



## **ISO 5011 Test Results**

**Certified to the ISO 5011 Air Filtration Standard**

**Cold Air Intake Kit:**

75-5054 (Cleanable Filter)

75-5054D (Dry Filter)

**Vehicle Fitment:**

2008-2010

Ford Powerstroke 6.4L

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## **ISO 5011, Second Edition**

### **Air Filter or Intake Kit Test Report**

The test data presented in the following report represents the restriction of airflow, efficiency and dust loading capacity. The filters tested were procured from various distributors or provided by customers. The tests were performed in accordance with ISO 5011. The following were measured in accordance with the test: (1) Pressure Drop for Clean Element, Initial Efficiency and Dust Loading Capacity. The Flow Rate used to conduct the Dust Loading and Capacity test(s) is listed under the *Average Environmental Conditions and Test Specifications*. PTI ISO Course Test Dust was utilized and the particle data sheet for the batch is attached.

The test sequence begins with measuring the pressure drop of a clean filter as a function of the airflow rate which is measured in cubic feet per minute (CFM). Subsequently, the cumulative efficiency and dust loading capacity are measured. The termination point when measuring for capacity is shown at the bottom of the report under the heading *Termination* <sup>^</sup>P. The results of the tests are recorded in the top table and charts shown on the next page. The filters are inspected before and after the tests are performed.

The Top Table demonstrates the results of the testing for up to three (3) samples per filter type (part number). The Efficiency represents the amount of dust (contaminants) that was stopped by the filter during each test. The Capacity measures the dust holding capability of the filter.

During the test, the filter is loaded with dust until it reaches a terminal pressure drop increase of 10 inches of water (28" H<sub>2</sub>O for Heavy Duty Vehicles) across the filter element (please refer to the Average Environmental Conditions and Test Specifications at the bottom of the next page to verify the pressure drop utilized on this particular test).

The Line Graph shows the pressure drop as a function of the airflow rate for the clean filter(s). The computer controlled test equipment initiates the test at close to zero (0) cubic feet per minute (CFM) and then increases the CFM gradually until the CFM termination point is reached. During the test, the restriction of the filter is measured in inches of water ("H<sub>2</sub>O) as it relates to the air flow rate (CFM). Visual inspections of filters are performed to insure against dust leakage and manufacturing flaws.

The Bar Graph illustrates the cumulative efficiency for the filter(s) tested.

### **Definition of Terms & Test Protocol**

#### Restriction

Restriction measures how difficult it is for the air to get through the filter and is measured in inches of H<sub>2</sub>O. Instead of referring to restriction, the industry uses "air flow" to describe the effect of restriction. They say for example, that a High Performance Filter "flows better" than the OEM paper filter. On a line graph, the lower the restriction of a filter the better the air flow.

#### Efficiency

Efficiency is measured in % and is the amount of dirt/contaminants that the filter stops from going into the engine.

#### Capacity

Capacity is the total amount of contaminants/dirt the filter will hold before reaching its termination point. The termination point is a predefined restriction point that is used as the cut-off point when measuring how much dirt a filter will hold. For typical vehicles, 10" H<sub>2</sub>O is used at the termination point. For heavy duty trucks, this number is 28" H<sub>2</sub>O.

Note: Testing was conducted based on the ISO 5011 testing standard; however, variances from the actual test procedures may exist. The intent of the testing is to show comparative test results between various products that are intended for similar use. Tests are conducted under a climate controlled environment; however, changes in temperature and humidity between tests may occur which could alter the actual test results.

# **Test Report #1**

**S&B Intake w/ Cleanable Filter vs Stock**



## ISO 5011 Test Report

### How does the side inlet affect airflow?

January 26, 2012

#### Test Summary

Filter Tested	Improvement in Airflow vs Stock		Efficiency Rate
	Resistance to Flow @ 593 CFM	Resistance to Flow During Dust Loading @ Approx 100 grams	Conducted at Vehicle's Max Rated Flow (643 CFM)
75-5054 (Cleanable & No Side Plug)	23.3%	22.9%	99.51%
75-5054 (Cleanable & w/ Side Plug)	17.0%	7.3%	99.60%
OE - Stock System	-	-	99.91%

Airflow Analysis			
Filter Mfg. & Part No.	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
Filter #1	0.0	0.0	0.0%
S&B Cleanable (Open Inlet) 75-5054	297.3	4.5	23.7%
	445.2	9.7	23.6%
	591.7	17.1	23.3%
	741.4	26.8	23.6%
	891.3	38.5	23.2%

Filter #2	0.0	0.0	
OE	296.2	5.9	
Stock System	444.4	12.7	
	593.0	22.3	
	743.9	35.1	
	886.0	50.1	

Filter #3	0.0	0.000	0.0%
S&B Cleanable (Closed Inlet) 75-5054	297.1	4.700	20.3%
	445.1	10.400	18.1%
	592.4	18.500	17.0%
	744.2	29.100	17.1%
	886.9	41.800	16.6%

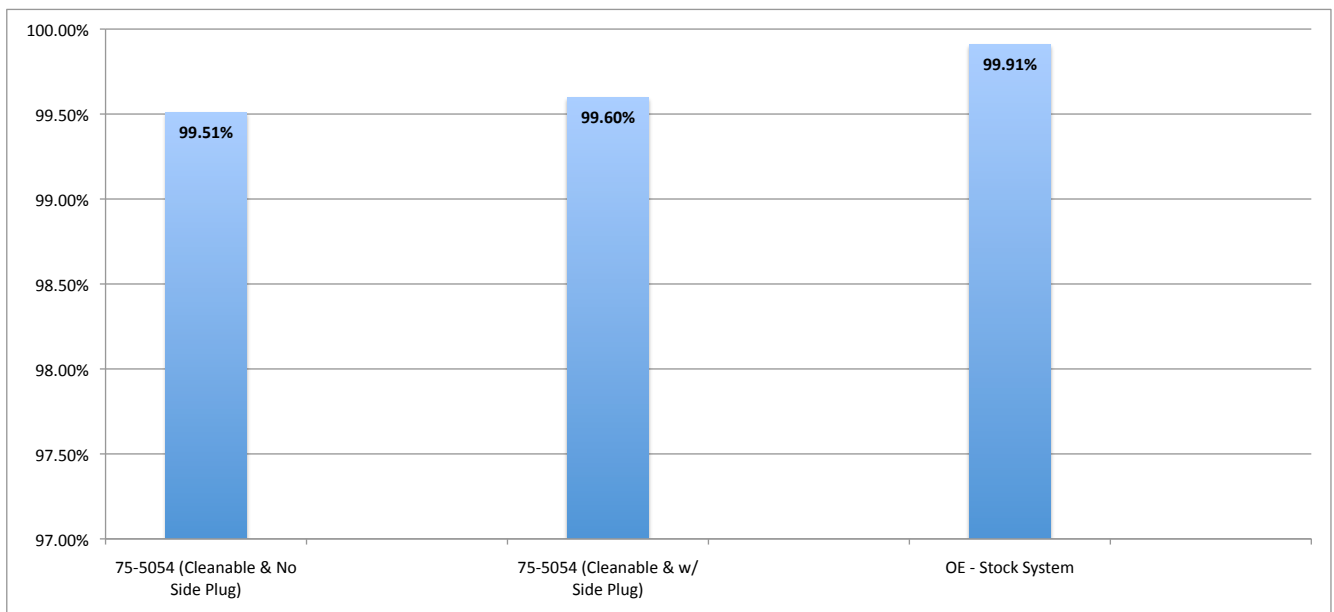
#### Average Environmental Conditions & Test Specifications

Temperature	70.30	deg F
Relative Humidity	50.61	%
Baro Pressure	28.90	mmHg
Test Stand	#1	
Inlet Size		inches
Housing	Intake	
Contaminant	Course	
Contam. Lot #	11157C	
Dust Feed Rate	16.6	grams/minute
Rated Flow	593	cfm

This report represents results of airflow, efficiency and capacity testing conducted at S&B Filters' climate controlled laboratory. Testing was in accordance with the internationally accepted ISO 5011 Filtration Test Standard.

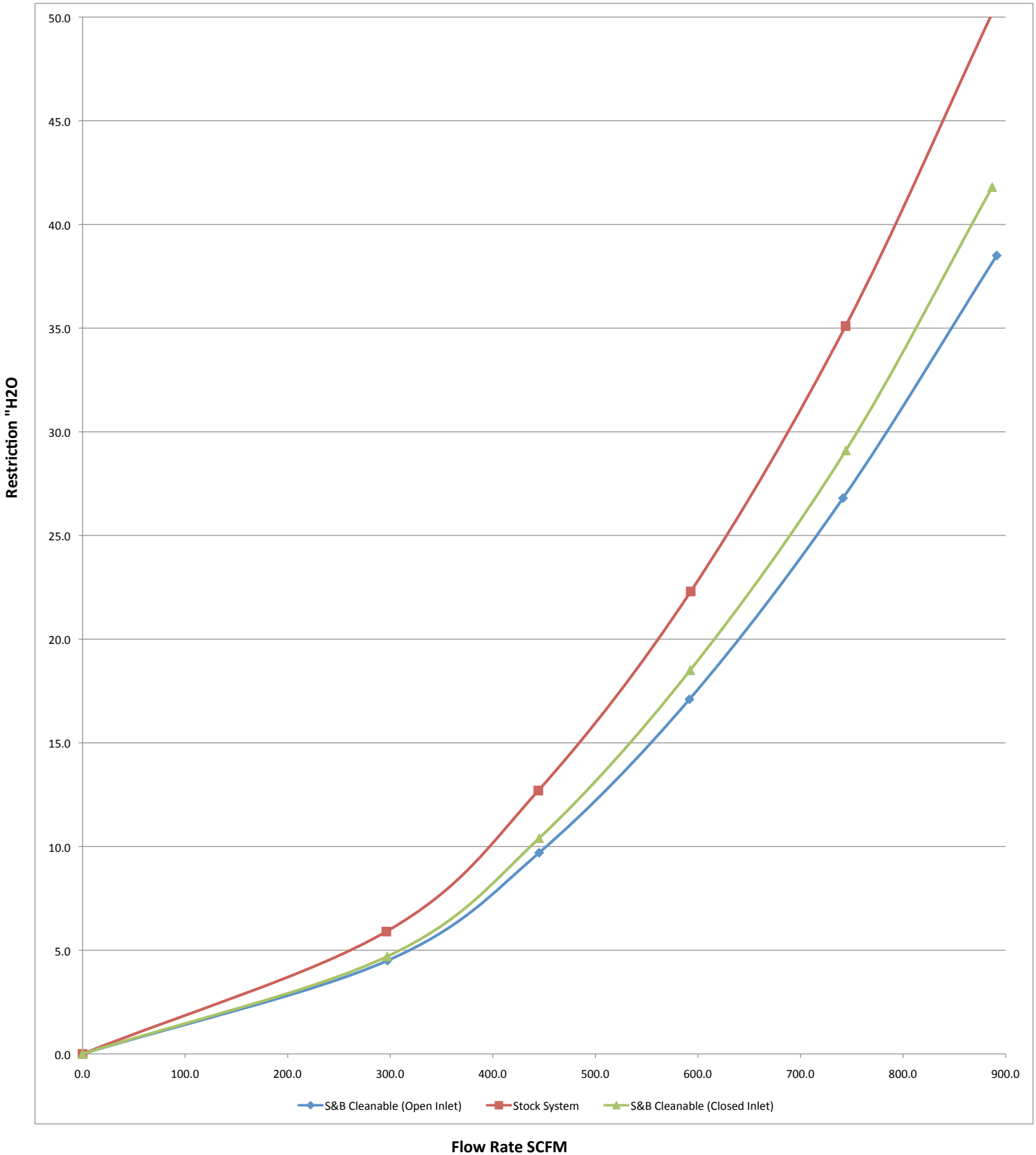
### Efficiency Rate

(% of dirt stopped from bypassing filter. S&B's minimum goal is 99.3%)



### Resistance to Flow

(A lower restriction curve translates into better airflow.)



**Comments:**

With the side inlet closed with the supplied plug, the kit flows 24.1% less air than with the inlet open. That being said, even with the side inlet closed, the S&B intake flows 17.0% better than the stock system at 593 cfm. Testing was conducted with a cleanable cotton filter.

