layers are not necessary unless required by the client for other reasons.

With all the new improvements in containment and with its inherent explosion protection, ECR dust collectors are truly “The Game Changer” on the market. Within their compact volume, they provide safe and reliable containment, and offer excellent filtration and explosion protection (with dry dust as well as hybrid mixtures) without the need for installation of an external autonomous explosion protection system.



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### More about TRM Filter:

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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.