# Cartridge Filter Technology

## Futures in the Dust Control industry

### Beginning of the Revolution

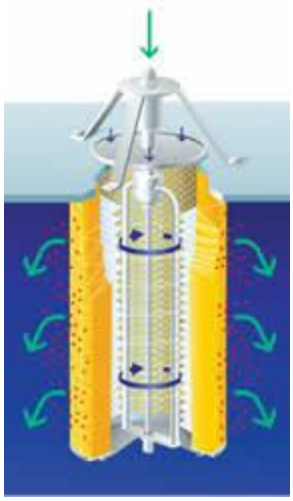
It's hard to believe but only 25 years ago, the use of cartridge type filter elements in industrial dust control and process air filtration was virtually unknown. Filter medias for use in cartridge type elements were very much in their infancy and little application data was available regarding its use. Woven bag type medias were a tried and tested method of filtration and it's true to say that cartridges were viewed with a great deal of scepticism by much of the Dust Control Industry.

However, some Dust Control companies business were convinced of the considerable benefits of this innovative approach and were therefore keen to embrace the new technology. The benefits were twofold: Firstly, cartridge medias offered vastly superior efficiencies over conventional bag type medias and secondly, much more compact solutions could ca be achieved through the use of a 'pleated' cartridge type element.

There can be little doubt that their convictions were correct, as today the pioneering work of such companies has led to cartridge technology becoming universally accepted across the whole spectrum of manufacturing industry. The following article offers a brief outline of the development of cartridge technology over the last two decades.

### Legislation and Environmental Considerations

With the advent of COSHH and the more recent Environmental Protection Act (EPA) more consideration is being given to stringent control of emission levels for a wide range of ingredients and products. In recent years, many of these products have been were found to be harmful to health or the environment.



Filter solutions must be capable of conforming to these current regulations whilst also taking up the minimum amount of space. Cartridge Technology offers extremely compact solutions (up to 50% saving in footprint area) and efficiency guarantees, which are simply not achievable with the use of conventional bag type medias.

### Media Development

The choice of filter media is crucial In the early days of cartridge filtration the relatively high cost of polyester cartridges meant that the most widely used media

was a cellulose paper similar to that used in automotive filtration. While this offered good levels of efficiency, it was not a particularly resilient media and was also unsuitable for use with damp or sticky products. A lot has changed since those early days. Modern media manufacturing and cartridge production processes have meant that polyester based medias are now a very cost effective solution offering high strength, excellent efficiency (for example 100% down to 2 µm using Dustcheck's latest TI15 media) and superior product release characteristics.

Interestingly, cartridges can also be effectively laundered providing careful guidelines are adhered to. This dispels the myth that cartridges are a 'one use only' solution and also improves the 'green' credentials of the technology.

Over the last decade there have been continuous advances in the development of standard and also more exotic cartridge medias. For finer or more cohesive products, PTFE membranes can be applied to the base polyester offering much greater efficiencies (100% down to 0.5 µm using TI56) and even better product release characteristics.

For some time now, all media variations have been available in 'anti-static' formats to aid the release characteristics for products prone to static build up (polymer based products being a prime example). The anti-static agent applied to membrane (cartridge) type media is also inherent in the media itself offering true anti-static properties throughout. In contrast, the bag filters use only conductive threads woven into the fabric of the material. Another important benefit of the range of anti-static media is its ability to prevent spark generation caused by static discharge – an important consideration in complying with requirements of the latest ATEX directive, which is having a major impact on the dust control industry.

## Latest Developments

Cartridge Filtration is continuously always developing to keep up with the demands of industry. Latest Dustcheck developments consist of DRG5N, a 316L stainless steel media suitable for high temperature applications whilst still offering high levels of efficiency (particularly appealing for the pharmaceutical industry as the media is suitable for autoclave sterilisation). Most recently TI26, a H14 rated HEPA media suitable for secondary filtration and in-line protection applications have also been made available thereby offering HEPA rated filter media in a cartridge format – a technology which was not available previously.

## Adapting to Application Requirements

Dust control is rarely the main consideration for the designers of process engineering plant. However, multiple design considerations need to be taken into account when designing filter equipment. Air volume, filter area, ambient conditions, cleaning cycle, flow management and element geometry are all crucial.

Product characteristics such as particle size, bulk density, bonding, agglomeration and moisture content also play an important part in the design process.