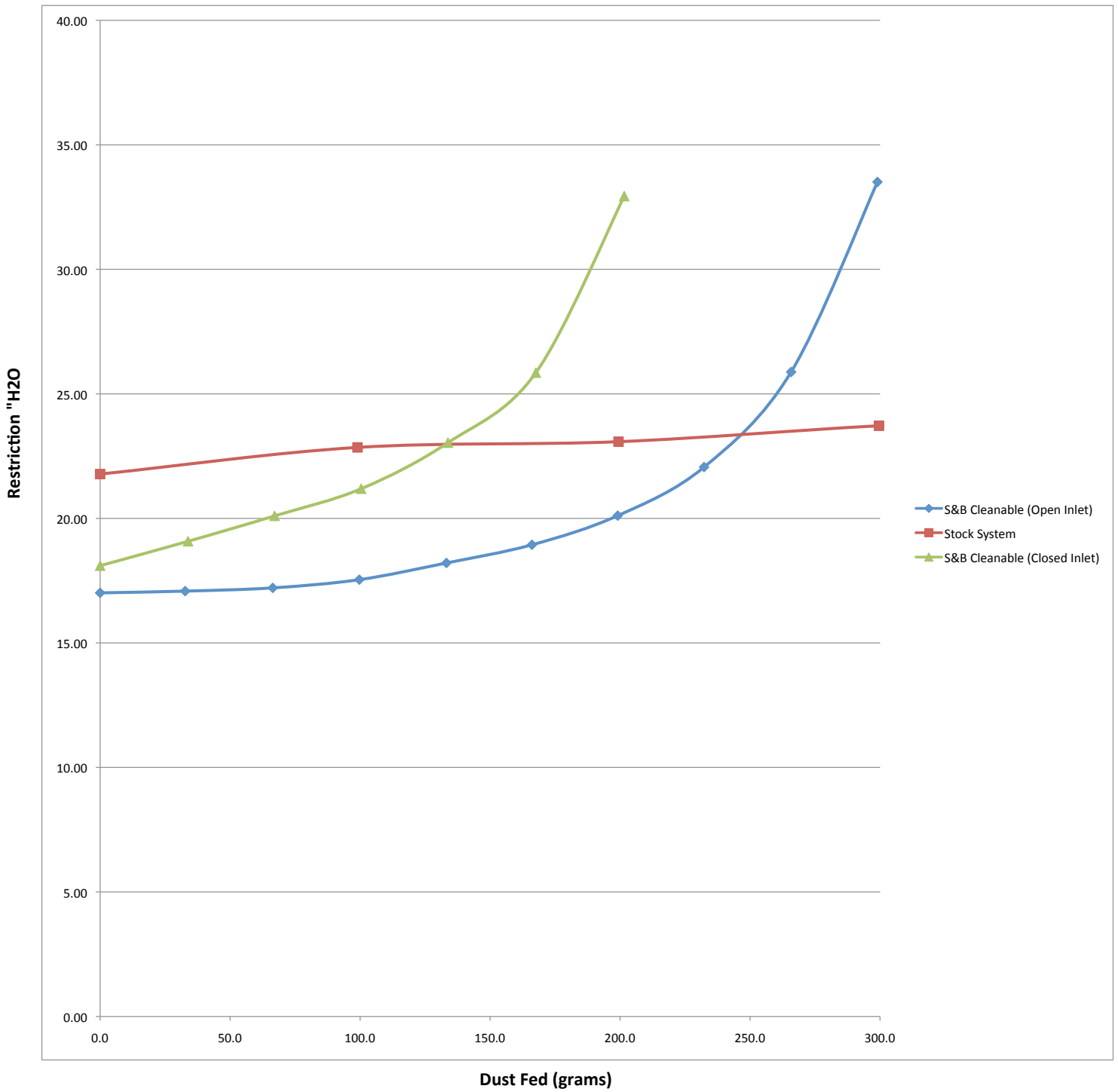


### Air Filter Capacity & Efficiency Test Report

Filter Mfg. & Part No.	Initial Restriction ("H2O)	Capacity (grams)	Efficiency (%)	Restriction (H2O)	Dust Fed (grams)	Time (minutes)
<b>Filter #1</b>	17.01	297.6	99.51	17.01	0.0	0
S&B Cleanable (Open Inlet) 75-5054				17.08	32.7	2
				17.21	66.4	4
				17.54	99.7	6
				18.21	133.2	8
				18.94	166.1	10
				20.11	199.1	12
				22.06	232.3	14
				25.88	265.8	16
				33.51	299.0	18
	<b>Filter #2</b>	21.78	1499.4	99.91	21.78	0.0
OE Stock System				22.85	99.0	6
				23.08	199.4	12
				23.72	299.6	18
				24.19	399.2	24
				24.56	499.3	30
				24.98	599.4	36
				25.60	699.8	42
				26.13	800.7	48
				26.68	901.0	54
				27.50	1,000.1	60
				28.29	1,100.9	66
				29.02	1,200.3	72
				30.14	1,300.3	78
	<b>Filter #3</b>	18.10	200.8	99.60	18.10	0.0
S&B Cleanable (Closed Inlet) 75-5054				19.08	33.8	2
				20.10	67.1	4
				21.19	100.4	6
				23.04	133.8	8
				25.85	167.6	10
				32.94	201.6	12

### Resistance to Flow During Dust Loading

(A lower restriction curve translates into better airflow.)



**Comments:**

At a 100 grams of dirt, the intake with the side inlet sealed flowed 7.1% better than stock while the intake with the open side inlet flowed 22.9% better than the stock system.



## **Test Report #2**

**S&B Intake w/ Disposable Filter vs Stock**



## ISO 5011 Test Report for 75-5054 How does the side inlet affect airflow (dry filter)?

January 26, 2012

### Test Summary

Filter Tested	Improvement in Airflow vs Stock		Efficiency Rate
	Resistance to Flow @ 593 CFM	Resistance to Flow During Dust Loading @ Approx 100 grams	Conducted at Vehicle's Max Rated Flow (643 CFM)
75-5054D (Dry, Open Side Inlet)	21.5%	23.2%	99.59%
75-5054D (Dry, Closed Side Inlet)	16.6%	7.2%	99.51%
OE - Stock System	-	-	99.91%

Airflow Analysis			
Filter Mfg. & Part No.	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #1</b>	0.0	0.0	<b>0.0%</b>
S&B Dry (Open Inlet)	295.2	4.5	<b>23.7%</b>
75-5054D	444.3	9.9	<b>22.0%</b>
	592.3	17.5	<b>21.5%</b>
	739.7	27.4	<b>21.9%</b>
	894.8	39.5	<b>21.2%</b>

Filter #2	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #2</b>	0.0	0.0	<b>0.0%</b>
OE	296.2	5.9	
Stock System	444.4	12.7	
	593.0	22.3	
	743.9	35.1	
	886.0	50.1	

Filter #3	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #3</b>	0.0	0.000	<b>0.0%</b>
S&B Dry (Closed Inlet)	295.3	4.800	<b>18.6%</b>
75-5054D	446.9	10.500	<b>17.3%</b>
	593.9	18.600	<b>16.6%</b>
	743.2	29.200	<b>16.8%</b>
	883.6	42.300	<b>15.6%</b>

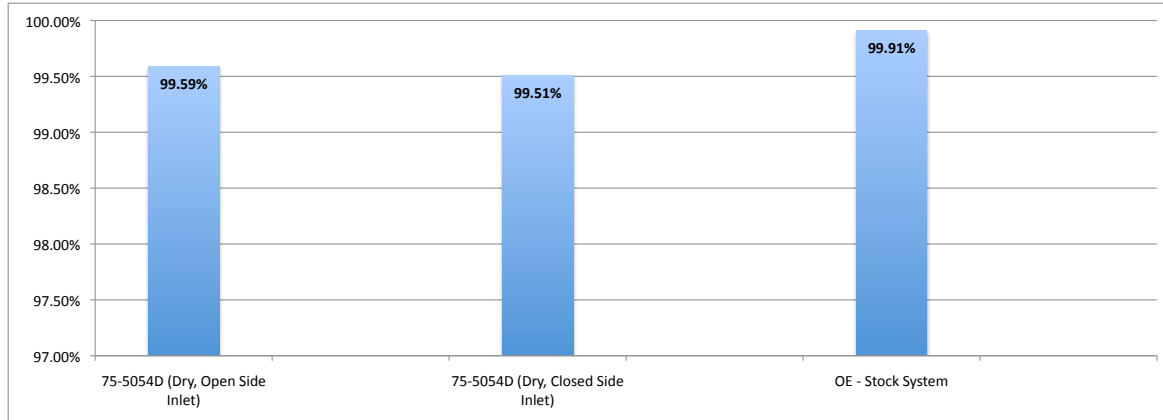
### Average Environmental Conditions & Test Specifications

Temperature	70.04	deg F
Relative Humidity	50.56	%
Baro Pressure	28.96	mmHg
Test Stand	#1	
Inlet Size		inches
Housing	Intake	
Contaminant	Course	
Contam. Lot #	11116C	
Dust Feed Rate	16.6	grams/minute
Rated Flow	593	cfm

This report represents results of airflow, efficiency and capacity testing conducted at S&B Filters' climate controlled laboratory. Testing was in accordance with the internationally accepted ISO 5011 Filtration Test Standard.

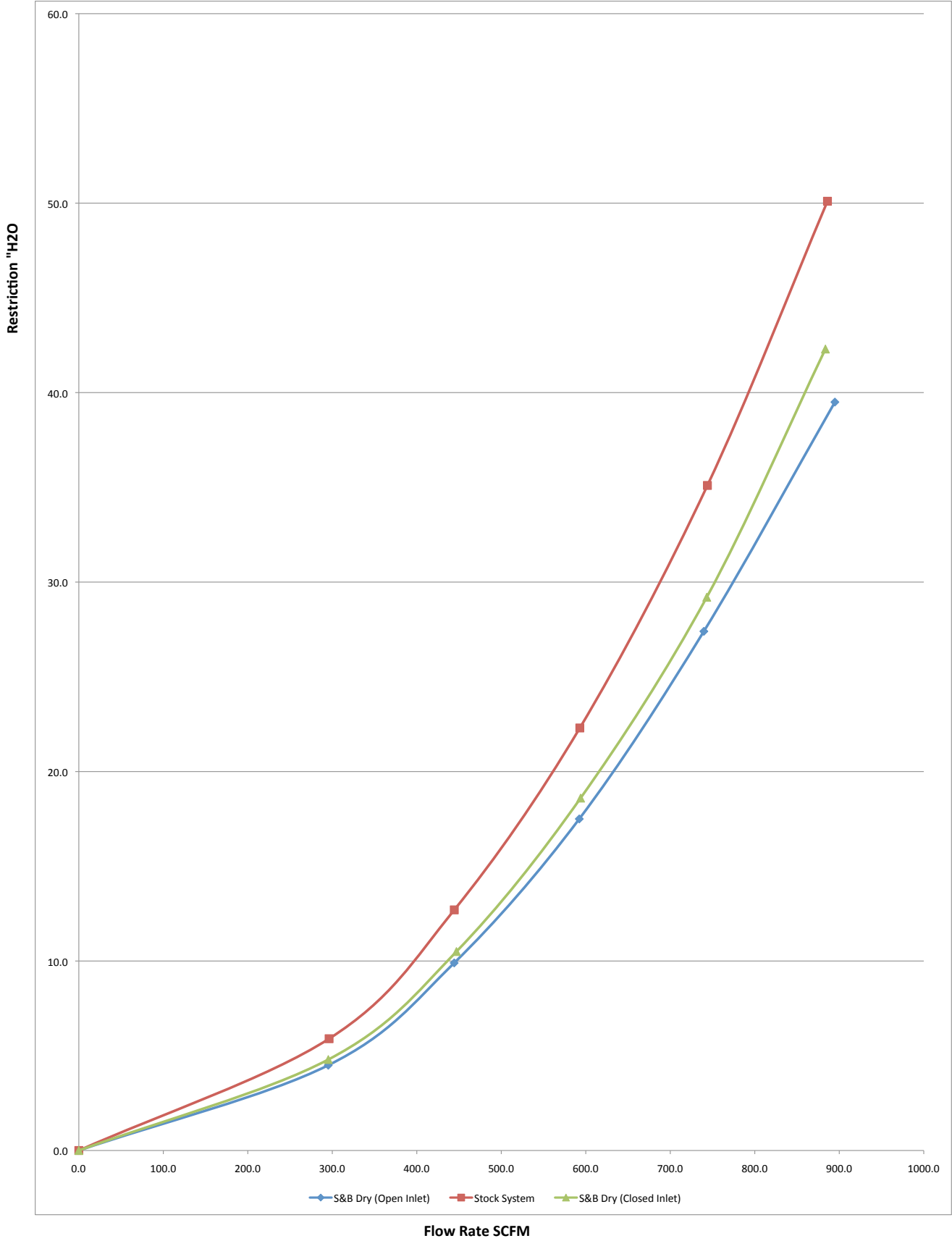
### Efficiency Rate

(% of dirt stopped from bypassing filter. S&B's minimum goal is 99.3%)



# Resistance to Flow

(A lower restriction curve translates into better airflow.)



