

**THE EFFECT OF FuelSpec® 114-05 COMBUSTION CATALYST
ON THE FUEL CONSUMPTION OF
A TRACTOR-TRAILOR COMBINATION VEHICLE**

Conducted By:

CLAUDE TRAVIS AND ASSOCIATES, LLC.

Fleet Consultants

Report prepared by:

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Date:

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Type of Report:

Final Report

Prepared for:

Armour & Aberdeen, LLC
910 Fairgate Drive
Houston, Texas 77094

Section 1.0 - INTRODUCTION

The fuel economy test described herein was performed by Claude Travis and Associates, LLC, Fleet Consultants, 2550 Holtman Drive NE, Grand Rapids, Michigan 49525.

Section 2.0 - OBJECTIVE

The objective of this test was to measure the difference in fuel consumption when FuelSpec[®] 114-05 (distributed by Armour & Aberdeen, LLC of Houston, Texas) is added to the diesel fuel and used in the operation of the engine of a Class VIII tractor-trailer combination vehicle.

Section 3.0 - APPROACH

The fuel economy procedure performed was the TMC/SAE Fuel Consumption Test Procedure Type II, SAE J-1321. The test data was obtained using the gravimetric fuel tank weigh method.

Section 4.0 - TEST PROCEDURE

The test procedure is found in SAE J-1321. No modifications were required.

- 4.1 Both vehicles operated with lights on and windshield wipers off.
- 4.2 All windows closed.
- 4.3 Tractors were the same make and model. Both trailers were 53' long, 13'6" high and 102" wide on tandem axles and radial tires.
- 4.4 Portable fuel tanks were positioned identically on both tractors, above the frame rails and behind the cab.
- 4.5 Cab heater fan and air conditioner motor switches, in both trucks, were in the OFF position.
- 4.6 Engine cooling fan hub was blocked in the RUN position on the Control Truck and the Test Truck.
- 4.7 Gross vehicle weight difference between the vehicles was 960 lbs., including the drivers.

Section 5.0 - TEST COURSE

The highway utilized for conducting the test was a 59.6 mile section of US 131, north of Grand Rapids, Michigan. A southbound side rest area was the start and stop point. Weighing portable tanks and refueling was also done at this point. The highway follows a general course north and south and consists of rolling grades that do not require gear changes. The southern turn around was at mile post 131 and consisted of an off ramp and stop sign, overpass and an on ramp. The northern turn around was at mile post 159 and consisted of an off ramp, stop sign, overpass and an on ramp. Any traffic delays at stop signs were timed in seconds, with engines at idle and subtracted from a scheduled 60 second idle period at the end of each test run. The rest of the area where the start/stop point was located was at mile post 137, near Big Rapids, Michigan.

Section 6.0 - TEST VEHICLES

6.1 Specifications- The control tractor, Ryder Truck Rental 477801, was a 3 axle Volvo sleeper cab, built in 2012 and registered 28,707 miles when received. This tractor was attached to a 53' Ryder van trailer and was powered by a Cummins 450 hp engine through a Fuller/Eaton 10 speed overdrive transmission and a Rockwell 3.55 ratio differential. The trailer, owned by Ryder Truck Rental was ballasted with palletized brick to 67,160 GVW. The test tractor, Ryder 477506, was a 3 axle Volvo sleeper cab powered by a Cummins 450 hp diesel engine through a Fuller/Eaton 10 speed overdrive transmission and a Rockwall Tandem 3.55 ratio differential and registered 71,404 miles when received. This tractor was coupled to a 53' tandem axle trailer owned by Ryder, and ballasted with palletized brick to 66,200 lbs. GVW. Both vehicles were equipped with 8.25 x 22.5 rims and 295/75R22.5 tires inflated to 100 lbs.

6.2 Maintenance- The test vehicles were inspected and records were reviewed. It was determined that incremental preventive maintenance services had been performed as scheduled and the work had been executed properly. The trucks were road tested. All systems performed as intended and approximately equal power was delivered to the drive wheels of each truck. Axle alignment was checked and found to be correct. Brake adjustment was legal and without shoe to drum contact (drag).

