



PARTS COMPARISON BULLETIN

Filters

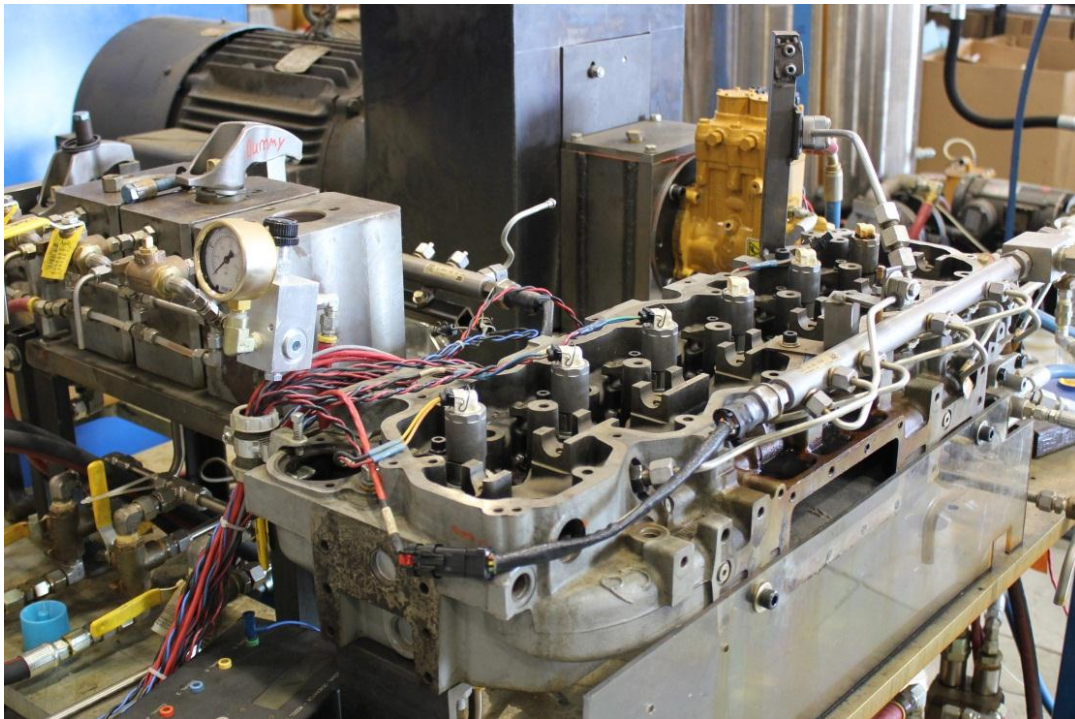
COMPARATIVE TESTING OF CAT® 1R-0749 VS WIX, FLEETGUARD, DONALDSON, AND BALDWIN

Caterpillar	Baldwin	Donaldson	Fleetguard	Wix
1R-0749	BF7587	P551311	FF5319	33674
				

Cat® High Efficiency Fuel Filters offer the most reliable and effective protection of today's high performance, low emission engines. Protecting critical fuel system components is getting more difficult all the time. Improved machine performance brings tighter component tolerances, increasing engine temperatures, and higher injector pressures. All these changes demand significantly cleaner fuel be used in your equipment.

Performance Testing

Caterpillar developed an accelerated injector life test that utilizes a Cat C9 engine fuel system. The test rig consists of a factory cylinder head, fuel injectors, fuel pump, lines and electronics. The tests were conducted using a single 1R-0749 secondary filter (or competitive 4 μm equivalent). No primary or a tertiary filters were installed.