**Comments:**

With the side inlet closed with the supplied plug, the kit flows 22.8% less air than with the inlet open. That being said, even with the side inlet closed, the S&B intake flows 16.6% better than the stock system at 593 cfm. Testing was conducted with a dry disposable filter.

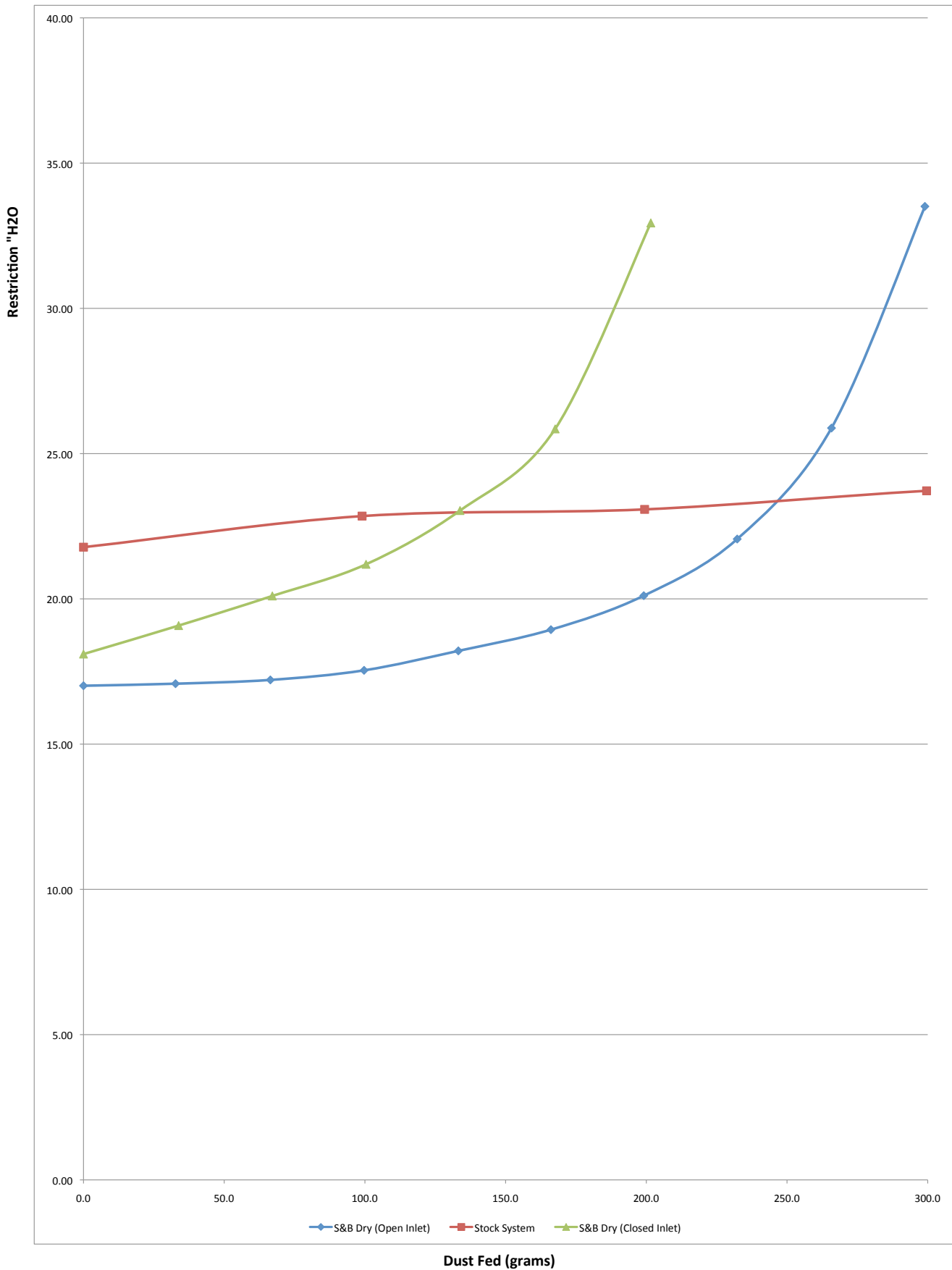


### Air Filter Capacity & Efficiency Test Report

Filter Mfg. & Part No.	Initial Restriction ("H2O)	Capacity (grams)	Efficiency (%)	Restriction (H2O)	Dust Fed (grams)	Time (minutes)
Filter #1 S&B Dry (Open Inlet) 75-5054D	17.01	297.6	99.51	17.01	0.0	0
				17.08	32.7	2
				17.21	66.4	4
				17.54	99.7	6
				18.21	133.2	8
				18.94	166.1	10
				20.11	199.1	12
				22.06	232.3	14
				25.88	265.8	16
				33.51	299.0	18
Filter #2 OE Stock System	21.78	1499.4	99.91	21.78	0.0	0
				22.85	99.0	6
				23.08	199.4	12
				23.72	299.6	18
				24.19	399.2	24
				24.56	499.3	30
				24.98	599.4	36
				25.60	699.8	42
				26.13	800.7	48
				26.68	901.0	54
				27.50	1,000.1	60
				28.29	1,100.9	66
				29.02	1,200.3	72
30.14	1,300.3	78				
Filter #3 S&B Dry (Closed Inlet) 75-5054D	18.10	200.8	99.60	18.10	0.0	0
				19.08	33.8	2
				20.10	67.1	4
				21.19	100.4	6
				23.04	133.8	8
				25.85	167.6	10
				32.94	201.6	12

# Resistance to Flow During Dust Loading

(A lower restriction curve translates into better airflow.)



**Comments:**

At a 100 grams of dirt, the intake with the side inlet sealed flowed 7.2% better than stock while the intake with the open side inlet flowed 23.2% better than the stock system.

# **Test Report #3**

**S&B Intake vs Banks**



## ISO 5011 Test Report for 75-5054

### How does Banks' intake compare to S&B?

January 26, 2012

#### Test Summary

Filter Tested	Improvement in Airflow vs Stock		Efficiency Rate
	Resistance to Flow @ 593 CFM	Resistance to Flow During Dust Loading @ Approx 100 grams	Conducted at Vehicle's Max Rated Flow (643 CFM)
S&B 75-5054 (w/ Cleanable Filter)	23.3%	22.9%	99.51%
S&B 75-5054D (w/ Dry Filter)	21.5%	14.7%	99.59%
Banks 42185	20.6%	9.0%	97.51%
OE - Stock System	-	-	99.91%

Airflow Analysis			
Filter Mfg. & Part No.	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #1</b>	0.0	0.0	<b>0.0%</b>
S&B (Cleanable) 75-5054	297.3	4.5	23.7%
	445.2	9.7	23.6%
	591.7	17.1	23.3%
	741.4	26.8	23.6%
	891.3	38.5	23.2%

Filter #2	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #2</b>	0.0	0.0	<b>0.0%</b>
OE	296.2	5.9	
Stock System	444.4	12.7	
	593.0	22.3	
	743.9	35.1	
	886.0	50.1	

Filter #3	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #3</b>	0.0	0.000	<b>0.0%</b>
S&B (Dry) 75-5054D	295.2	4.500	23.7%
	444.3	9.900	22.0%
	592.3	17.500	21.5%
	739.7	27.400	21.9%
	894.8	39.500	21.2%

Filter #4	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #4</b>	0.0	0.000	<b>0.0%</b>
Banks 42185	298.1	4.500	23.7%
	442.1	10.000	21.3%
	592.7	17.700	20.6%
	734.2	27.800	20.8%
	888.1	40.100	20.0%

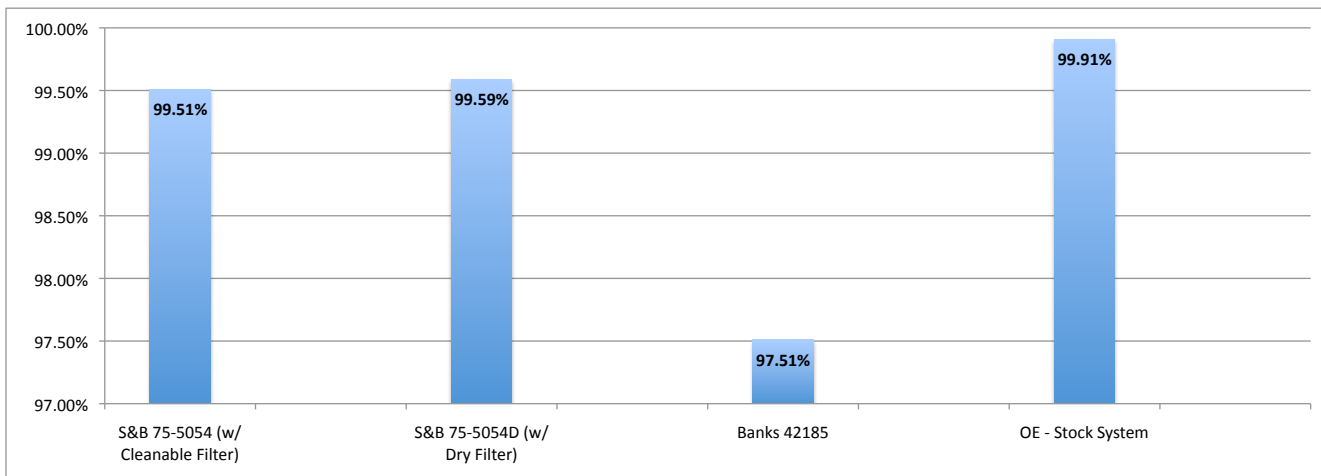
#### Average Environmental Conditions & Test Specifications

Temperature	70.17	deg F
Relative Humidity	50.55	%
Baro Pressure	28.94	mmHg
Test Stand	#1	
Inlet Size		inches
Housing	Intake	
Contaminant	Course	
Contam. Lot #	11157C	
Dust Feed Rate	16.6	grams/minute
Rated Flow	593	cfm

This report represents results of airflow, efficiency and capacity testing conducted at S&B Filters' climate controlled laboratory. Testing was in accordance with the internationally accepted ISO 5011 Filtration Test Standard.

