

PERFORMANCE ADDITIVES UPDATE

# DIESEL FUEL FILTER BLOCKING

## — Enhancing Protection



### Q. What is filter blocking\*?

**A.** All diesel vehicle fuel systems are fitted with a filter to prevent harmful particulate material reaching the fuel injection equipment (FIE). If such material was not removed, it would cause erosion and wear of critical components, leading to premature failure of the fuel injection systems. However, whilst the filter protects the injection system, it can itself become blocked and prevent fuel reaching the engine at the expected rate.

*\*Note that this issue is not the same as cold filter plugging, where wax forms in the fuel under very low temperature conditions and blocks the filter until such time as the wax re-dissolves.*

### Q. Why is filter blocking becoming a bigger issue?

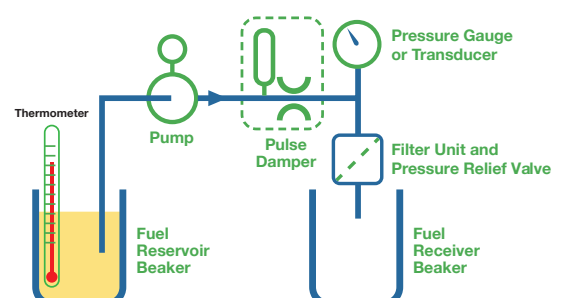
**A.** The drive to reduce emissions has led to the use of increasingly sophisticated fuel injection systems. To help protect these, filter technology and capability has changed. Fuel filter pore sizes have decreased to as low as 2µm - 5µm in the secondary filters that provide the main protection. However, as the filtration efficiency has improved, it stands to reason that instances of filter blocking should increase due to more material being filtered out.

At the same time, biodiesel has been identified as one of the key contributors to filter blocking field issues. The use of biodiesel continues to grow in many markets, with supplies coming from more and more sources and based on an ever increasing range of feedstock.

### Q. How is filter blocking measured?

**A.** Filter blocking can be measured in a variety of ways, but all rely on the same underlying principle, with fuel being flowed through a known filter, with time for the entire sample volume to pass through or the pressure drop across the filter, or a combination of both being measured.

The most commonly used is the Standard Test Method for Determining Filter Blocking Tendency (FBT) (ASTM D2068 / IP 387) which is the general procedure used for middle distillate fuels including biodiesel and biodiesel blends. An alternative version, IP 618 has also been developed for testing at between +3 and -1°C in response to problems seen in the UK over recent winters. There are also variants which test after holding the sample at reduced temperature. The Canadian Cold Soak Filter Blocking Tendency test (CSFBT) holds at 1°C for 16 hours and the European Cold Soak test (CS IP387) uses 5°C for 16 hours. These two tests evaluate how cold exposure can affect the problem.

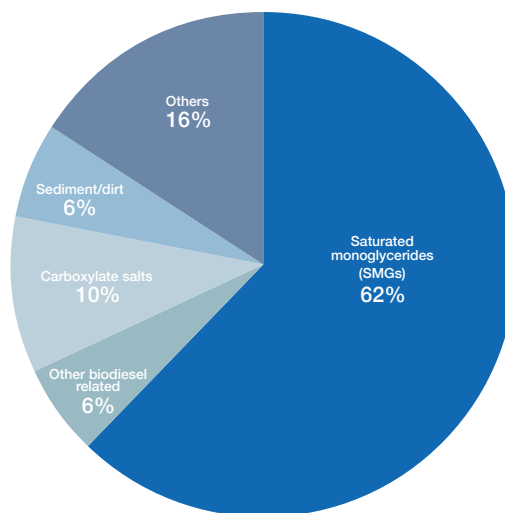


## Q. What is actually blocking the filter?

- A. Many recent filter blocking issues have been associated with biodiesel by-products. These are often organic in nature and do not present the same risk to the FIE system as the particulate matter that the filters are designed to remove. More than 50 blocked filters from the U.S. were analyzed to identify the cause of filter blocking in the field, with the majority being saturated monoglycerides. However, there can be significant variation between markets and it was often found that combinations of materials were identified as being responsible for blocking the filter. The base stock used to make the biodiesel can also have an effect.



## Filter Blocking Causes % of Filters from Field

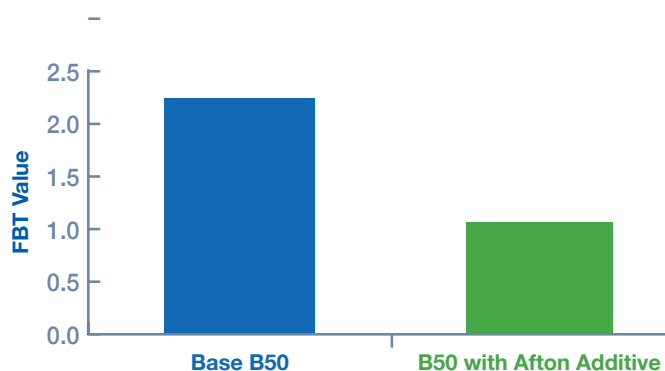


## Q. What impact does a blocked filter have on vehicle operation?

- A. When a filter is blocked, it will restrict or prevent the fuel from reaching the engine. This can lead to problems with starting and a loss of power, affecting both performance and driveability. More importantly, modern fuel injection systems are designed to operate with a particular fuel pressure and flow. If this is not achieved, the engine Malfunction Indicator Light (MIL) will illuminate, and the engine will either go into limited operation mode to protect the injection system, or will shut down altogether until the filter has been replaced, at great inconvenience to the end user.

## Q. Can Afton's diesel additive technology help filters from blocking?

- A. Using components that match the materials found to have blocked filters; Afton Chemical's technical team has been able to replicate the field failures and their severity in the laboratory. Under these scientifically controlled conditions, they have been able to demonstrate that by using the appropriate Afton additives, the situation can be greatly improved, and in some cases returned to an FBT associated with a wholly uncontaminated fuel. Subsequent field experience has reinforced these findings, with many previously affected end users now enjoying the added filter blocking protection and reassurance provided by Afton's next-generation detergent, Greenclean™.



 **Greenclean™ 4**  
OUR GREENEST AND CLEANEST DIESEL TECHNOLOGY

### Summary

The global push to reduce greenhouse gas emissions and improve fuel consumption has led OEMs to introduce more sophisticated diesel fuel injection systems and oil companies to increase the supply of renewable fuels such as biodiesel.

Afton has collaborated with OEMs, FIE Manufacturers and Oil Companies to develop our next-generation detergent technology - Greenclean™, an advanced fuel additives that effectively reduces and controls filter-blocking tendencies, helping engines and vehicles remain in service for longer.

For more information please contact your local Afton representative or visit [www.aftonchemical.com](http://www.aftonchemical.com)