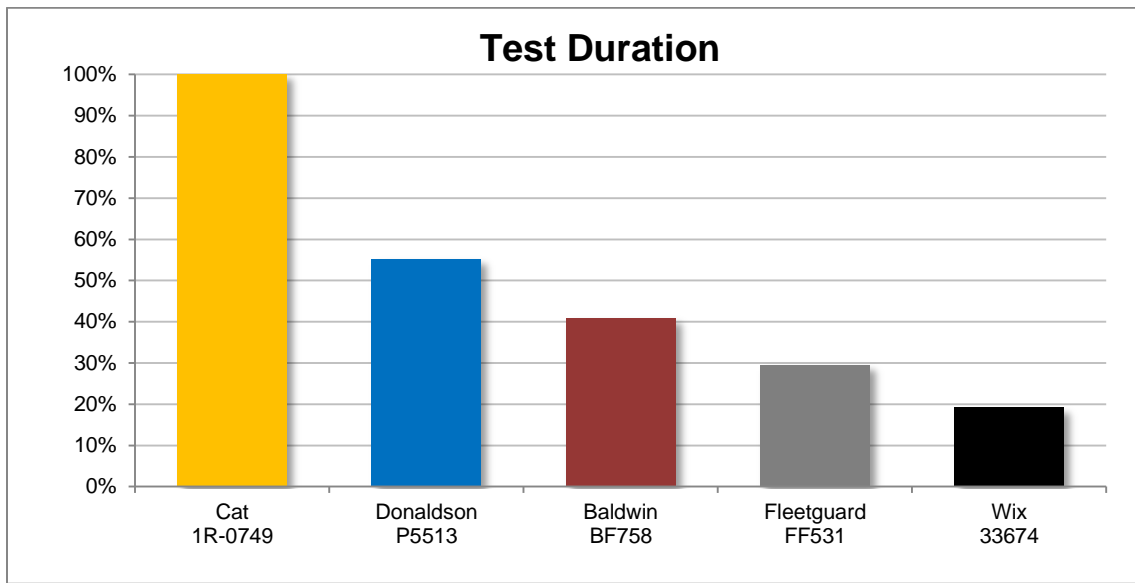


Highly contaminated fuel (ISO 22 / 40,000 particles per mL > 4 μm) was circulated at system rated fuel pressure (180 MPa) and high idle (1800 RPM) to simulate an extremely harsh operating environment. Tests were terminated when the injectors exhibited a leakage rate three times that of a new injector or when 50 hours in duration was achieved. In actual operation, an injector with fuel leakage 3X that of new would severely compromise engine performance, fuel efficiency, and overall fuel system component life.

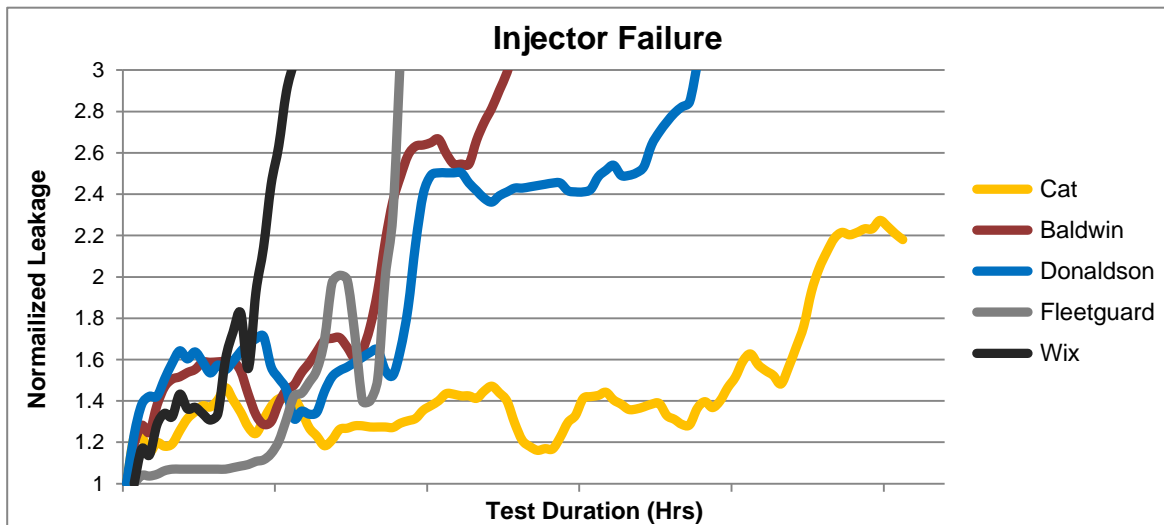
Test Results

The Cat 1R-0749 Advanced High Efficiency Fuel Filter was pitted against (4) equivalent competitive filter brands to compare injector life. Two filters for each brand were tested and the results averaged together to show the performance for each brand.