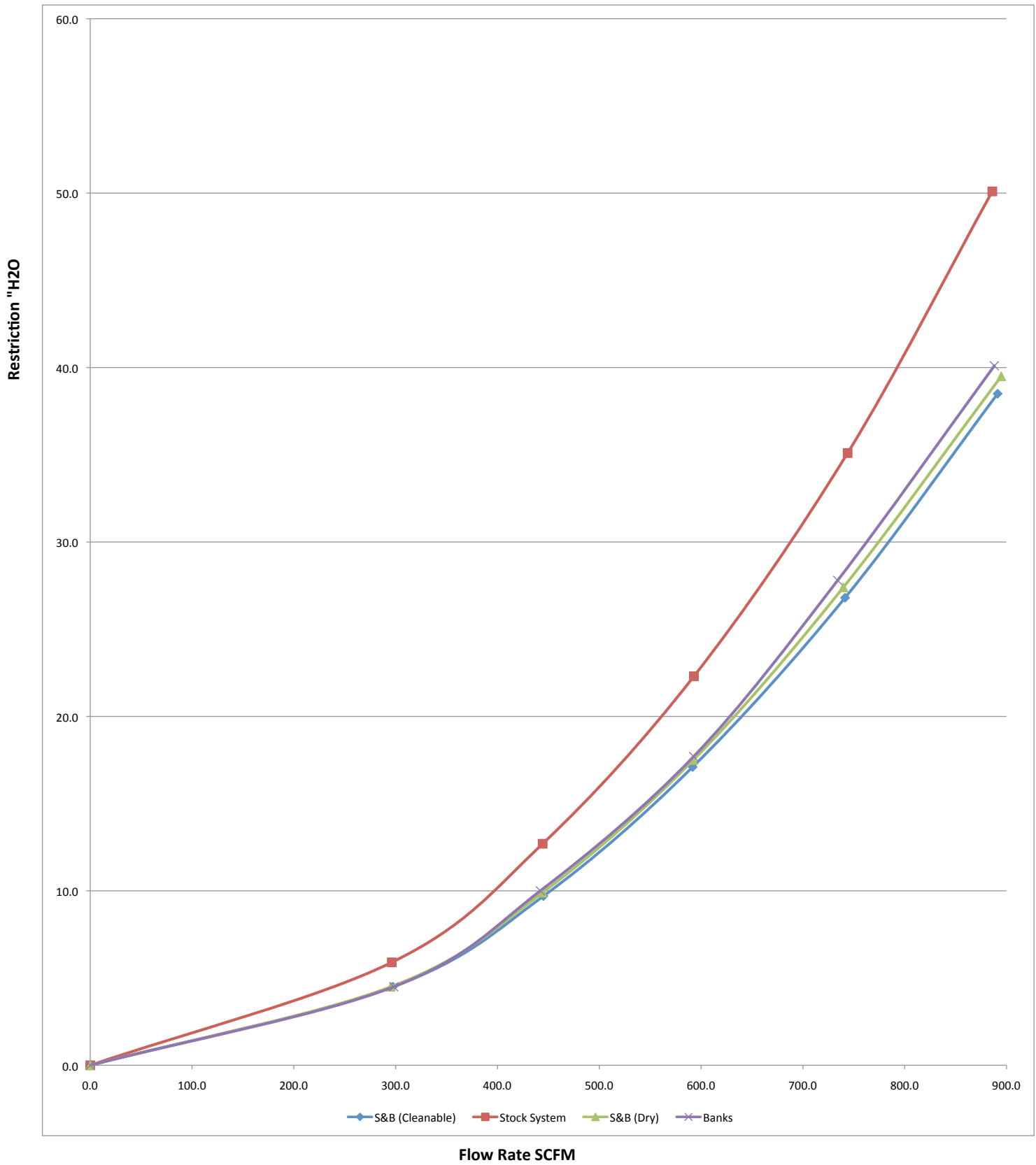
#### Efficiency Rate

(% of dirt stopped from bypassing filter. S&B's minimum goal is 99.3%)



# Resistance to Flow

(A lower restriction curve translates into better airflow.)



**Comments:**

S&B's Intake with a Dry Filter flowed 21.5% better than the stock filter at 593 cfm, and the cotton filter flow 23.3% better than the stock system.



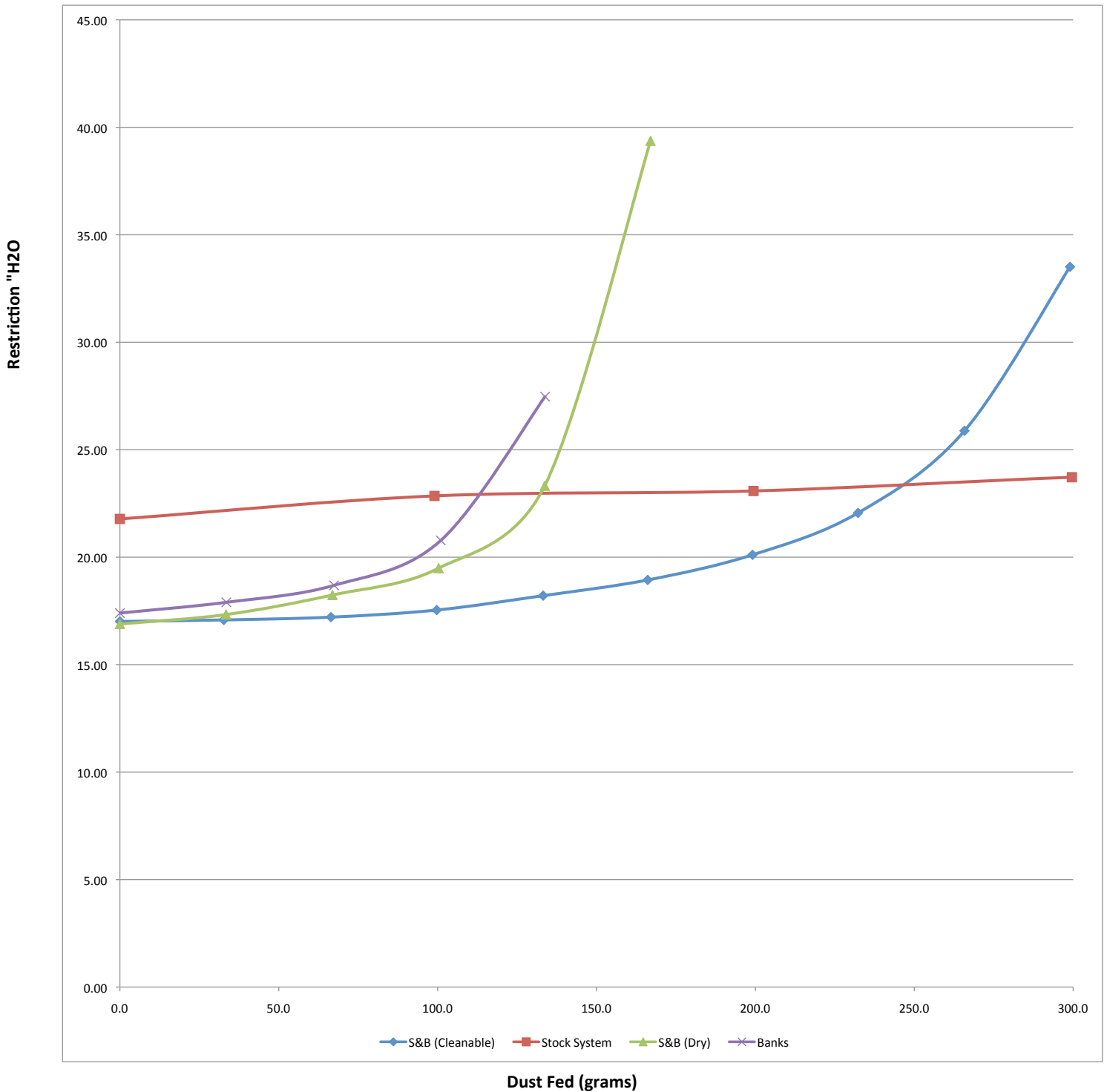


### Air Filter Capacity & Efficiency Test Report

Filter Mfg. & Part No.	Initial Restriction ("H2O)	Capacity (grams)	Efficiency (%)	Restriction (H2O)	Dust Fed (grams)	Time (minutes)
Filter #1 S&B (Cleanable) 75-5054	17.01	297.6	99.51	17.01	0.0	0
				17.08	32.7	2
				17.21	66.4	4
				17.54	99.7	6
				18.21	133.2	8
				18.94	166.1	10
				20.11	199.1	12
				22.06	232.3	14
				25.88	265.8	16
				33.51	299.0	18
Filter #2 OE Stock System	21.78	1499.4	99.91	21.78	0.0	0
				22.85	99.0	6
				23.08	199.4	12
				23.72	299.6	18
				24.19	399.2	24
				24.56	499.3	30
				24.98	599.4	36
				25.60	699.8	42
				26.13	800.7	48
				26.68	901.0	54
				27.50	1,000.1	60
				28.29	1,100.9	66
				29.02	1,200.3	72
30.14	1,300.3	78				
Filter #3 S&B (Dry) 75-5054D	16.89	166.3	99.59	16.89	0.0	0
				17.33	33.4	2
				18.24	66.9	4
				19.49	100.3	6
				23.32	133.7	8
				39.37	167.0	10
Filter #4 Banks 42185	17.40	130.5	97.51	17.40	0.0	0
				17.90	33.5	2
				18.69	67.4	4
				20.78	101.0	6
				27.47	133.8	8

## Resistance to Flow During Dust Loading

(A lower restriction curve translates into better airflow.)



### Comments:

#### How did Banks do when it comes to protecting an engine from debris?

While the Banks intake did fairly well with respect to just airflow, it achieved this by sacrificing protection. The efficiency rate for Banks was 97.51% compared to S&B's 99.51%. The efficiency rate of the stock filter was 99.91%. S&B's minimum goal for efficiency is 99.3%.

#### How does the filter perform when dirt is added?

How a filter performs when dirt is added is the true measure of a filter system. With 100 grams added to the filter, S&B's still showed a 22.9% improvement over stock while Banks' numbers fell sharply to show only a 9% gain over stock.

#### Who's filter held the most dirt & why is that important?

Lastly, S&B's filter held 56.1% more dirt. This is important because as the filter fills up with dirt, the S&B will maintain better airflow than Banks. Furthermore, since the S&B filter holds more dirt, you can go longer between cleanings.

# **Test Report #4**

**S&B Intake vs AFE**

## ISO 5011 Test Report for 75-5054

### How does AFE's intake compare to S&B?

January 26, 2012

#### Test Summary

Filter Tested	Improvement in Airflow vs Stock		Efficiency Rate
	Resistance to Flow @ 593 CFM	Resistance to Flow During Dust Loading @ Approx 100 grams	Conducted at Vehicle's Max Rated Flow (643 CFM)
S&B 75-5054 (w/ Cleanable Filter)	23.3%	23.2%	99.51%
S&B 75-5054D (w/ Dry Filter)	21.5%	14.7%	99.59%
AFE w/ Proguard7	8.5%	-28.1%	99.64%
AFE w/ Pro Dry	10.8%	6.4%	98.53%
AFE with Pro5	11.7%	-19.7%	97.51%
OE - Stock System	-	-	99.91%

#### Airflow Analysis

Filter Mfg. & Part No.	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #1</b>	0.0	0.0	<b>0.0%</b>
S&B (Cleanable) 75-5054	297.3	4.5	23.7%
	445.2	9.7	23.6%
	591.7	17.1	23.3%
	741.4	26.8	23.6%
	891.3	38.5	23.2%
<b>Filter #2</b>	0.0	0.0	
OE Stock System	296.2	5.9	
	444.4	12.7	
	593.0	22.3	
	743.9	35.1	
	886.0	50.1	
<b>Filter #3</b>	0.0	0.000	<b>0.0%</b>
S&B (Dry) 75-5054D	295.2	4.500	23.7%
	444.3	9.900	22.0%
	592.3	17.500	21.5%
	739.7	27.400	21.9%
	894.8	39.500	21.2%
<b>Filter #4</b>	0.0	0.000	<b>0.0%</b>
AFE w/ Proguard7 72-81262	296.7	5.300	10.2%
	443.5	11.600	8.7%
	595.7	20.400	8.5%
	737.4	31.800	9.4%
	894.1	45.600	9.0%
<b>Filter #5</b>	0.0	0.000	<b>0.0%</b>
AFE w/ Pro Dry 75-81262 21-90015	295.7	5.100	13.6%
	441.4	11.400	10.2%
	595.9	19.900	10.8%
	738.1	30.900	12.0%
	890.2	44.600	11.0%
<b>Filter #6</b>	0.0	0.000	<b>0.0%</b>
AFE w/ Pro5 75-81262 24-90015	296.5	5.000	15.3%
	441.9	11.100	12.6%
	593.2	19.700	11.7%
	742.0	30.900	12.0%
	895.9	44.500	11.2%

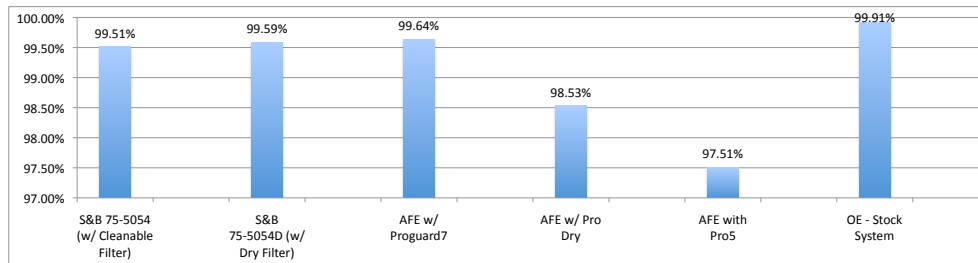
#### Average Environmental Conditions & Test Specifications

Temperature	69.78 deg F
Relative Humidity	49.96 %
Baro Pressure	29.00 mmHg
Test Stand	#1
Inlet Size	inches
Housing	Intake
Contaminant	Course
Contam. Lot #	11157C
Dust Feed Rate	16.6 grams/minute
Rated Flow	593 cfm

This report represents results of airflow, efficiency and capacity testing conducted at S&B Filters' climate controlled laboratory. Testing was in accordance with the internationally accepted ISO 5011 Filtration Test Standard.

