

Bonavista Technologies, Inc.

Below is a summary of the 24 Page Report conducted by Bonavista Technologies on the GCF Model O-2. This summary includes the results of a capacity test between the Gulf Coast Model O-2 and a 1 Quart Competitive Bypass Filter. Results: GCF O-2 over 2.2 Lb (1026 Grams) of ISO Test Dust, 1 Quart Competitive Bypass Filter only 2.5 ounces (66 Grams).

29-029: Test Report for Gulf Coast Filters Efficiency and Capacity

Testing

Dates tests performed: 18 – 19 May 2009

SUMMARY

TEST 1

Test 1 was on a **GCF Model O-2 filter** for efficiency with 0.98 micrometer fluorescence silica nanospheres. The results of this test are 99.20% efficiency after 2 hours and 99.96% efficiency after 5 hours.

Before Filtration- 6.2 Grams per Volume Tested
After 2 Hours of Filtration- 0.049 Grams per Volume Tested – Reduction 99.2%.

Test Parameters

Test Contaminant: Corpuscular Inc. 141211-XX Plain Green Fluorescence silica nanospheres. Diameter = 0.98 micrometer Lot # MFFt 1875

Test Fluid: Mobil Aero HFA (MIL-H-5606)

Test Rig: Bonavista B26-059 Automated Dual Loop Multipass Test System

Test Rig validated to ISO 16889

Test System: Low Flow, 1 to 10 LPM

Test Sink Volume Capability: 7 L

Test Flow Rate: 1.9 LPM (0.5 gpm)

Test System Volume: 15.1 L (4.0 USG)

Test Filter Volume: 9.5 L (2.5 USG)

Test Sink Operating Volume: 5.6 L (1.5 USG)

Conclusion:

The **Gulf Coast Filters Model O-2 Filter is highly effective at removing particles less than 1-Micron**

TEST 2

Test 2 was on a GCF Model O-2 filter for dust capacity with ISO fine test dust. The results of the dust capacity test after 9.3 hours and 1247.4grams added are that the test filter retained 1026.4 grams (2.26 lbm) of ISO fine test dust with no increase in pressure drop across the filter.

Gulf Coast Filter Model O-2 dust capacity with ISO Fine test dust

Test Results

Dust capacity test was 9.3 hours duration the test filter retained 1026.4 g (2.26 lbs) of ISO 12103-1, A2 Fine Test Dust with no increase in pressure drop across the filter.

Test Parameters

Test Contaminant: ISO 12103-1, A2 Fine Test Dust Lot 5216F

Test Fluid: Mobil Aero HFA (MIL-H-5606)

Test Rig: Bonavista B26-059 Computer Automated Dual Loop Multipass Test System

Test Rig validated to ISO 16889

Test System: Low Flow, 1 to 10 LPM

Test Sink Volume Capability: 7 L

Test Flow Rate: 1.9 LPM (0.5 gpm)

Test System Volume: 15.1 L (4.0 USG)

Test Filter Volume: 9.5 L (2.5 USG)

Test System Operation Temperature: 40 C (104 F)

Contaminant dust add quantity: 56.7 g (2 ounces)
Contaminant dust add increment: Every 20 minutes
Fluid Sample Size: Approximately 125 mL

Test 2 Sample 7 Gravimetric Analysis per ISO 4405

1. Fluid Sample number 7 was hand agitated until all particles were re-suspended in the sample fluid. Approximately 8 - 10 minutes.
2. A smaller sample was poured from the sample bottle into a 10 ml graduated cylinder. 9.1 mL was measured.
3. This cylinder sample was filtered through a Millipore 0.8 micrometer, 25 millimeter diameter pre-weighed filter patch. The weight was 0.0808 g.
4. All of the test fluid and contaminant was washed from the graduated cylinder with Bioact solvent.
5. The filter patch was dried in an oven per ISO 4405 to evaporate any solvent or moisture remaining in the filter patch.
6. The filter patch is re-weighed after cooling. The weight was 0.2114 g.
7. The collected contaminant weight is $0.2114 - 0.0808 = 0.1306$ g.
8. Gravimetric weight per mL is $0.1306 / 9.1 = 0.01435165$ g / mL or 14.35166 g / L remaining in the test system.
9. To obtain the contaminant remaining suspended in the test system multiply the gravimetric weight per liter times the fluid volume in the test system. $14.35166 \text{ g} / \text{L} \times 15.4 \text{ L} = 221.0 \text{ g}$

Conclusion:

The **GCF O-2 Filter** has exceptional dirt holding capacity retaining **over 2.2 Lbs** of ISO Fine Test Dust with hardly any pressure increase across the filter.

TEST 3

1 Quart Competitive Filter dust capacity with ISO Fine test dust

Test Results

After 1.3 hours the test filter retained 65.34 g (0.143 lbm) of ISO 12103-1, A2 Fine Test Dust with 23.5 psid increase in pressure drop across the filter.

Test Procedure

1. Installed test filter with new filter elements into the Low Flow test loop of Bonavista B26-059 multipass test system.
2. Filled test filter and test system with 4 L of MIL-H-5606 fluid while initiating flow through the test filter.
3. Obtain background particle counts. Test number 090518-02
4. Bypass test filter with control valve while maintaining the test flow rate.
5. Loaded the test system with 2 g of contaminant for initial efficiency test.
6. Circulated for 10 minutes before challenge test filter.
7. Switch control valve to challenge filter with contaminated test fluid.
8. Set test flow rate.
9. Initiate particle counting for 1 hour. Test number 090528-03. See Appendix G.
10. Record filter pressure drop = 8.0 psid
11. Terminate particle counting after 1 hour.
12. Capacity test started at 6:32 pm, 18 May 2009 with the first dust add.
13. Test dust was added in 14.17 g increments every 20 minutes.

Conclusion:

After 1.3 hours the **Competitive filter** retained 65.34 g (0.143 lbm) (**Less than 3 ounces**) of ISO 12103-1, A2 Fine Test Dust with 23.5 psid increase in pressure drop across the filter.