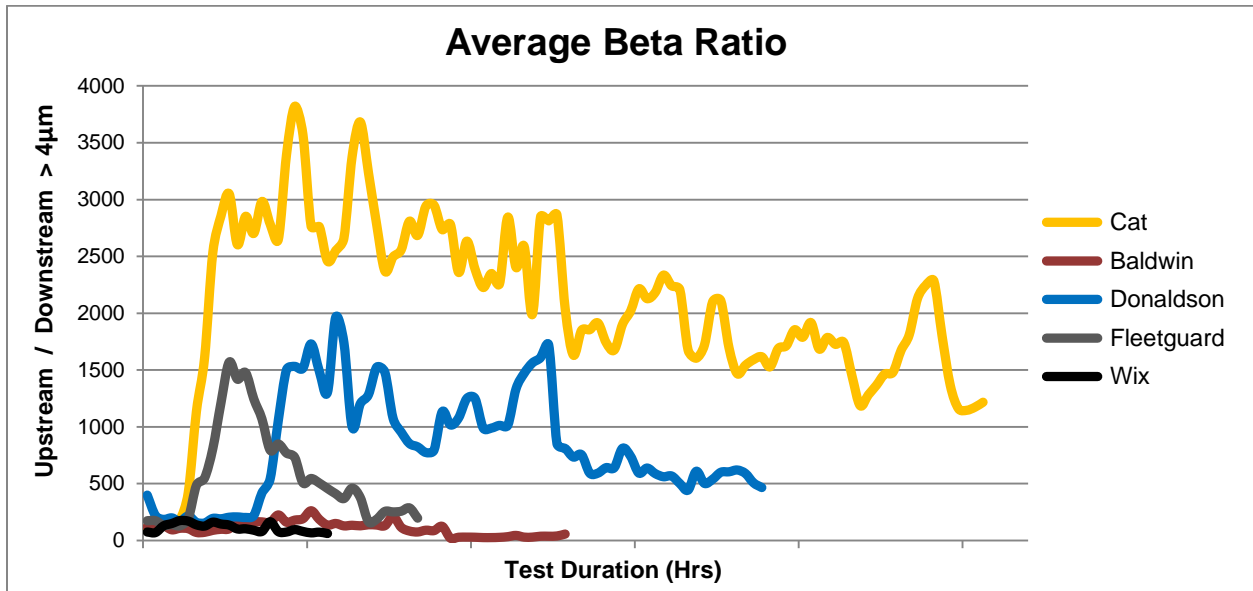
The first graph depicts the duration of the test until the injectors exhibited the 3X leakage rate. The injectors with Cat filtration ran to the test termination point whereas the injectors with competitive filtration failed in significantly less time. Cat outperformed the closest competitor by 45%.



This represents the injector leakage rate and the amount of time it took to reach the failure point of 3X injector leakage. The injectors with the competitive filters all failed prior to the test termination point. The injectors with Cat filters ran to termination point and still did not exhibit excessive leakage.



This is the average beta ratio throughout the test duration. Particle counts were taken measuring the number of particles greater than 4 microns at the tank outlet (upstream) and the secondary fuel filter outlet (downstream). The upstream value is then divided by the downstream value to arrive at the beta ratio. The Cat filter had the highest peak beta as well as maintained the average beta throughout the test duration.