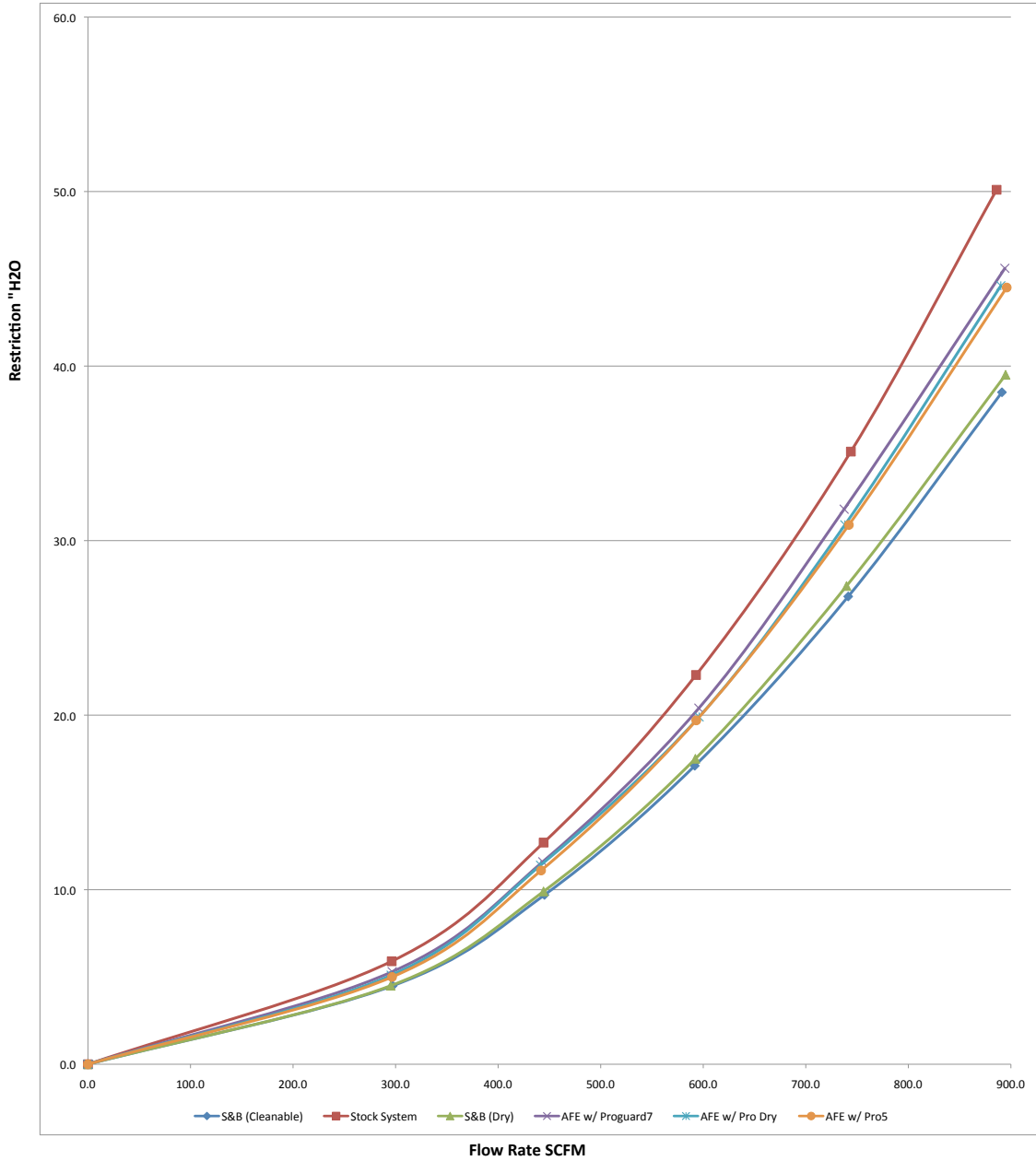
#### Efficiency Rate

(% of dirt stopped from bypassing filter. S&B's minimum goal is 99.3%)



# Resistance to Flow

(A lower restriction curve translates into better airflow.)



**Comments:**

S&B's Intake with a Dry Filter flowed 21.5% better than the stock filter at 593 cfm, and the cotton filter flow 23.3% better than the stock system. With either the dry or cleanable filter installed, S&B beat AFE's intake in airflow by over 9.8%. Each of AFE's 3 filters where tested on the AFE intake and the following are the improvements in airflow vs stock: Proguard7 8.5%, Pro Dry 10.8% and Pro5 11.7%.

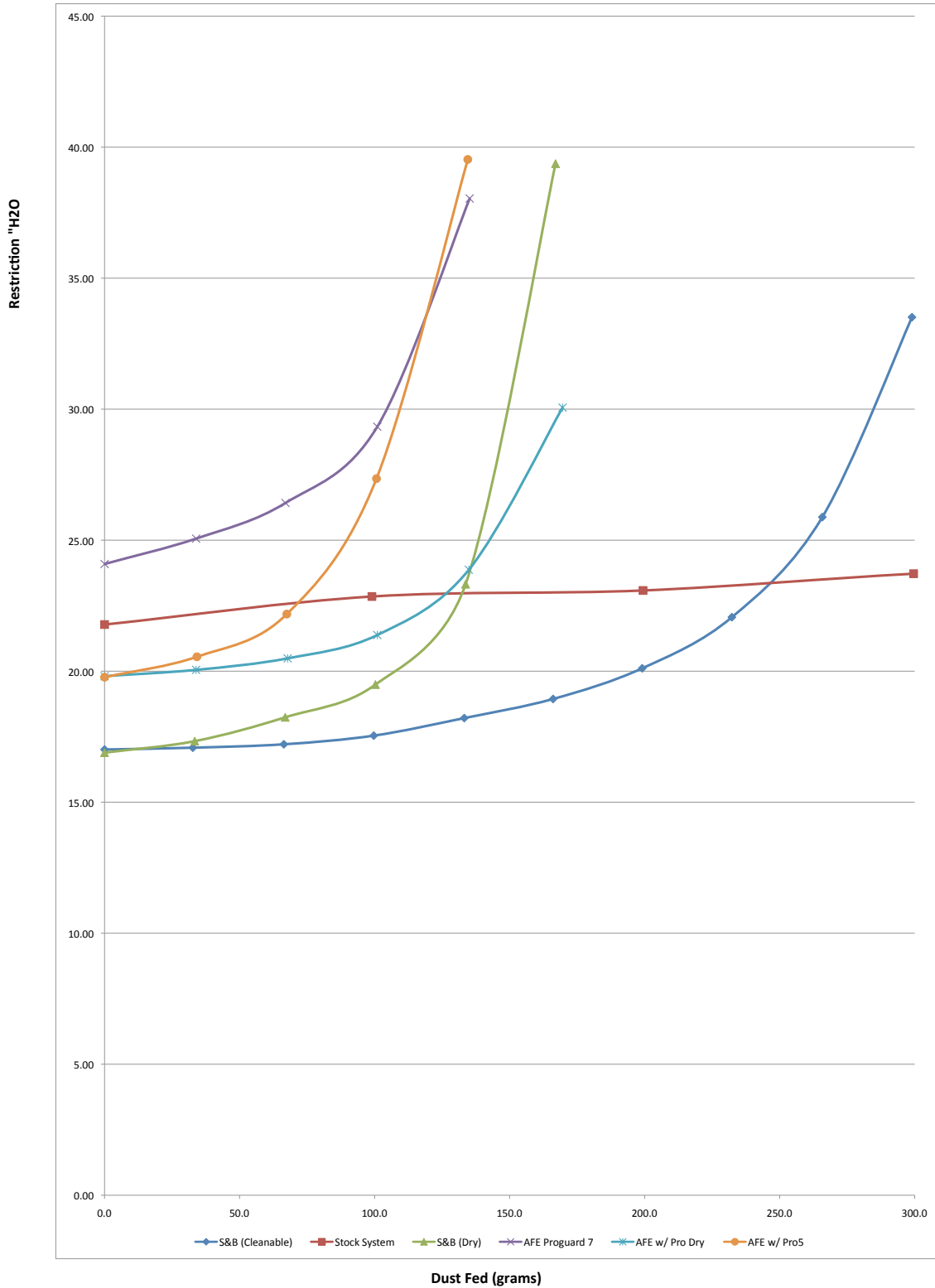


### Air Filter Capacity & Efficiency Test Report

Filter Mfg. & Part No.	Initial Restriction ("H2O)	Capacity (grams)	Efficiency (%)	Restriction (H2O)	Dust Fed (grams)	Time (minutes)
Filter #1 S&B (Cleanable) 75-5054	17.01	297.6	99.51	17.01	0.0	0
				17.08	32.7	2
				17.21	66.4	4
				17.54	99.7	6
				18.21	133.2	8
				18.94	166.1	10
				20.11	199.1	12
				22.06	232.3	14
				25.88	265.8	16
				33.51	299.0	18
Filter #2 OE Stock System	21.78	1499.4	99.91	21.78	0.0	0
				22.85	99.0	6
				23.08	199.4	12
				23.72	299.6	18
				24.19	399.2	24
				24.56	499.3	30
				24.98	599.4	36
				25.60	699.8	42
				26.13	800.7	48
				26.68	901.0	54
				27.50	1,000.1	60
				28.29	1,100.9	66
				29.02	1,200.3	72
30.14	1,300.3	78				
Filter #3 S&B (Dry) 75-5054D	16.89	166.3	99.59	16.89	0.0	0
				17.33	33.4	2
				18.24	66.9	4
				19.49	100.3	6
				23.32	133.7	8
				39.37	167.0	10
				Filter #4 AFE Proguard 7 72-90015	24.09	134.7
25.06	33.9	2				
26.42	67.0	4				
29.33	101.0	6				
38.04	135.2	8				
Filter #5 AFE w/ Pro Dry 75-81262 21-90015	19.81	167.1	98.53	19.81	0.0	0
				20.05	33.9	2
				20.49	67.8	4
				21.38	101.0	6
				23.87	134.9	8
				30.06	169.6	10
Filter #6 AFE w/ Pro5 75-81262 24-90015	19.77	126.7	94.16	19.77	0.0	0
				20.55	34.2	2
				22.18	67.5	4
				27.35	100.7	6
				39.53	134.5	8

## Resistance to Flow During Dust Loading

(A lower restriction curve translates into better airflow.)



**Comments:**

**How did AFE do when it comes to protecting an engine from debris?**

While AFE's filters showed a slight improvement with respect to just airflow, only the intake with the Proguard7 filter installed showed a good efficiency rate. The efficiency rate for AFE intake was 97.51% with the Proguard7, 98.53% with the Pro Dry and only 97.51% with the Pro5 installed compared to S&B's 99.51%. The efficiency rate of the stock filter was 99.91%. S&B's minimum goal for efficiency is 99.3%.

**How does the filter perform when dirt is added?**

How a filter performs when dirt is added is the true measure of a filter system. With 100 grams added to the filter, S&B's still showed a 22.9% improvement over stock while AFE's numbers fell sharply. In fact, with the Proguard7 and Pro5 filters installed, the AFE intake flowed over 19.7% worse than stock. Only AFE's Pro Dry filter showed an improvement 6.4% versus stock with 100 grams loaded on the filter.

**Who's filter held the most dirt & why is that important?**

Lastly, S&B's cotton filter held over 43.9% more dirt than all of the AFE filters. This is important because as the filter fills up with dirt, the S&B will maintain better airflow than AFE. Furthermore, since the S&B filter holds more dirt, you can go longer between cleanings.

