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S&B Filters
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Subject: Letter Report, Test Results, Southwest Research Institute® (SwRI®)
Project No. 08.17765.05.001, “Water Spray Removal Testing of 75-5040 Intake
with AS-1005 Scoop”

Reference: S&B Filters P.O. No. P3613

Dear Mr. Van Gompel:

This report presents results of water spray removal testing conducted on a 75-5040 Intake (with red filtering media) with AS-1005 Scoop configuration provided by S&B Filters for evaluation. Testing was conducted in accordance with SAE J2554, Engine Intake Air Water Separation Test Procedure, APR2003. Water spray removal testing was accomplished at 435 scfm, as specified. Proper droplet size and flow delivery were achieved by nozzle selection and pressure control. The spray nozzle was sized to provide a spray with a median volume diameter (MVD) of 1000 microns, based on nozzle performance specifications. The MVD is a value where 50% of the total volume (or mass) of liquid sprayed is made up of drops with diameters larger than the median value and 50% smaller than the median value. The MVD and the actual droplet size distribution (DSD) were not measured. For the specified airflow rate, SAE J2554 called for a water feed rate of 500 ml/min. This testing was accomplished, using the same general experimental arrangement and test protocol as used in previous scoop testing where the fender vent remained open and the water spray was aimed horizontally under the scoop, as illustrated in the S&B schematic shown in Figure 1. The general test arrangement is shown in Figure 2.

Test results are given in Tables 1 and Figure 3 and 4. Table 1 gives quantitative results in term of pre-test airflow resistance at rated flow, and water spray collection and penetration. Figure 3 shows pre-test airflow resistance as a function of flow rate, and Figure 4 shows general



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photographs taken during and after testing. While SAE J2554 is primarily intended to measure separation efficiency, it is apparent in this case that the parameter of most importance is water penetration to the upper filter unit and beyond. In particular, the target for allowable penetration is zero, since the filter should remain dry during vehicle operation in all weather and road conditions. No water penetrated the unit and only a trace of water (by weight, none visible) was retained by the filter. When the airflow was turned off, a very small amount of water remained on the inner walls of the scoop.

Table 1. Water Spray Penetration and Collection: S&B 75-5040 Intake (with red filtering media) with AS-1005 Scoop, with Fender Vent Open; 1000 µm Mean Volume Diameter (MVD) Spray (Single, Spray Systems Co. 1/8 G-1, 0.031" Dia., Full Jet Nozzle at 24 psi,); Water Spray Presented Laterally under Scoop; Unit Airflow: 435 scfm.

Configuration	Test Airflow Rate, scfm*	Pre-test Restriction, "of water	Water Penetrating Unit, % (a)	Water Penetrating Scoop Section, % (b)	Water Retained by Upper Unit/ and by Filter and Outlet Tube, % (c)	Water Retained by Filter/ Outlet Tube, % (c)	Water Collected on Scoop walls, % (d)
Fender vent open	435	5.46	0.0	0.05	0.05/0.05	0.05/0.00	0.50

Tests conducted: Jan 2013

*cfm At 20°C and 101.3 kPa

$$a. \text{ Water penetration} = \left[\frac{\text{wt. of water collected downstream of unit}}{\text{total wt. of water provided to scoop}} \right] \times 100$$

$$b. \text{ Water penetration} = \left[\frac{\text{wt. of water collected downstream of scoop section}}{\text{total wt. of water provided to scoop}} \right] \times 100$$

$$c. \text{ Water retained} = \left[\frac{\text{wt. of water collected in upper unit/and by the filter and outlet tube}}{\text{total wt. of water provided to scoop}} \right] \times 100$$

$$d. \text{ Water retained} = \left[\frac{\text{wt. of water collected on scoop walls}}{\text{total wt. of water provided to scoop}} \right] \times 100$$

It is important to understand the above terminology. Water penetrating the scoop section is the amount of water presented to the upper filtration section, as a percent of the total water collected during the test. Water retained by the upper unit is the amount of water retained in the filtration section (filter and filter housing area) as a percent of the total amount of water collected during the test run. The amount of water collected by the filter is also based on the total amount of water collected during the test run. The total amount of water collected includes water collected in the downstream catch basins. It is also important to note that all testing was conducted under suction only, and with the vent open, only a portion of the air enters the unit through the scoop. It is most likely that a better simulation would include ram air below the inlet in addition to the spray stream. This is doable, but would add some complexity to the test setup and testing protocol.