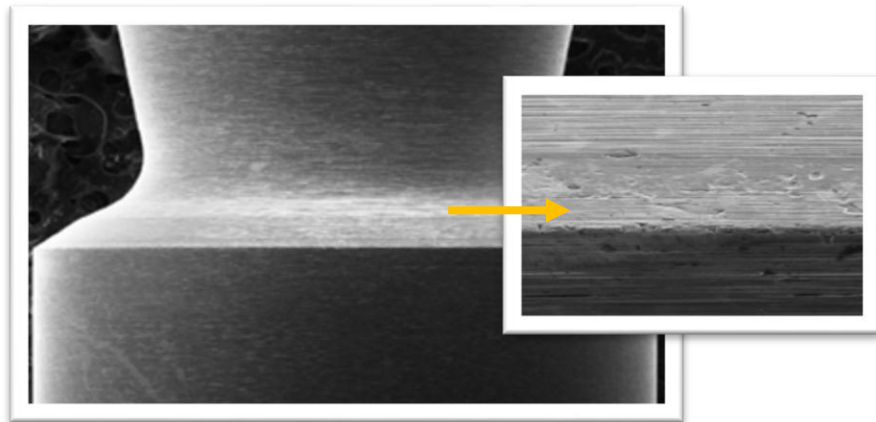
Injector Valve Seats

At the conclusion of the performance test, the injectors were disassembled and inspected for signs of wear. The following pictures are a visual indication of the increased level of protection provided by the Cat 1R-0749 fuel filter. When viewed under a scanning electron microscope (SEM), the injector valve seat displays noticeably less wear when the Cat fuel filter was used. Significantly more wear was seen on the injector valve seats from the tests utilizing the competitive fuel filters. The improved level of protection provided by Cat fuel filters ensures optimal engine performance and the longest life for critical fuel system components.