# **Test Report #5**

**S&B Intake vs Volant**





## ISO 5011 Test Report

### How does Volant's intake compare to S&B?

January 26, 2012

#### Test Summary

Filter Tested	Improvement in Airflow vs Stock		Efficiency Rate
	Resistance to Flow @ 593 CFM	Resistance to Flow During Dust Loading @ Approx 100 grams	
S&B 75-5054 (w/ Cleanable Filter)	23.3%	15.2%	99.51%
S&B 75-5054D (w/ Dry Filter)	21.5%	14.7%	99.59%
Volant Intake w/Powercore Filter	<b>-15.2%</b>	n/a	n/a
Volant Intake w/Powercore & Scoop	<b>-11.2%</b>	See Graph	99.81%
OE - Stock System	-	-	99.91%

Airflow Analysis			
Filter Mfg. & Part No.	Air Flow scfm	Net Restriction (Inches of H2O)	% Less Restrictive than OE
<b>Filter #1</b>	0.0	0.0	<b>0.0%</b>
S&B (Cleanable) 75-5054	297.3	4.5	<b>23.7%</b>
	445.2	9.7	<b>23.6%</b>
	591.7	17.1	<b>23.3%</b>
	741.4	26.8	<b>23.6%</b>
	891.3	38.5	<b>23.2%</b>

Filter #2			
OE	0.0	0.0	
Stock System	296.2	5.9	
	444.4	12.7	
	593.0	22.3	
	743.9	35.1	
	886.0	50.1	

Filter #3			
S&B (Dry) 75-5054D	0.0	0.000	<b>0.0%</b>
	295.2	4.500	<b>23.7%</b>
	444.3	9.900	<b>22.0%</b>
	592.3	17.500	<b>21.5%</b>
	739.7	27.400	<b>21.9%</b>
	894.8	39.500	<b>21.2%</b>

Filter #4			
Volant: Powercore 198646	0.0	0.000	<b>0.0%</b>
	296.5	6.700	<b>-13.6%</b>
	445.1	14.500	<b>-14.2%</b>
	592.2	25.700	<b>-15.2%</b>
	743.7	40.100	<b>-14.2%</b>
	886.3	50.100	<b>0.0%</b>

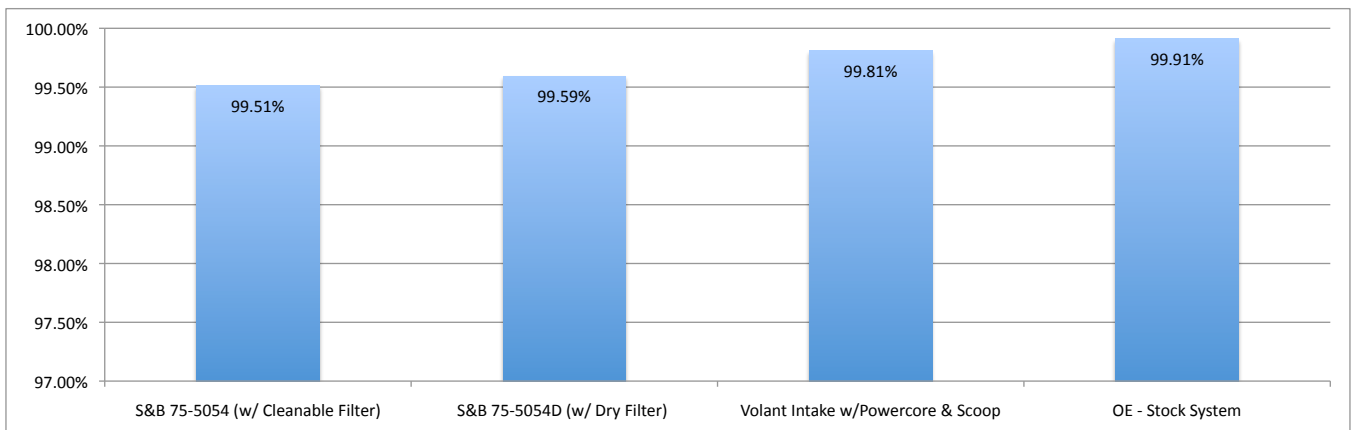
Filter #5			
Volant: Powercore & Scoop 198646	0.0	0.000	<b>0.0%</b>
	296.8	6.500	<b>-10.2%</b>
	446.1	14.000	<b>-10.2%</b>
	594.5	24.800	<b>-11.2%</b>
	746.4	38.900	<b>-10.8%</b>
	888.7	50.100	<b>0.0%</b>

Average Environmental Conditions & Test Specifications		
Temperature	69.86	deg F
Relative Humidity	50.26	%
Baro Pressure	28.98	mmHg
Test Stand	#1	
Inlet Size		inches
Housing	Intake	
Contaminant	Course	
Contam. Lot #	11157C	
Dust Feed Rate	16.6	grams/minute
Rated Flow	593	cfm

This report represents results of airflow, efficiency and capacity testing conducted at S&B Filters' climate controlled laboratory. Testing was in accordance with the internationally accepted ISO 5011 Filtration Test Standard.

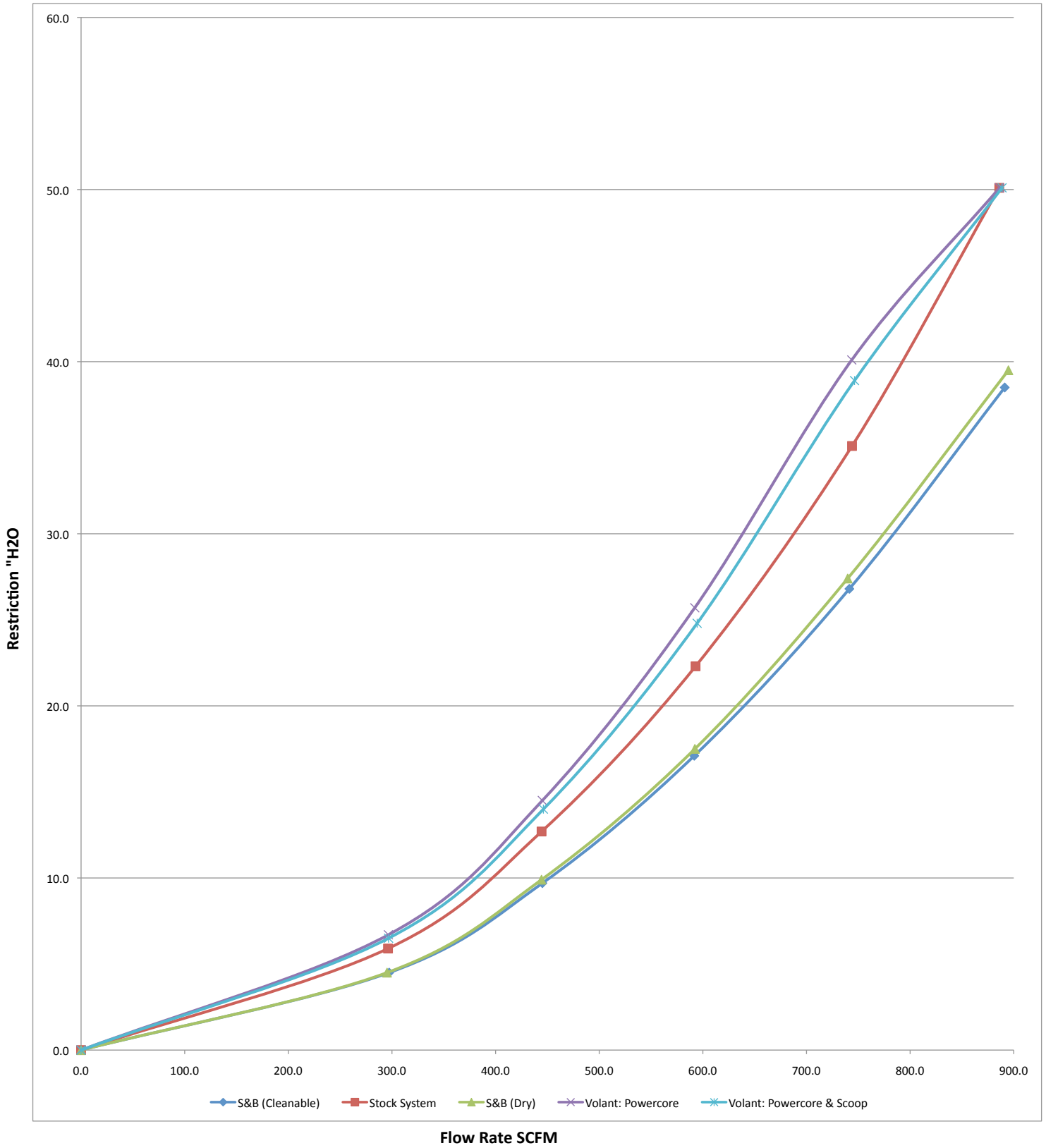
#### Efficiency Rate

(% of dirt stopped from bypassing filter. S&B's minimum goal is 99.3%)



# Resistance to Flow

(A lower restriction curve translates into better airflow.)



**COMMENTS:**

S&B's Intake with a Dry Filter flowed 21.5% better than the stock filter at 593 cfm, and the cotton filter flow 23.3% better than the stock system. The Volant intake with and without the scoop attached flowed worse than the system at virtually all the airflow rates. At approximately 593 cfm, the Volant intake with the Donaldson filter flowed 15.2% worse than the stock intake. With the scoop installed, the flow improved slightly but was still 11.2% worse than stock.