Therefore, not only is it necessary to choose the correct media for the product being handled, it is also important to select the correct cartridge format for the application. One would not, for instance, normally advocate the use of a large diameter, deep close pleated element for use in high dust load applications such as pneumatic conveying.

To this end, considerable time has been put into developing a range of cartridge formats to suit a wide range of applications.

'Conical' filter technologies are now available which offer considerable cleaning efficiency benefits. This means lower differential pressures, reduced product re-entrainment and better product pre-separation, leading to longer filter life, lower utility usage and reduced maintenance.

Two piece elements consisting of an outer filter sheath and a re-usable inner core reduce replacement costs and additional waste. It also means that the internal element can be incinerated for easy disposal.

In addition, most cartridge configurations can be offered in both 'clean-side' and 'dirty-side' executions to offer the maximum flexibility for any application.

**Reduced Maintenance and Improved Cleaning**

Maintenance on conventional bag type filters has always been a lengthy, dirty and intricate procedure. There are also health and safety issues to be considered – particularly if the products being handled are of a toxic nature. Cartridge technology has revolutionised this operation offering much faster, cleaner and simpler solutions – not least is the consideration that for a given filter area, the number of filter cartridges is far less than the equivalent bag type solution.

There are a number of different cleaning methods which have been developed; mechanical shake, reverse air and reverse jet. The vast majority of cartridge type solutions utilise reverse jet technology. The technique is relatively simple; a jet of high-pressure air is injected into the filter element against the direction of process airflow. This allows particulate which has built up on the surface of the filter media to be dislodged, allowing it to fall back into the process (or in the case of a dust collector into a collection bin).

Both bag and cartridge reverse jet systems employ very much the same hardware for this operation; a compressed air manifold/reservoir, automatic diaphragm cleaning valve operated by (in the most part) some form of electrically or pneumatically signaled controller and a jet tube to direct cleaning air into the core

of the filter element(s).

The methods of directing air into the filter element are also similar; some use a simple hole (or series of holes) drilled into the jet tube to direct air into the element, others use a venturi in order to ‘induce’ additional air into the element to improve cleaning.

However, differences occur because bag type medias rely on ‘depth’ type filtration which allows dust particulate to be trapped in the fibres of the filter fabric. It is dependant on the cleaning air to considerably flex/shake the filter element to remove any particulate.

Cartridge filters, by comparison utilise ‘surface’ filtration which does not allow particulate to penetrate the media and relies on a slight build up of dust on the media surface to act as a ‘pre-filter’. The media is held rigid within the confines of the cartridge and the reverse jet air is then used to simply ‘flush’ the media to dislodge particulate from the surface. Due to the much reduced core volume of a cartridge filter compared with an equivalent bag element, the effect of a given quantity of cleaning air is much greater, leading to improved cleaning efficiency. Multi-hole cleaning jets are also used to very good effect on a number of cartridge filters to ensure efficient distribution of cleaning air over the whole surface of the filter element. It is the above parameters which make it possible for cartridge filters to be capable of cleaning up to 20m² of filter area from a single cleaning air source thereby leading to reduced cleaning valve requirements.

Another cleaning method unique to cartridge filtration is the wing cleaning system. It was developed for very light bulk density dusts and can be much more effective than traditional reverse jet cleaning systems. It utilises a rotating cleaning ‘wing’ coupled to an integral damper plate, which isolates the filter cartridge against process air flow during cleaning, thereby allowing true ‘off-line’ cleaning. This gives much better product release characteristics and reduced chance of product re-entrainment. The rotating wing gives a very effective filter ‘rinsing’ action ensuring superior cleaning and sustained lower filter differential pressures. This leads to longer filter life and lower maintenance. Operating at lower air pressures than traditional reverse-jet systems, the wing cleaning is also much quieter in operation.

**The future**

Cartridge filters have been successfully applied to a wide range of applications over the last two decades; general dust extraction, pneumatic conveying, powder coating plants, blasting plants and sack emptying to name but a few. More recently, continuing development of new advanced filter medias has meant that cartridges are now being used for more difficult type applications such as wet

lacquer, cohesive materials and metal-spray.

Cartridge Technology is no longer a concept to be considered with any degree of caution. The vast number of applications in all products across industry sectors are testament to this. More recently, the fact that most of the Dust Control industry also offer their own cartridge solutions speaks volumes.

Continuing product development and the pioneering work of companies such as Dustcheck means that Cartridge Technology will remain a major force in industrial dust control and air filtration for many years to come.

For more information contact:
Pete Dawson at Dustcheck Ltd
Tel: 01782 599454

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