Ceramic Filters for Industry

Multi-functional applications in virtually any medium: air, gas, liquids & acids

iCerMax™ Ceramic filters are manufactured from Wonderstone ceramic which exhibits some unique properties compared to current ceramics in the market place.

- Sustainable cleanliness levels through depth filtration.
- Absolute reliability in monitoring the filtration medium's integrity.
- Thermal and structural strength and chemical resistance in air, gas and liquid filtration.
- Multiple cleaning methods providing extended lifecycles.
- Process application efficiencies allowing for functional optimisation of plant design.

The Ceramic filters illustrated below have been tested for liquids at the renowned Independent French Filter Test Facility, IFTS.

Flexibility

Ceramic media porosity can be customised during manufacturing to suit the required flow rates, micron rating and differential pressure requirements for each application.

The ceramic filters are manufactured at the Wonderstone plant to ISO 9001:2008 and ISO 14001:2004 standards

Specifications	
Maximum temperature	1200º C
Thermal shock	Excellent, even with surface disparity
Thermal coefficient of expansion	3.6 x 10^{-6} @ 25 – 600ºC
Binding strength	Excellent
Wear resistance	Excellent
Bursting pressure, flow inside to outside	Excellent
Resistance to acid, fires and sparks	Excellent

Applications

- Hot gas candles
- Mixed gas filtration – acidic or alkali applications
- Filtration systems in advanced combustion and gasification
- Protects gas turbines from particle fouling and erosion
- Advanced coal or biomass-based power applications
- Cleaning process gas to meet emission requirements
- Heat exchangers – cooling /heating
- Food filtration applications
- Mineral processing

USE OF CERAMIC FILTERS IN BULK FUEL FILTRATION

As can be deduced from the extract from an article in Fleetwatch Magazine by Patrick Swan repoduced below, Ceramic Filters are playing an indispensable role in ensuring that diesel standards meet the tight specifications of the modern diesel engine.

Advances in fuel injection: Exhaust emissions and fuel economy are the major design goals of modern engine manufacturers. In a diesel engine, raw fuel is injected into the combustion chamber where it must mix thoroughly with the waiting air, vaporise, auto ignite and burn. To start this process, the fuel is atomised so the overall air and fuel mixture is reasonably uniform throughout the combustion chamber. To improve combustion efficiency, there must be only one combustion chamber thus eliminating precombustion chambers, and the fuel must be injected at significantly higher pressures and through more holes in the injector tip to achieve a more uniform air fuel mixture.

Injection pressures have increased at least 10 fold in the past 10 to 15 years - from about 200 bar to a minimum of 2 000 bar, and the number of holes in the injector tip have increased to nine in some instances. These holes now have a much smaller diameter - less than 200 micron - and are laser drilled. Between 10 and 30% of the fuel entering an injector passes through into the combustion chamber. The remaining 70 to 90% is used to cool the injector tip and passes back to the tank which doubles as a radiator to cool the fuel. Modern injectors therefore see higher transient temperatures and greatly higher internal pressures. To control fuel flow within the injector, the internal tolerances have been reduced from around 10 micron to about 1 micron.

Advances in diesel fuel: In line with international requirements, diesel fuel sulphur in South Africa has been reduced in steps to the current maximum of 0.05%, or 500 parts per million. Some fuel suppliers also offer a boutique diesel with a sulphur content of less than 50 parts per million. This boutique diesel is required for engines fitted with Diesel Particulate Filters (DPF) and may also benefit some engines with Exhaust Gas Recirculation (EGR).

Engine failures: Modern engines are perceived to be more prone to failure than older engines. Given the fuel system changes in modern engines, the question is: What comes first, maintaining new technology engines or failure of new technology engines?

Dirty fuel: The quality of diesel fuel in South Africa is controlled by SANS 342:2006. This specification loosely conforms to the European En590 specification and for South African conditions, gives equal performance. The major differences between these specifications are fuel sulphur and boiling range, both to assist the European industry to more easily reach their significantly more severe emissions targets than those applicable in South Africa. Because sulphur is such a good lubricant and also acts to control fuel oxidation at higher temperatures, it can be argued that South African diesel fuel is superior to European fuel - but is not as environmentally friendly.

It's not the fuel therefore, but the solid contaminants in the fuel that matter. Solid particles in the fuel should be removed by the engine's fuel filters. When this doesn't happen, the injector nozzle needle sticks, resulting in uncontrolled fuel flow into the combustion chamber. Past engine technologies could operate with solid particles in the fuel that had a diameter of up to 5 or even 8 micron, and those particles would pass through the injector nozzle.

With a clearance of close to 1 micron, modern injectors will stick if 1 micron particles are in the fuel. Airborne dust is a major problem in South Africa due to our dry atmosphere and typical soil types and it is easy for these minute dust particles to enter any bulk fuel storage system unless breathers are also filtered to about 1 micron. The results of a sticking injector needle are disastrous.