- Intake kit (75-5040) to be tested with Scoops (AS-1005) by directing the spray across the flat portion of the scoop.
- Both test are to be run at 435cfm
- The side opening of the air box is to be remained open for both tests.

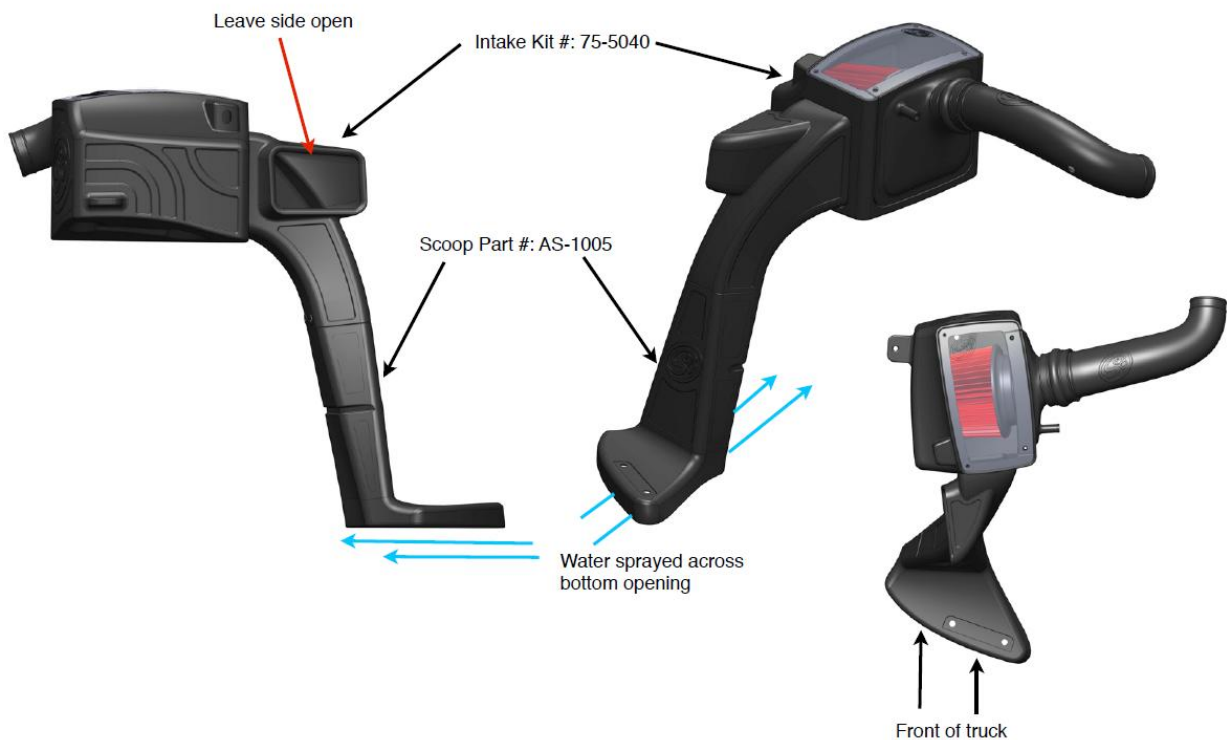