6.3 Preparation- After maintenance, the vehicles were ballasted with palletized brick (see Section 6.1 for vehicle test weights). The Control and Test Trucks were prepared for the installation of the portable fuel tanks by the application of additional fuel lines as required. When complete, the engines received fuel from and returned fuel to the portable tanks only. The portable tanks were connected by quick disconnect fittings with positive shutoffs. Tires were gauge checked for pressure maintenance. Radiator fan drivers which normally operate by temperature demand, were altered to operate 100% of engine-on time. Air conditioner defroster and heater motor switches were put in OFF position and not used.

7.0- TEST FUEL

Fuel was purchased at Ryder Truck Rental in Grand Rapids. Care was taken to insure that the test was started and completed using the same fuel. Diesel No. 2 was used throughout the series and was stored in drums on a support vehicle. A sample of fuel will be retained and available for analysis for 120 days, on request.

8.0- FUEL SAVING DEVICE

The product tested is the combustion catalyst FuelSpec[®] 114-05 distributed by Armour & Aberdeen, LLC of Houston, Texas. Phone Number (832) 321-5555. The catalyst is a liquid and blended to the fuel like any fuel additive. The dosage

rate for this product equals 1 fluid ounce of FuelSpec® 114-05 for each 30 gallons of diesel.

9.0- INSTRUMENTATION

9.1 Gravimetric Fuel Tanks- Gravimetric fuel tanks with a sixteen gallon capacity were used for measuring fuel consumption. Two tanks were assigned to each vehicle to avoid delay in tank change-over. Prior to test start-up each tank was purged, filled with test fuel and weighed. The tanks were installed above the frame rails and behind the cab. Fuel line connections were made with quick-disconnections for convenience of installation and removal and to avoid spillage.

9.2 Weigh Scale- A champ Digital Bench Scale Model No.300 calibrated to a maximum resolution of 1:20000 was used for weighing the gravimetric tanks before and after each test run. Weights were recorded in pounds to 2 decimal places. The scale was checked frequently with calibrated weight to assure accuracy and zeroed before each weighing. The scale was positioned inside a utility van trailer. The trailer doors were closed when necessary to prevent the wind from affecting the scale accuracy.

10.0 - TEST RESULTS

SAE J-1321 / ATA-TMC TYPE II

Test Cycle:	Long Haul
Test Speed:	62 mph
Percent of Fuel Saved*	6.92%
Percent Improvement**	7.44%

**Percent of Fuel Saved equals the actual quantity of fuel saved*

***Percent Improvement equals the distance (mileage) delta to the Baseline results*

10.1 Data Reduction- The fuel consumption percentage of fuel savings and percentage improvement are derived by following the calculation methods outlined in Joint TMC/SAE Fuel Consumption Test Procedures Type II, SAE J1321. Properly conducted tests using portable tank weigh methods are considered, based on test experience using long-haul test routes , to have an overall accuracy within +/-1% (for example, 6% measured difference can be from 5-7% actual difference). See SAE J-1321 Appendix I.

11.0- SUMMARY

On Wednesday, October 24, 2012 and Thursday, October 25, two Ryder rental tractor-trailer combination vehicles were inspected and prepared for use during the tests. The vehicles were checked for proper alignment and all brakes were found to be legal and with out shoe to drum drag. The trailers were loaded with palletized brick and doors were locked to ensure weight accuracy throughout the test. The tractors were fitted with fuel lines that would accommodated 16 gallon fuel tanks mounted between the frame rails and behind the cab.

On Friday, October 26, a 65 mile warm-up run was made and the 2 vehicles were fitted with weighed 16 gallon fuel tanks an dispatched 35 seconds apart on baseline segment run #1. Each run is 59.6 miles in length. Switching weighed tanks between runs takes 5 and 6 minutes per truck. Trucks were immediately dispatched on runs 2 and 3, within 12 minutes of arrival. Runs 1, 2 and 3 fit within the fuel consumption (2%) and time (1/2%) constraints of the test procedure.

After the baseline segment was completed, FuelSpec[®] 114-05 was added to the Test Truck. The Control Truck was parked and not used. No changes were made to the Control Truck. The Test Truck was operated over public highways for one hundred (100) hours. On Saturday, November 3, 2012 the Test Truck and Control Truck made test segment runs 1,2 and 3 and all fit within the fuel

consumption and time constraints of the procedure and resulted in a 6.92% fuel savings and 7.44% improvement in fuel consumption.