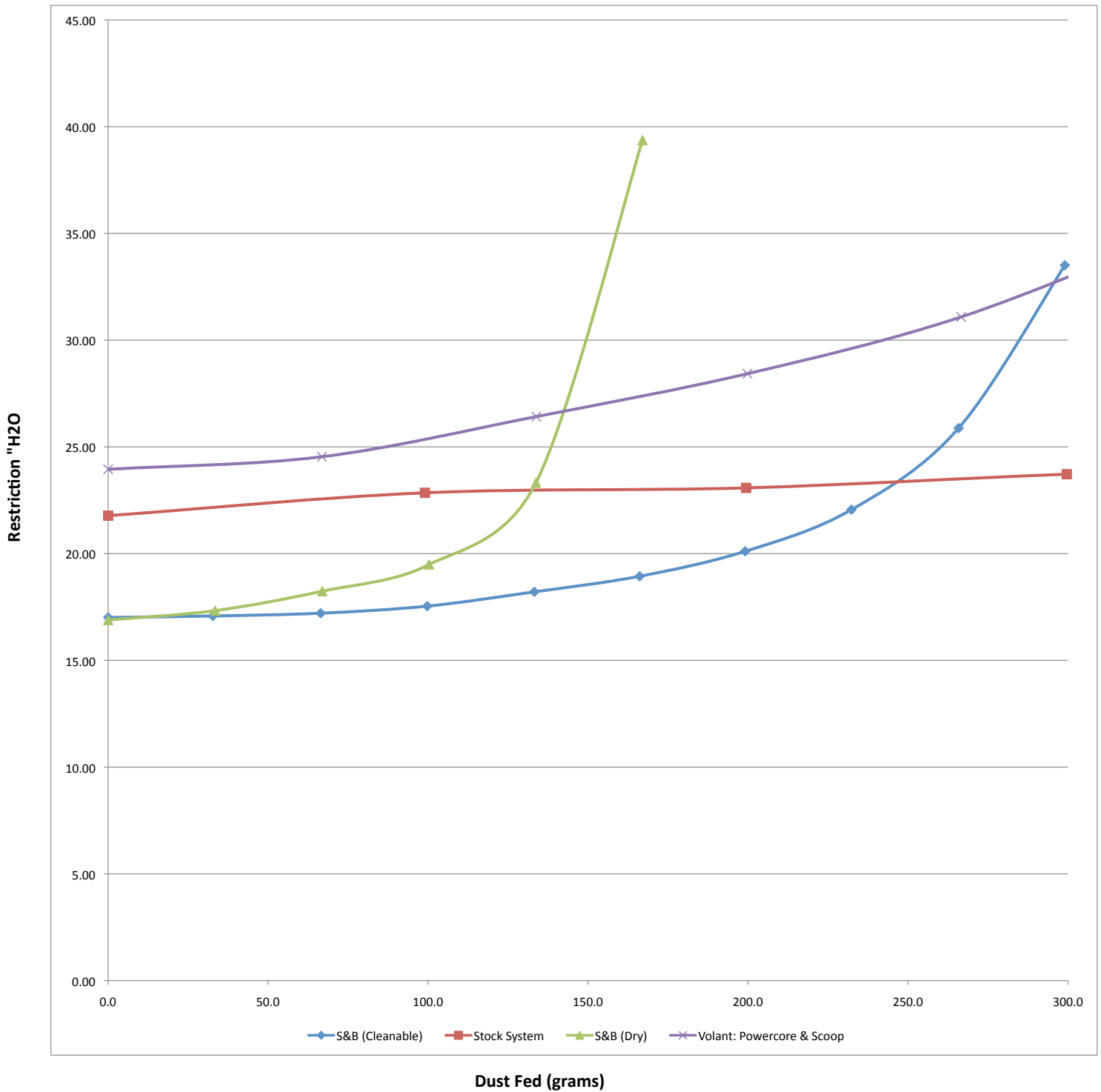


### Air Filter Capacity & Efficiency Test Report

Filter Mfg. & Part No.	Initial Restriction ("H2O)	Capacity (grams)	Efficiency (%)	Restriction (H2O)	Dust Fed (grams)	Time (minutes)
Filter #1 S&B (Cleanable) 75-5054	17.01	297.6	99.51	17.01	0.0	0
				17.08	32.7	2
				17.21	66.4	4
				17.54	99.7	6
				18.21	133.2	8
				18.94	166.1	10
				20.11	199.1	12
				22.06	232.3	14
				25.88	265.8	16
				33.51	299.0	18
				Filter #2 OE Stock System	21.78	1499.4
22.85	99.0	6				
23.08	199.4	12				
23.72	299.6	18				
24.19	399.2	24				
24.56	499.3	30				
24.98	599.4	36				
25.60	699.8	42				
26.13	800.7	48				
26.68	901.0	54				
27.50	1,000.1	60				
28.29	1,100.9	66				
29.02	1,200.3	72				
30.14	1,300.3	78				
Filter #3 S&B (Dry) 75-5054D	16.89	166.3	99.59	16.89	0.0	0
				17.33	33.4	2
				18.24	66.9	4
				19.49	100.3	6
				23.32	133.7	8
				39.37	167.0	10
				Filter #4 Volant: Powercore & Scoop 198646	23.95	333.0
24.54	66.8	4				
26.42	133.8	8				
28.43	199.8	12				
31.09	266.6	16				
35.02	333.7	20				

## Resistance to Flow During Dust Loading

(A lower restriction curve translates into better airflow.)



**COMMENTS:**

**How did Volant do when it comes to protecting an engine from debris?**

While the Volant intake performed very poor with respect to airflow (worse than stock), it did a good job at stopping the dirt as it achieved an efficiency rate of 99.81%. S&B improved the airflow by more than 23.3% over stock and still was able to stop 99.51% of the dirt. The efficiency rate of the stock filter was 99.91%.

**How does the filter perform when dirt is added?**

How a filter performs when dirt is added is the true measure of a filter system. With 100 grams added to the filter, S&B's still showed over a 14.7% improvement over stock. The Volant intake maintained an airflow curve that was worse than the stock system.

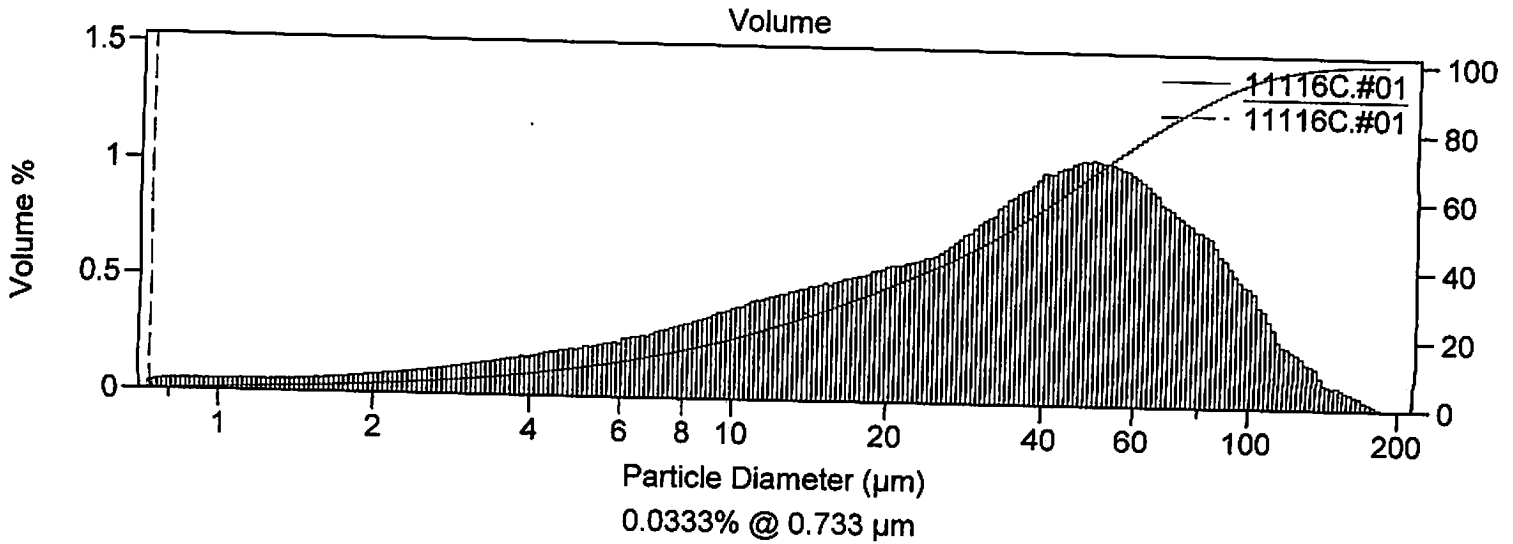
**Who's filter held the most dirt & why is that important?**

Typically if you are comparing two different intakes and both show an improvement in airflow vs stock, you will then look to see how the intakes flowed while dirt was applied to the filter. Since the Volant system flowed worse than stock with a clean filter, you can't really compare the two intakes with respect to capacity. While S&B intake held 10.7% less dust than the Volant intake, S&B demonstrated a significant improvement in airflow during the dust loading test. Volant's intake flowed worse than the stock system in both tests.

Filename: 11116C.#01 Sample Number: 267  
 Group ID: 11116C  
 Sample ID: 11116C  
 Comment: ISO 12103-1, A4 COARSE TEST DUST, NIST TRACEABLE  
 Operator: JDF  
 Acquired: 11:26 12 Sep 2011  
 Edited size data



14531 Ewing Avenue South Burnsville, Minnesota 55306  
 Phone: 952-894-8737



Volume Statistics (Geometric) 11116C.#01

Calculations from 0.725 µm to 184.2 µm

Volume 10.87e9 µm<sup>3</sup>  
 Mean: 26.54 µm S.D.: 49.8 µm  
 Median: 33.85 µm  
 Mean/Median Ratio: 0.784  
 Mode: 49.77 µm

11116C.#01

Particle Diameter µm	Volume % <	Particle Diameter µm	Volume % <
1	0.677	200	100.00
2	2.53		
3	4.42		
4	6.40		
5	8.37		
7	12.14		
10	17.64		
20	33.27		
40	57.17		
80	88.17		
120	97.82		
180	99.99		

11116C.#01

Channel Number	Particle Diameter µm	Cum < Volume %	Diff Number %	Cum < Number %	Diff Volume %
1	0.725	0	25.90	0	0.250
7	0.825	0.250	20.39	25.90	0.287
13	0.940	0.537	14.12	46.29	0.294
19	1.070	0.831	10.00	60.41	0.307
25	1.218	1.14	6.76	70.41	0.307
31	1.387	1.44	4.95	77.18	0.332
37	1.579	1.78	3.90	82.12	0.386
43	1.798	2.16	3.08	86.02	0.450
49	2.048	2.61	2.45	89.10	0.528
55	2.331	3.14	1.91	91.54	0.609
61	2.655	3.75	1.52	93.45	0.713
67	3.022	4.46	1.19	94.97	0.826
73	3.441	5.29	0.928	96.16	0.951
79	3.918	6.24	0.707	97.09	1.07
85	4.461	7.31	0.541	97.80	1.21
91	5.080	8.52	0.409	98.34	1.35
97	5.784	9.86	0.311	98.75	1.51
103	6.585	11.38	0.236	99.06	1.69
109	7.498	13.07	0.181	99.29	1.91
115	8.537	14.98	0.138	99.47	2.16
121	9.720	17.13	0.105	99.61	2.42
127	11.07	19.55	0.078	99.72	2.66
133	12.60	22.21	0.057	99.79	2.87
139	14.35	25.08	0.041	99.85	3.04
145	16.34	28.12	0.030	99.89	3.24
151	18.60	31.35	0.022	99.92	3.47
157	21.18	34.83	0.015	99.94	3.65
163	24.11	38.48	0.011	99.96	3.95
169	27.46	42.43	0.009	99.97	4.51
175	31.26	46.94	0.007	99.98	5.12
181	35.59	52.06	0.005	99.98	5.71
187	40.53	57.77	0.004	99.99	6.14
193	46.14	63.91	0.003	99.99	6.36
199	52.54	70.27	0.002	100.00	6.20
205	59.82	76.47	0.001	100.00	5.66
211	68.11	82.12	0.001	100.00	4.95
217	77.55	87.08	0.0038	100.00	4.36
223	88.30	91.44	0.002	100.00	3.42
229	100.5	94.86	9.6E-5	100.00	2.39
235	114.5	97.25	3.9E-5	100.00	1.43
241	130.3	98.68	1.5E-5	100.00	0.800
247	148.4	99.48	5.5E-6	100.00	0.437
253	169.0	99.92	7.1E-7	100.00	0.077

# MATERIAL SAFETY DATA SHEET

## Section 1: Product/Company Information

**Identity:** Arizona sand including Arizona Test Dust, Arizona Road Dust, Arizona Silica, AC Fine and AC Coarse Test Dusts, SAE Fine and Coarse Test Dusts, J726 Test Dusts, ISO 12103-1, A1 Ultrafine Test Dust, ISO 12103-1, A2 Fine Test Dust, ISO 12103-1, A3 Medium Test Dust and ISO 12103-1, A4 Coarse Test Dust, MIL STD 810F Blowing Dust.

**Mfg. Name:** Powder Technology Inc.  
14331 Ewing Avenue S.  
Burnsville, MN 55306

**Emergency Number:** (952) 894-8737  
**Number for Info:** (952) 894-8737  
**Date Updated:** 3 January 2011

## Section 2: Emergency and First Aid

- Eyes:** Immediately flush eye thoroughly with water. Seek medical attention if irritation persists.
- Skin:** Wash with soap and water. Seek medical attention if irritation persists.
- Inhalation:** Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. Seek medical help if coughing and other symptoms do not subside.
- Ingestion:** Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician if discomfort is experienced.

## Section 3: Composition Information

### Typical chemical composition:

Chemical	CAS Number	Percent of Weight
SiO <sub>2</sub>	14808-60-7	68-76%
Al <sub>2</sub> O <sub>3</sub>	1344-28-1	10-15%
Fe <sub>2</sub> O <sub>3</sub>	1309-37-1	2-5%
Na <sub>2</sub> O	1313-59-3	2-4%
CaO	1305-78-8	2-5%
MgO	1309-48-4	1-2%
TiO <sub>2</sub>	13463-67-7	0.5-1.0%
K <sub>2</sub> O	12136-45-7	2-5%

Loss on Ignition 2 - 5 %

All components of this material are included on the TSCA Inventory.

## **Test Dust Specifications**



#### Section 4: Hazardous Ingredients/Identity Information

This product contains free silica. Inhalation of dust may be harmful to your health. NIOSH has recommended an REL (Recommended Exposure Limit) of 0.05 mg/m<sup>3</sup> as determined by a full shift sample up to 10 hours working day, 40 hours per week.