Figure 1. S&B Schematic for Water Testing of 75-5040 Intake with AS-1005 Scoop

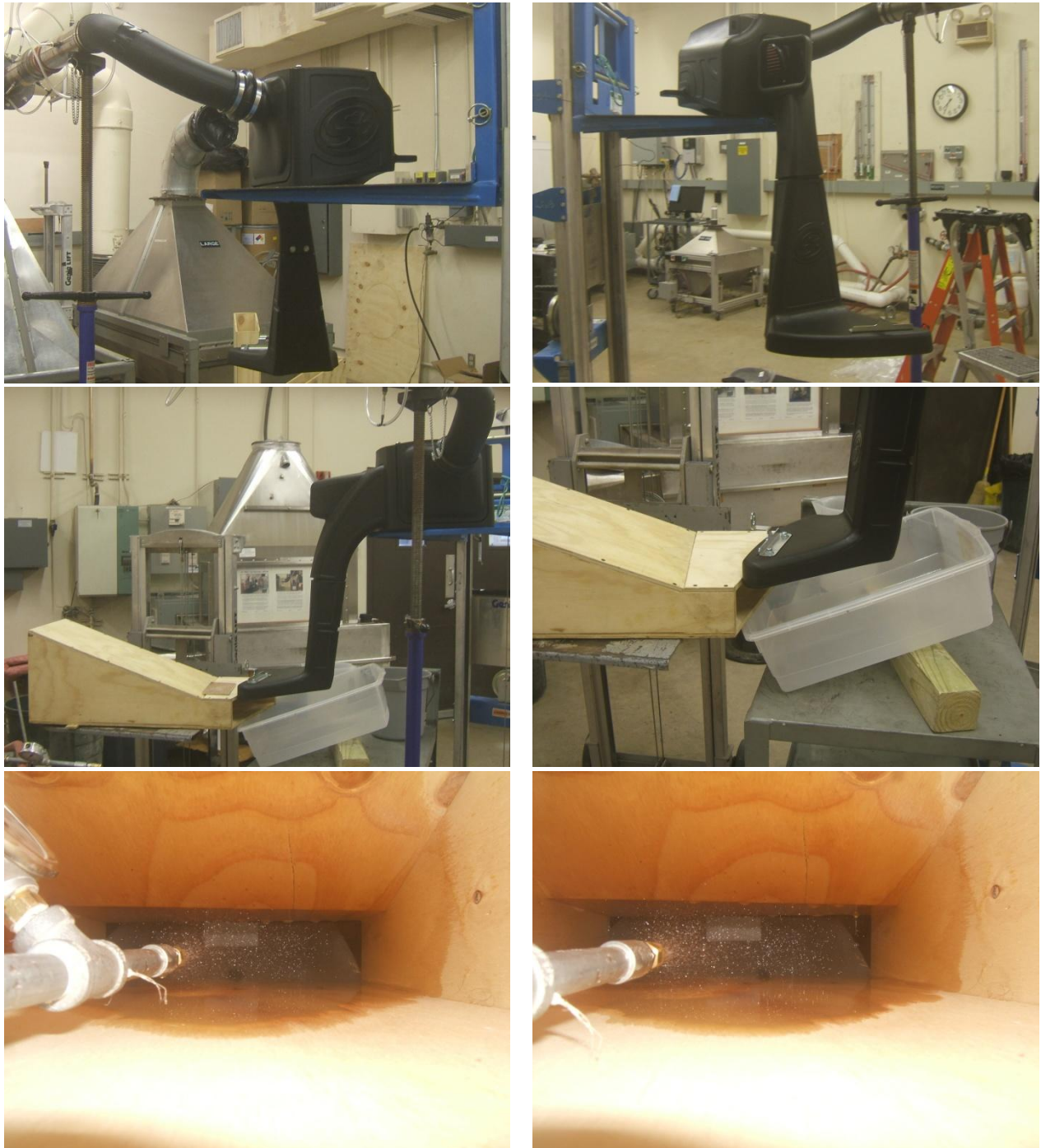


Figure 2. General Test Arrangement for 75-5040 Intake (with red filtering media) with AS-1005 Scoop (top row: airflow testing; other rows: water spray testing)