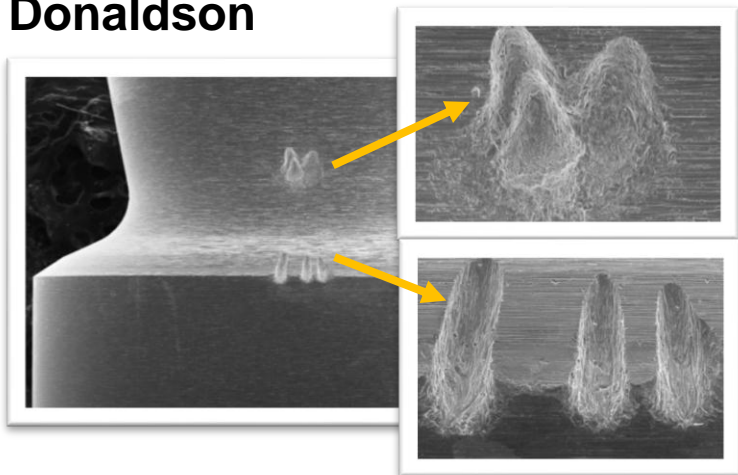


3-Way Injector Valve

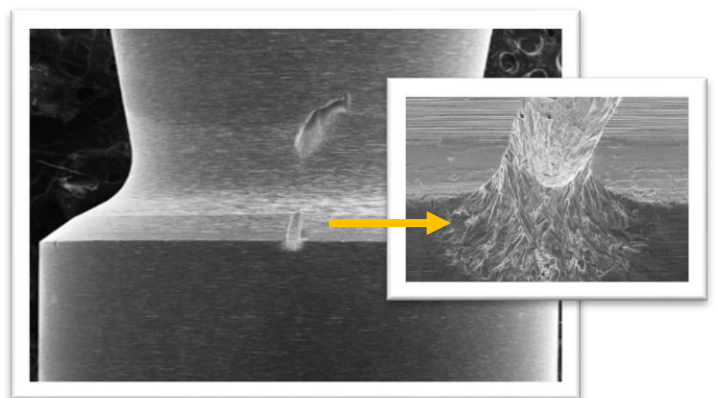
Cat Filter



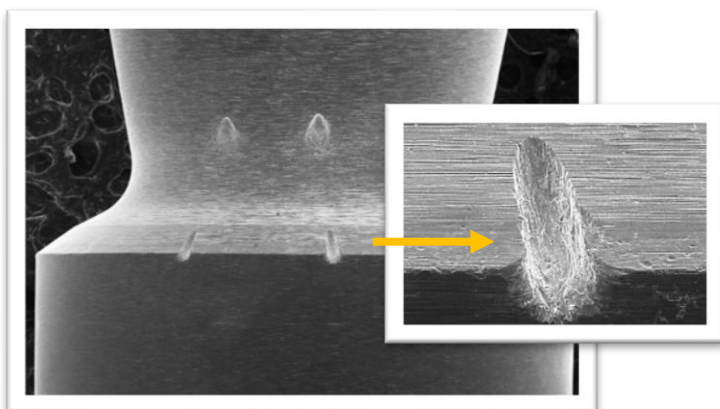
Donaldson



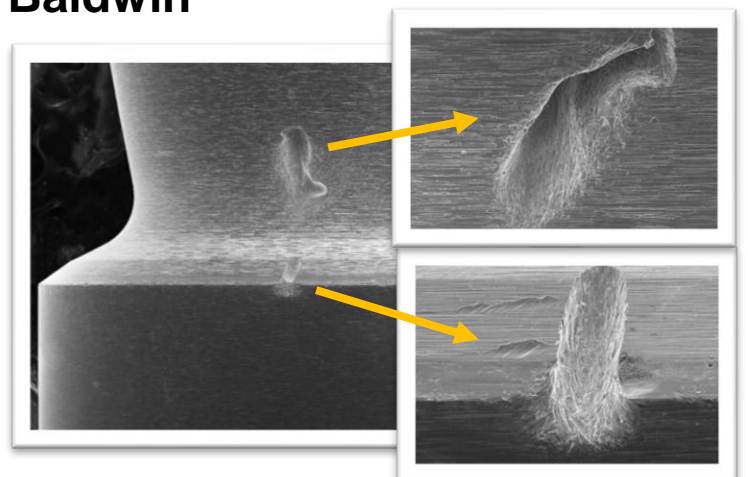
Wix



Fleetguard



Baldwin



Multipass Efficiency & Capacity Tests

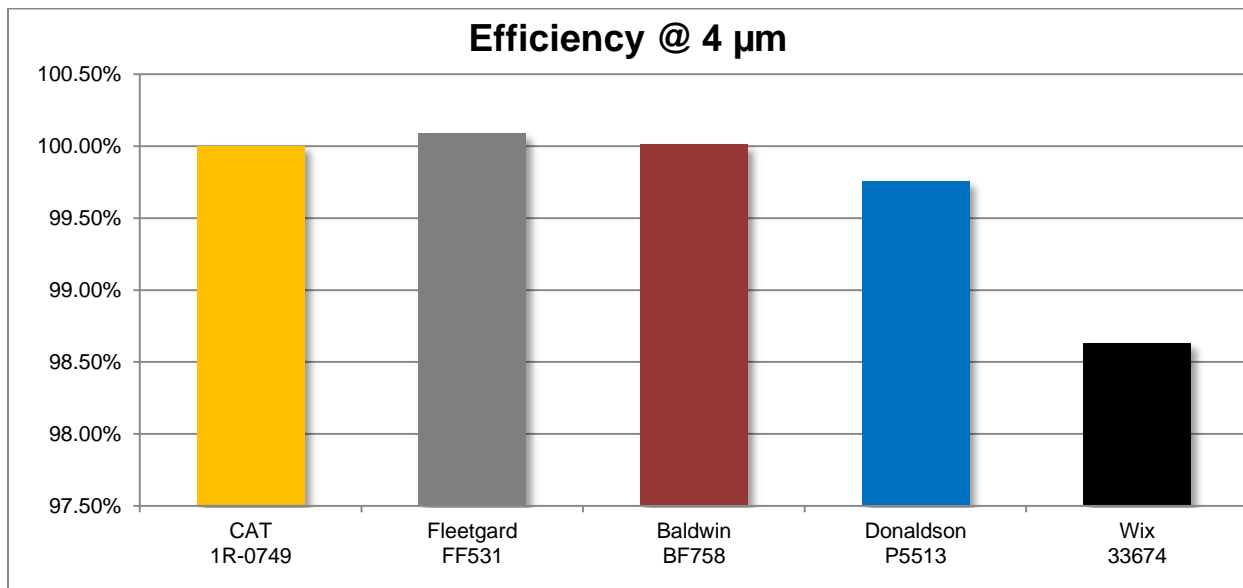
The Multipass Test is an industry standard test used for determining filter efficiency and dirt holding capacity.

- All filters were tested under identical conditions according to ISO 4548-12.
- (3) filters for each brand were tested and the results were averaged to provide the performance for that brand.

Efficiency Test Results:

A filter’s efficiency is measured by the size of particles captured and the rate of particle capture. The level of filtration efficiency required will vary based on the design and performance requirements of different fuel system platforms. The Cat Advanced High Efficiency Secondary Fuel Filter (1R-0749) was designed to meet the efficiency requirements of numerous Cat engines.