**H.M.I.S. ratings:** Health – \*                      Flammability – 0                      Reactivity - 0

\* see Section 5 of this MSDS for further information on health effects

#### Section 5: Hazard Identification

**Potential Health Effects:** Potential health effects may vary depending upon the duration and degree of exposure. To reduce or eliminate health hazards associated with this product, use exposure controls or personal protection methods as described in Section 12.

**Eye Contact:** (Acute/Chronic) Exposure to airborne dust may cause immediate or delayed irritation or inflammation of the cornea.

**Inhalation:** (Chronic) Inhalation exposure to free silica may cause delayed lung injury, including silicosis, a disabling and potentially fatal lung disease, and/or cause or aggravate other lung diseases or conditions.

**Carcinogenic Potential:** This product contains free silica, which IARC classifies as a known human carcinogen. The NTP, in its Ninth Annual Report on Carcinogens, classified "silica, crystalline (respirable)" as a known carcinogen.

#### Section 6: Accidental Release Measures

Use clean-up methods that do not disperse dust into the air. Avoid inhalation of dust and contact with eyes. Use exposure control and personal protection methods as described in Section 12.

#### Section 7: Physical/Chemical Data

<b>Boiling Point:</b>	4040 <sup>0</sup> F
<b>Specific Gravity (H<sub>2</sub>O = 1.0):</b>	2.65
<b>Vapor Pressure:</b>	Not applicable
<b>Solubility in Water:</b>	Insoluble
<b>Appearance:</b>	Tan, Brown, Light Brown, Reddish Brown.
<b>Odor:</b>	No Odor
<b>Physical State:</b>	Solid
<b>Vapor Density:</b>	Not applicable

### Section 8: Fire and Explosion Hazard Data

**Flash Point:** None  
**Auto ignition Temperature:** Not combustible  
**Flammable Limits:** N/A  
**Extinguishing Media:** Not Combustible  
**Hazardous Combustion Products:** None

**Lower Explosive Limit:** None  
**Upper Explosive Limit:** None  
**Special Fire Fighting Procedures:** None  
**Unusual Fire and Explosion Hazards:** None

### Section 9: Stability and Reactivity Data

**Stability:** Product is stable  
**Incompatibility (Materials to Avoid):** Strong oxidizing agents and acids  
**Hazardous Decomposition:** Will not occur  
**Hazardous Polymerization:** Will not occur

### Section 10: Handling and Storage

Handle and store in a manner so that airborne dust does not exceed applicable exposure limits. Use adequate ventilation and dust collection. Use exposure control and personal protection methods as described in Section 12.

### Section 11: Toxicological Information

#### **Inhalation:**

##### **-Silicosis**

The major concern is silicosis, caused by the inhalation and retention of respirable crystalline silica dust. Silicosis can exist in several forms, chronic (or ordinary), accelerated, or acute. Chronic or Ordinary Silicosis (often referred to as Simple Silicosis) is the most common form of silicosis, and can occur after many years of exposure to relatively low levels of airborne respirable crystalline silica dust. It is further defined as either simple or complicated silicosis. Simple silicosis is characterized by lung lesions (shown as radiographic opacities) less than 1 centimeter in diameter, primarily in the upper lung zones. Often, simple silicosis is not associated with symptoms, detectable changes in lung function or disability.

Simple silicosis may be progressive and may develop into complicated silicosis or progressive massive fibrosis (PMF). Complicated silicosis or PMF is characterized by lung lesions (shown as radiographic opacities) greater than 1 centimeter in diameter.

Although there may be no symptoms associated with complicated silicosis or PMF, the symptoms, if present, are shortness of breath, wheezing, cough and sputum production. Complicated silicosis or PMF may be associated with decreased lung function and may be disabling.

Advanced complicated silicosis or PMF may lead to death. Advanced complicated silicosis or PMF can result in heart disease secondary to the lung disease (corpumonale). Accelerated Silicosis can occur with exposure to high concentrations of respirable crystalline silica over a relatively short period; the lung lesions can appear within five (5) years of initial exposure. Progression can be rapid. Accelerated silicosis is similar to chronic or ordinary silicosis, except that lung lesions appear earlier and progression is more rapid.

Acute Silicosis can occur with exposures to very high concentrations of respirable crystalline silica over a very short time period, sometimes as short as a few months. The symptoms of acute silicosis include progressive shortness of breath, fever, cough and weight loss. Acute silicosis is fatal.

**Carcinogenic Potential:** IARC - The International Agency for Research on Cancer ("IARC") concluded that there was "*sufficient evidence* in humans for the carcinogenicity of crystalline silica in the forms of quartz or cristobalite from occupational sources", and that there is "*sufficient evidence* in experimental animals for the carcinogenicity of quartz and cristobalite." The overall IARC evaluation was that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans (Group 1)*." The IARC evaluation noted, "Carcinogenicity was not detected in all industrial circumstances studies. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." For further information on the IARC evaluation, see IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 68, and "Silica, Some Silicates..." (1997).

## Section 12: Exposure Control/Personal Protection

**Respiratory Protection:** Use local exhaust or general dilution ventilation to control dust levels below applicable exposure limits. Minimize dispersal of dust into the air. Use appropriate NIOSH approved respiratory protection for respirable crystalline silica. NIOSH recommends the use of half-facepiece particulate respirators with N95 or better filters for airborne exposures to crystalline silica at concentrations less than or equal to 0.5 milligrams per cubic meter of air (mg/m<sup>3</sup>).

**Eye Protection:** Wear safety glasses with side shields or goggles to avoid contact with the eyes. In extremely dusty environments and unpredictable environments, wear tight-fitting unvented or indirectly vented goggles to avoid eye irritation or injury.

## Section 13: Disposal Considerations

All disposal methods must be in accordance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterization and compliance with applicable laws are the responsibility solely of the waste generator.

#### Section 14: Transportation Data

Arizona Test Dust is not hazardous under U.S. DOT or TDG regulations.

#### Section 15: Other Regulatory Information

**Status under US OSHA Hazard**

**Communications Rule 29 CFR 1910.1200:**

Silica sand is considered a hazardous chemical under this regulation and should be included in the employer's hazard communication program.

**Status under CERCLA/Superfund, 40 CFR 117 and 302:**

Not listed

**Hazard Category under SARA (Title III), Sections 311 and 312:**

Silica sand qualifies as a hazardous substance with delayed health effects.

**Status under SARA (Title III), Section 313:**

Not subject to reporting requirements under Section 313

**Status under Canadian Environmental Protection Act:**

Not listed.

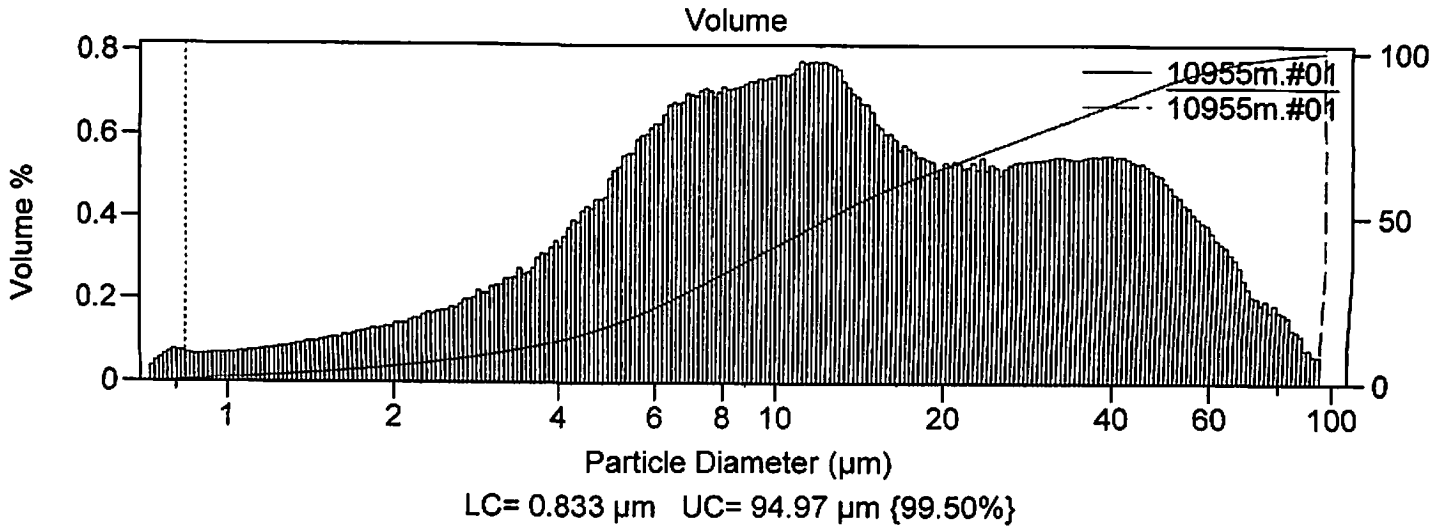
#### Section 16: Other Information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. It is the user's obligation to determine the conditions of safe use of this product.



14331 Ewing Avenue South, Burnsville, Minnesota 55306  
Phone: 952-894-8737

Filename: 10955m.#01 Sample Number: 267  
 Group ID: 10955M  
 Sample ID: ISO 12103-1, A3 MEDIUM TEST DUST  
 Comment: SAE MEDIUM TEST DUST, NIST TRACEABLE  
 Operator: LHA  
 Acquired: 22:44 2 May 2011  
 Edited size data



Volume Statistics (Geometric) 10955m.#01

Calculations from 0.715 µm to 94.97 µm

Volume 987.7e6 µm<sup>3</sup>  
 Mean: 12.49 µm S.D.: 21.9 µm  
 Median: 12.35 µm  
 Mean/Median Ratio: 1.011  
 Mode: 11.08 µm

10955m.#01

Particle Diameter µm	Volume % <	Particle Diameter µm	Volume % <
1	1.14	80	99.02
2	4.69	120	100.00
3	8.41		
4	12.55		
5	17.34		
7	28.16		
10	41.55		
20	65.73		
40	85.21		

10955m.#01

Channel Number	Particle Diameter µm	Diff Number %	Diff Volume %	Cum < Number %	Cum < Volume %
9	0.833	15.54	0.398	28.47	0.500
15	0.935	11.49	0.416	44.01	0.898
21	1.048	8.80	0.450	55.49	1.31
27	1.175	6.95	0.501	64.29	1.76
33	1.318	5.56	0.566	71.24	2.26
39	1.478	4.45	0.638	76.80	2.83
45	1.657	3.57	0.723	81.25	3.47
51	1.859	2.83	0.808	84.82	4.19
57	2.084	2.30	0.925	87.66	5.00
63	2.337	1.83	1.04	89.95	5.92
69	2.621	1.52	1.22	91.78	6.96
75	2.939	1.25	1.41	93.31	8.18
81	3.296	1.02	1.63	94.56	9.60
87	3.696	0.875	1.96	95.58	11.22
93	4.145	0.763	2.41	96.45	13.19
99	4.648	0.640	2.87	97.21	15.60
105	5.212	0.549	3.45	97.85	18.47
111	5.845	0.437	3.88	98.40	21.92
117	6.555	0.333	4.15	98.84	25.80
123	7.350	0.241	4.24	99.17	29.95
129	8.243	0.174	4.33	99.41	34.19
135	9.243	0.127	4.43	99.59	38.51
141	10.37	0.093	4.58	99.71	42.95
147	11.62	0.067	4.62	99.81	47.53
153	13.03	0.043	4.19	99.87	52.15
159	14.62	0.027	3.70	99.92	56.34
165	16.39	0.017	3.37	99.94	60.05
171	18.38	0.011	3.16	99.96	63.41
177	20.61	0.008	3.16	99.97	66.57
183	23.12	0.006	3.14	99.98	69.73
189	25.92	0.004	3.21	99.99	72.87
195	29.07	0.003	3.27	99.99	76.08
201	32.60	0.002	3.27	99.99	79.35
207	36.55	0.002	3.30	100.00	82.62
213	40.99	0.001	3.22	100.00	85.91
219	45.97	0.001	2.94	100.00	89.13
225	51.55	0.0041	2.50	100.00	92.07
231	57.81	0.0024	2.07	100.00	94.57
237	64.82	0.0012	1.46	100.00	96.64
243	72.69	6.4E-5	1.08	100.00	98.10
249	81.52	2.9E-5	0.686	100.00	99.18
255	91.41	2.2E-6	0.065	100.00	99.87