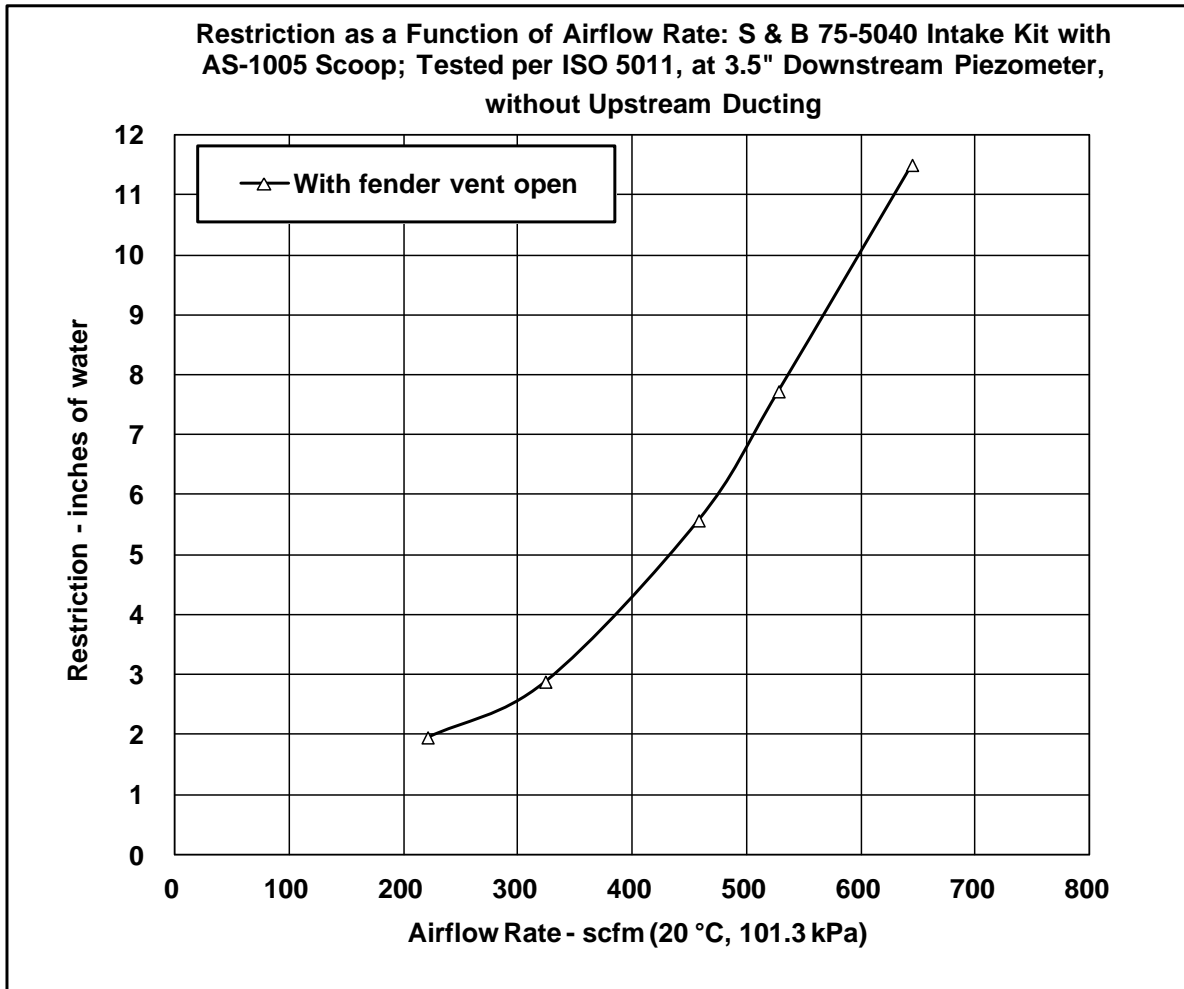


Figure 3



Figure 4. Some General Photographs during and after Testing of 75-5040 Intake (with red filtering media) with AS-1005 Scoop