12.0 – CONCLUSION

A fuel savings of 6.92% and a mileage improvement of 7.44% were demonstrated when FuelSpec® 114-05 was applied to the Test Truck. The fuel consumption results indicate a statistically significant fuel economy improvement.

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TEST FOR: Armour & Aberdeen, LLC **Location:** Big Rapids, MI
TEST TYPE: Two Truck; On-Highway Fuel Economy **Date:** 10/24/2012

	CONTROL			TEST # 1			TEST # 2			Time T/C	Temp (Fahrenheit)	Wind Direction	Wind Speed	Time	Condition	
	Tank	Weight	Run Time	Tank	Weight	Run Time	Tank	Weight	Run Time							
1	1 Blue	158.94 90.46 68.48	1:01.40 3700	1 Green	155.68 87.72 67.96	1:01.36 3696				0.998	58	WSW	0 - 5	10:01AM	Cloudy	
2	2 Blue	161.22 93.58 67.64	1:01.30 3690	2 Green	157.56 89.96 67.60	1:01.37 3697				1.001	60	WSW	0 - 5	11:15AM	Cloudy	
3	1 Blue	154.98 86.46 68.52	1:01.42 3702	1 Green	153.92 87.57 66.35	1:01.44 3704				1.000	61	WSW	0 - 5	12:30PM	Partly Cloudy	
										Average:						0.999

Test Supervisor:
Claud Travis

Drivers:
Lynn Browner - Test
Charles Young - Control

Site Crew:
Scott Travis
Rick Hudson
Ken Vermeer

Test Segment:
BASELINE SEGMENT

CALCULATIONS	NOTES
Baseline T/C Ratio = .996	#477506 Test Truck Start miles = 71,604 #472801 Test Truck Start miles = 28,707 Speed: 62 MPG Test Product: Combustion Catalyst / Fuel Additive Armour & Aberdeen, LLC FuelSpec 114-05

CLAUDE TRAVIS AND ASSOCIATES FLEET CONSULTANTS

TEST FOR: Armour & Aberdeen, LLC
TEST TYPE: Two Truck; On-Highway Fuel Economy

Location: Big Rapids, MI
Date: 11/3/2012

	CONTROL			TEST #1			TEST #2			Weight T/C	Time T/C	Temp (Fahrenheit)	Wind Direction	Wind Speed	Time	Condition
	Tank	Weight	Run Time	Tank	Weight	Run Time	Tank	Weight	Run Time							
1	1 Blue	163.22 95.12 68.10	61.32 3692	1 Green	168.18 105.04 63.14	61.22 3682				0.927	0.997	37	NNW	6 - 7	10:15AM	Overcast
2	2 Blue	157.46 88.72 68.74	61.26 3686	2 Green	157.44 93.76 63.68	61.28 3688				0.926	1.000	38	N	8 - 9	11:40AM	Overcast
3	1 Blue	156.46 87.32 69.14	61.34 3694	1 Green	157.58 93.32 64.26	61.32 3692				0.929	0.999	38	NINE	5	12:42PM	Overcast
										Average:	0.927	0.998				

Test Supervisor:
 Claud Travis

Drivers:
 Lynn Browner - Test
 Charles Young - Control

Site Crew:
 Scott Travis
 Rick Hudson
 Ken Vermeer

Test Segment:
 TEST SEGMENT

CALCULATIONS

$(B - T)/T * 100 = \text{Improvement in Driving Distance}$
 $(.996 - .927)/.927 * 100 = 7.44 \%$

$(B - T)/B * 100 = \text{Quantity of Fuel Saved}$
 $(.996 - .927)/.996 * 100 = 6.92\%$

where:
 B = Baseline Segment Average T/C
 T = Test Segment Average T/C

FuelSpec 114-05
 Test Segment Ratio - .927

NOTES

Test truck ran for a 100- hour conditioning period after Baseline Segment

Tractors: Volvo 450 HP Cummins
 3.55 MT40IISX @ 2100 RPM

Trailers: 53' tandem axle vans
 477506 Test 71,604 start miles
 472801 Control 28,707 Start miles

Weight: Test: 66,200 lbs.
 Control: 67,160 lbs.

59.8 miles each data point

TABLE I
Graphical Representation of Test Results

The following bar chart simply displays the improvement in fuel economy from the Baseline Segment (when the catalyst was not used) to the Test Segment (when the catalyst was used) for each test run. The test results are consistent and uniform.

