Program for Advanced Vehicle Evaluation

PAVE

at AUBURN UNIVERSITY

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Report on

SAE J1321 (TMC RP-1102) Type II Fuel Consumption Test

Conducted for

SPP
236 Rowan St.
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ABSTRACT

The Program for Advanced Vehicle Evaluation (PAVE) was established at Auburn University as a complementary research program at the National Center for Asphalt Technology's (NCAT) Pavement Test Track (www.pavetrack.com). In order to damage experimental pavements on the 1.7-mile test oval, it is necessary to run a fleet of heavy trucks over ¾ million miles a year. Trucking operations at the Track provide a unique opportunity to study issues that are important to the trucking industry in a highly controlled and cost effective manner. The purpose of the series of tests described herein was to determine the impact of the I-PHI (Partial Hydrogen Injection) product on fuel economy when used in the 14L diesel engine of class 8 tractors.

In these comparisons, two treatment tractors (each with a different test hardware setting) and one control tractor were used in two separate mileage based evaluations. The test plan for the two evaluations each included a baseline segment and two different test segments. Treatment data was collected after approximately 8000 conditioning miles, then again after approximately 23,000 conditioning miles.

The "Type II Test Procedure" published by both the Technology and Maintenance Council (TMC) and the Society for Automotive Engineers (SAE) was used to perform these evaluations (RP-1102 and J1321, respectively). The longer 40-mile minimum run distance required in the SAE version was used in order to be in strict conformance with both test procedures. All test runs were executed on the NCAT Pavement Test Track in Opelika, Alabama between June 15th and August 11th in 2010. The gross combined weight (GCW) of the tractor-trailers used for the evaluations was approximately 155,000 pounds. All three trucks (one control vehicle and two treatment vehicles) were run at a target speed of between 45 and 48 mph with the tractors in direct gear (1:1 ratio) and with a demand wheel horsepower of 200 to 350 horsepower.

During testing, fuel consumption was measured in 17-gallon portable weigh tanks. The calibration of the weigh scale was checked before and after each stage of testing. The measured specific gravity of the #2 diesel fuel used for testing was 0.840 at 60°F. The same drivers remained with the control vehicle and both test vehicles for the duration of testing. The cooling system fans on all three trucks were locked in the on position during all phases of testing to eliminate the fan as a possible confounding variable.

No vehicle or operational issues were encountered during any phase of testing. The wind was calm with a maximum gust of 12 mph. Ambient air temperature conditions ranged from 80° to 95° F. Wheel hub temperatures were monitored throughout testing. The valid treatment-to-control (T/C) ratios for fuel usage for all runs in both the baseline and treatment segments ranged from 0.5% to 1.7%, with the typical ratio spread being less than 1%. This is well inside the 2% filter, which is indicative of a highly controlled test. The following results were observed in the four evaluations:

Test #	Hardware Setting	Tractor #	Mileage	% Improvement
10-8	A	1	8071	+ 0.6
10-8	A	1	22,915	+ 4.4
10-7	B	3	8554	- 0.2
10-7	B	3	24,053	+ 3.2

With the accumulation of extended miles, it was necessary to change 26 tires on the control vehicle, 22 tires on treatment tractor #1, and 15 tires on treatment tractor #3. Other repaired components during the extended mileage accumulation included the replacement of seals on an air tank, charging one air conditioner, rebuilding one air compressor, and replacing sensors on the I-PHI hardware. These types of repairs were expected at the outset of this evaluation and are considered not to have a major impact on the results.

The two tractors equipped with the I-PHI product showed no improvement in fuel economy after the initial 8000-mile evaluation, but did show an improvement of + 3.2% and + 4.4% (depending on the hardware setting of the test device) after the second evaluation at approximately 23,000 miles.