Figure 1

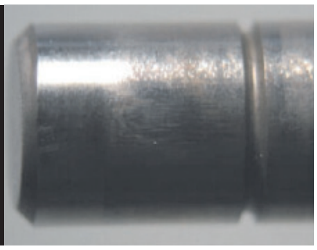

Figure 2

Figure 3

- Figure 1 shows typical abrasive wear of solid particles on an injector needle

- Figures 2 and 3 show typical resultant piston crown damage to a steel crown and an aluminium piston as the excess fuel burns on the crown.

Correct fuel filtration is critical. OEMs supply appropriate filters but often these filters are more expensive than aftermarket filter elements - so aftermarket filter elements are used. That's all well and good but do ensure that the filter performance is equal or the results will be disastrous.

Bulk fuel cleaning

Contamination in the fuel adversely affects the performance and reliability of the combustion components and this will affect the overall efficiencies - carbon generation, heat, oil, emissions, fuel consumption, life-cycle and failures. Fifty to seventy percent of heavy-duty diesel engine failures are related to the fuel system. South Africa has higher levels of dirt, with smaller particle sizes, than is experienced in Europe.

It is widely accepted that the additional cost of introducing filters will be more than recovered by lower fuel bills. In addition, savings will be achieved through longer economical life cycles of the equipment, less equipment failure, less internal engine wear and improved utilization of the assets. Injector wear due to particles in diesel can be significantly minimised if users become aware of the problem and enforce good housekeeping practices.

Clean diesel fuel - fuel that is within specification - still has 21mg of dirt per litre. That's 21g for each 1 000 litres. Cleanliness levels at our large mines commonly range between 50-75mg per litre of fuel. The normal dirt-holding capacity of a premium brand synthetic fuel filter of a 420hp engine is 80g. Normal engine fitted fuel filters struggle with their dirt-holding capacity, which raises the possibility that the filter becomes compromised during its service life-cycle.

The key issue with traditional cellulose media and with nanofibre filter media, is that too many dirt particles will cause the filter to plug. This results in particles being forced through, a problem which gets progressively worse as the differential pressure across the filter increases. Vibration and surges also accentuate this problem, as does any ingress of water. When these media fail, they can cause problems in three different ways. Firstly, the previously trapped particles can be released to pass through the break. This is called unloading. Secondly, the media fibres themselves can break off and migrate through the filter and thirdly, consecutive breaks can form a channel to allow fuel to by-pass the filter media.

To mitigate the impact of dirty fuel on engine performance, it is therefore critical that the fuel be pre-filtered to acceptable cleanliness levels prior to vehicle fuelling.

The use of ceramic depth filters for bulk fuel cleaning

Ceramic filters, comprising wear resistant Wonderstone ceramic, offer the following advantages over traditional filter media:

1. ***Sustainable cleanliness levels can be maintained***
   The structural rigidity and strength of ceramics, compared to other types of filtration media, means that ceramic filters don't form channels, don't have medium migration and there is no risk of severe unloading of contaminants due to filter medium structural failure or during flow or pressure surges.

2. ***Structural integrity***
   Due to their inherent strength and chemical resistant properties, ceramic filters can operate successfully under a wide range of operating conditions including fluid surge conditions, hammering effects, operating pressures (high or low), severe pressure variances, chemical attack from contaminants such as surfactants, water, acids, and biocides.

3. ***Sustainable capture efficiency***
   Ceramic filters have a very high collapse strength. This is important because on collapse, unfiltered fluid can be routed back into the system. The ceramic filters will always block and not break, thus achieving constant cleanliness levels.

4. ***Low resistance to flow or differential pressures***
   The uniform porosity minimises pressure drops across the filter and resistance to flow. This low resistance has a direct bearing on the filter's extended life.

5. ***Holding capacity and dirt retention***
   This is the main "Achilles heel" of non-ceramic filtration media. In ceramic filters dirt remains in the filter due to the high structural integrity of the filter medium.

6. ***Reliable filtration monitoring***
   As the ceramic medium does not compromise the filtration monitoring system, system sensors reflect the actual real time status of the filtration process. This allows much more efficient management of the filtration system and takes the guess work out of estimating filter change intervals.

7. ***Cost effectiveness***
   Ceramic media, due to their large contaminant holding capacities and high structural integrity, are a cost effective alternative to traditional filter systems due to lower maintenance costs.

8. ***Flexibility***
   Ceramic media porosity can be customised, during manufacture, to suit the required flow rates, micron ratings and differential pressure requirements of the application.

Bulk Filtration In- & Out-bound

On-board vehicle filtration

Ceramic filter media. Multi-functional for air, gas & liquid filtration.

Setting the benchmark for fuel and oil cleanliness levels.

iCerMax™ excels in long-term thermal, chemical and mechanical applications.

These may not be stock items. Please speak to our sales representative about lead times. Lead times, price and availability can only be determined on receipt of an official quote from our suppliers of component parts. This can sometimes take up to 3 days.

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iCerMax™ rock solid filtration