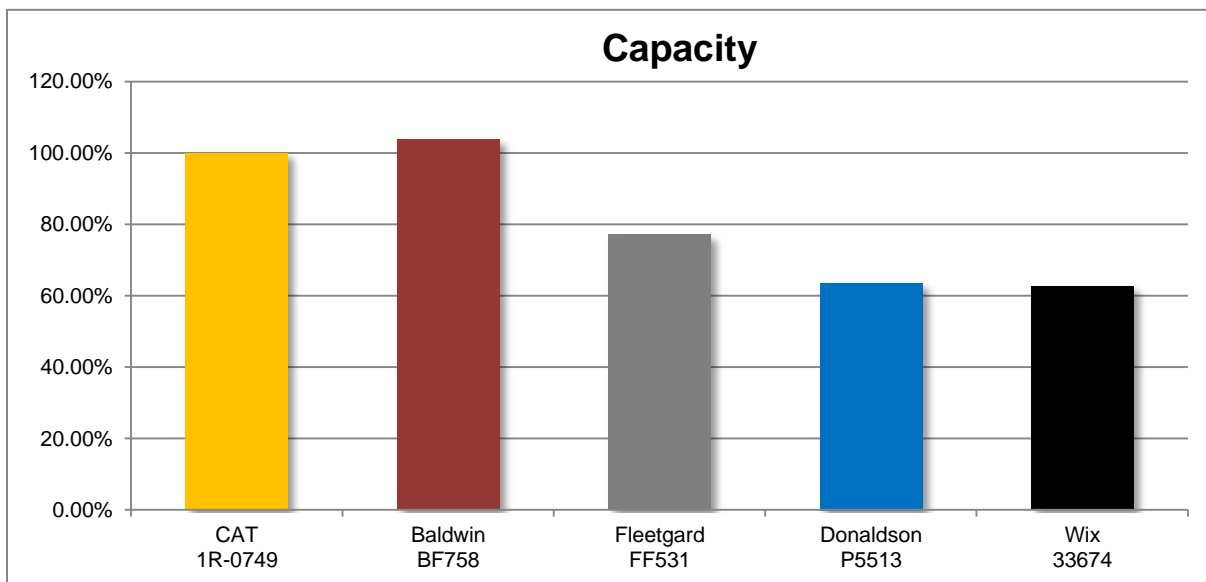
The Cat Advanced Efficiency Fuel Filter (1R-0749) provides the highest level of filtration efficiency and particle removal. Wix had the lowest efficiency results and did not meet the minimum efficiency level as determined by Caterpillar. All the rest of the competitive filters met the minimum efficiency level as determined by Caterpillar.



Capacity Test Results:

A filter’s capacity is measured by how much debris a filter can hold. In general, as filter media gets more efficient the filter media tends to have less dirt holding capacity. Filter design must balance the level of efficiency with the amount of dirt holding capacity in order to provide the ‘right’ filter for the equipment and application. Filters that have poor results on this test may plug prematurely which can affect machine performance and component life.

The Cat Advanced Efficiency Fuel Filter (1R-0749) held significantly more contaminants than is required by the minimum test capacity. The Wix and Donaldson filters failed to meet the minimum capacity requirement as determined by Caterpillar. All the rest of the competitive filters meet the minimum recommended capacity as determined by Caterpillar.