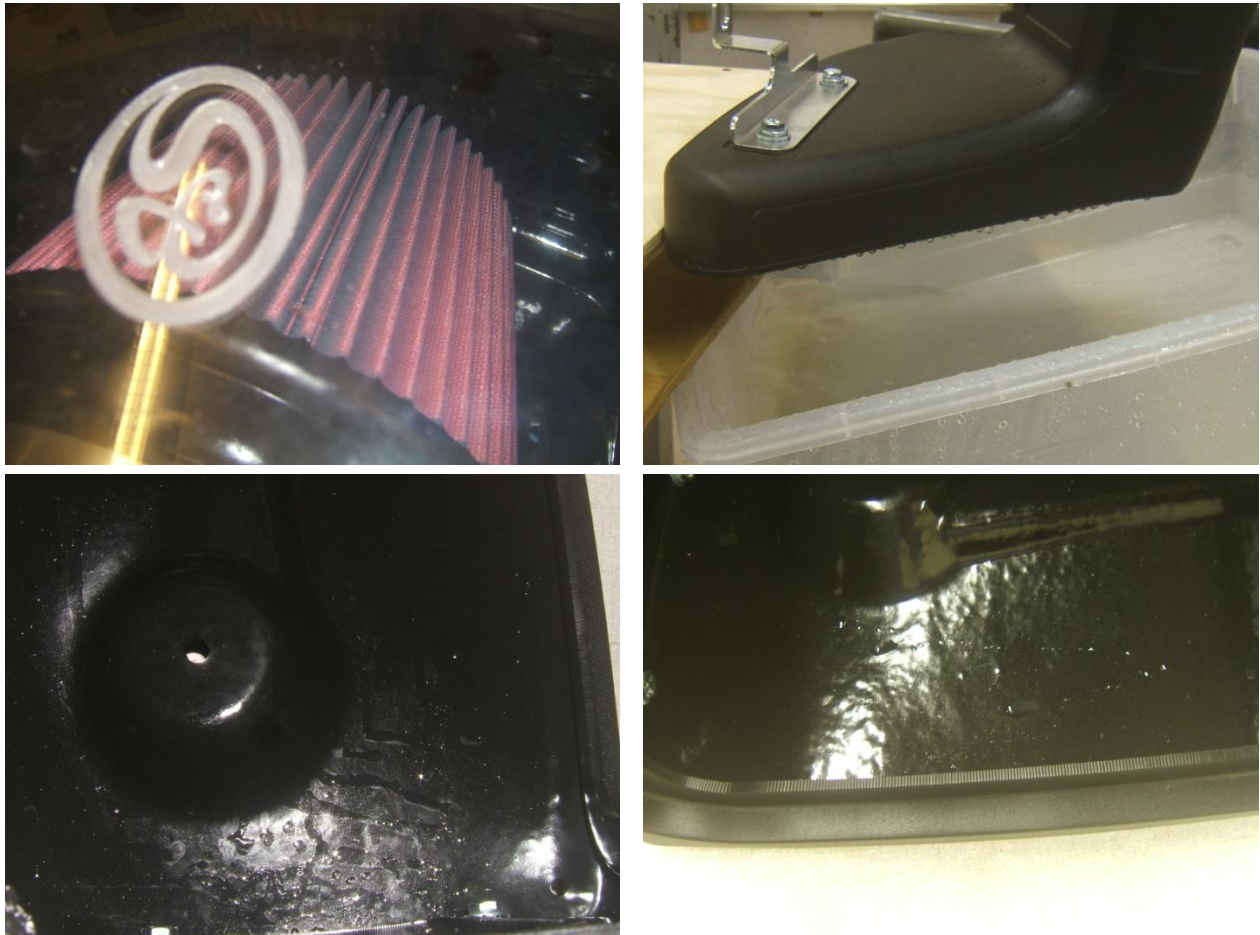


Figure 4. Some General Photographs during and after Testing of 75-5040 Intake (with red filtering media) with AS-1005 Scoop (Continued)

If you have any questions concerning the test program or the results, please do not hesitate to contact me at (210) 522-2626 during normal business hours. For your convenience, our facsimile number is (210) 522-5720 and my e-mail address is mtreuhaft@swri.org.

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