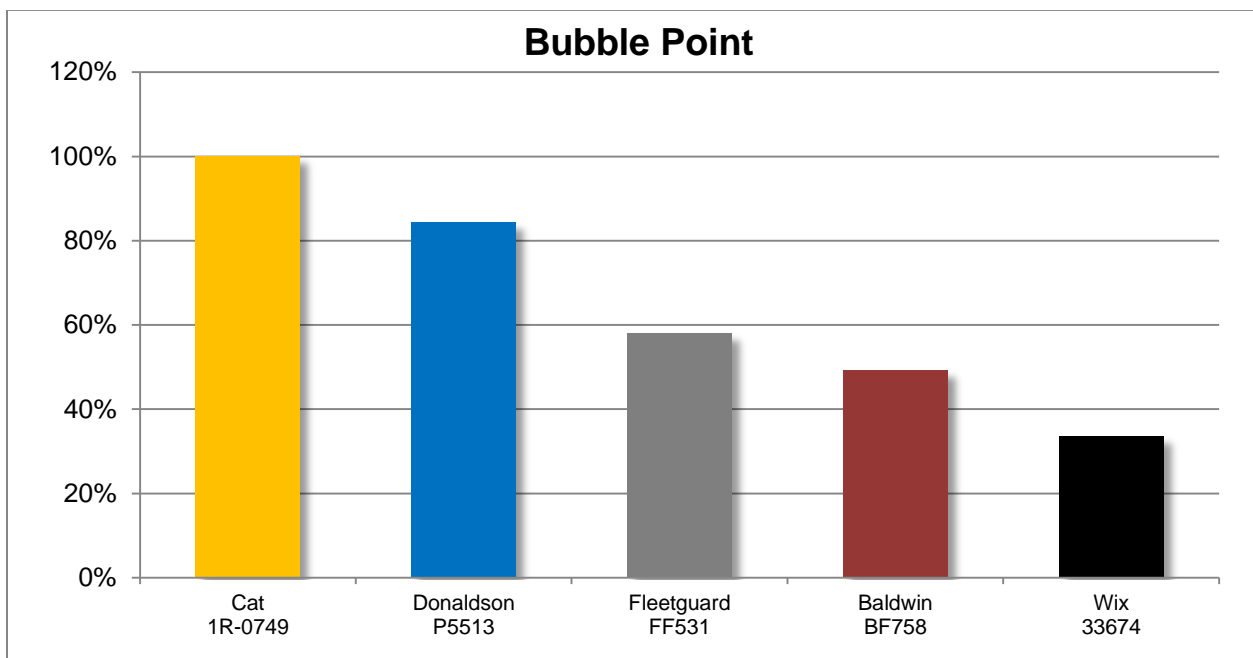
Fabrication Integrity

The Fabrication Integrity Test (also known as the Bubble Point Test) determines whether a filter allows leakage at the media seam seal or at the media to end cap seal.

- All filters were tested under identical conditions per the Caterpillar Product and Process Specification 1E2970A.

- Three filters from each brand were tested and the results were averaged to provide the performance for that brand. Test results for the Cat Filter were used as the reference for the competition.

This test shows that the design and construction of Cat Filters provides significant protection from leaks. Cat Filters far exceeded the minimum requirement and, in fact, withstood the maximum pressurization. Baldwin and Wix had leakage through the media occur below the minimum required test pressure. These two also had significant leaks where the media pleats meet the end caps.



Summary

While multi-pass testing on filters provides a baseline for filter efficiency and capacity it cannot predict how a filter will ultimately perform in operation. Multi-pass testing is a steady state test; constant temperature, flow, and pressure. A filter in operation is subjected to variable flows, fluctuating temperatures, and pressures spikes; all of which impact a filter’s efficiency and capacity.

This was evident in the outcome of injector performance test. On paper, from an efficiency and capacity perspective, the filters all appear equal. When the competitive filters were subjected to the variables inherent to a harsh operating environment they ultimately could not protect the critical fuel system components.

	Caterpillar	Donaldson	Baldwin	Fleetguard	Wix
Injector Performance	Pass	Fail	Fail	Fail	Fail
Efficiency	Pass	Pass	Pass	Pass	Pass
Capacity	Pass	Fail	Pass	Pass	Fail
Fabrication Integrity	Pass	Pass	Fail	Fail	Fail

How Tests Were Conducted

All tests were conducted by the Caterpillar Fluid Filter Lab. All Caterpillar Filter Laboratory competitive tests are conducted in accordance with documented Caterpillar test procedures. These procedures document the method of testing and reference the various ISO, SAE, and Caterpillar standards as they apply.

Test Results

The information in this report came from a random sample of fuel filters from Caterpillar and four competitive brands. The test procedures and results on file are certified to represent the filters actually tested. Caterpillar implies nothing further, and no one should infer that these filters typify the makers overall production. Any partial or complete reproduction of this release must include the above statement.

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