Dyno Program

Don Bowles
Gary Blanchard

Project Evaluator
Dr. William E. Noonan

Scope

- This test is to determine the measurable increase in wheel horsepower and torque, while reducing fuel consumption and lowering temperatures when Schaeffer's products replaces conventional lubricants in the same OTR truck.

Scope

- The test will be conducted by using a chassis dynamometer to eliminate idle time, wind and load differences.
- The same truck, fuel, dyno and operator will be used for initial and final tests.

Scope

Provide Project Evaluator to assist in test methodology and calculate test results from performance data provided by dynamometer.

Dr. William E. Noonan

Dr. William E. Noonan

- Education
  - Doctorate of Science- Mechanical Engineering, Washington University 1973
  - M.S. Mechanical Engineering SLU 1967
  - B.S. Aeronautical Engineering SLU 1957
- Experience
  - 42 years McDonnell Douglas and Boeing
  - Vibration and acoustics engineer
  - Gemini, Mercury, Apache, Harrier, F-15 and F-18 projects

Dyno Program Parameters

- Minimum of 400,000 miles on engine
- Use Taylor Dynamometer (Caterpillar)
- Uses other than Schaeffer's products
- Engine never used a Fuel additive
- Willing to do initial/second dyno runs

Test Criteria

- Same vehicle must be used w/o repairs modifications or upgrades
- Same dyno and operator will be used for all runs
- Same tire pressure maintained
- Same fuel batch in dyno fuel cell
- Air inlet removed to eliminate dirty filters
- Cooling fan blocked in (constant run)
- Air system charged so compressor did not run
- All temperatures shot in same location on transmission and differentials

Schaeffer's Responsibilities

- Provide all lubricants and fuel additives
- Pay for all fuel used
- Responsible for all dyno costs
- Provide test monitor (Don Bowles)
- Provide independent Project Evaluator (Dr. William E. Noonan)
- Provide published results of tests

Dyno Project

- RCT Trucking, Bradley, MI unit # 1145
- C-15 Caterpillar (15.2L) 475hp @ 1850 rpm
- Tested at Michigan Caterpillar (Grand Rapids)

Dyno Project

Dyno Project

Dyno Project

Dyno Project - Air

Dyno Project - Fuel

Dyno Project Fuel

- Test fuel used
- #2 Diesel
- Local purchase
- 32.3 specific gravity

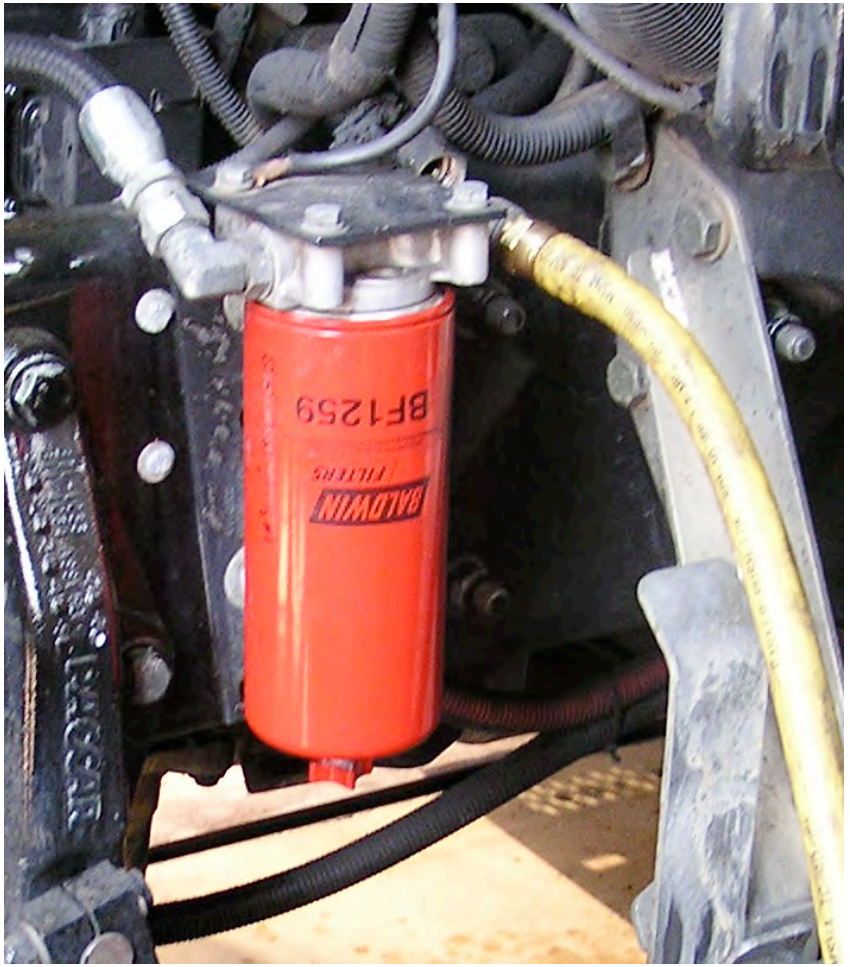
Dyno Project - Fuel

Fuel Cell Capacity
13.5 gallons

Note: Fuel supply and return lines at bottom of fuel cell

Dyno Project - Fuel

Now engine operates from dyno fuel cell



Dyno Project - Lubes

- Initial test November 3, 2008
- Mileage 693,700
- Lubes used:

• Engine	Citgo	C-500 15W40
• Trans	Cognis	(PAO) 75W90
• Diffs	Cognis	(PAO) 75W140

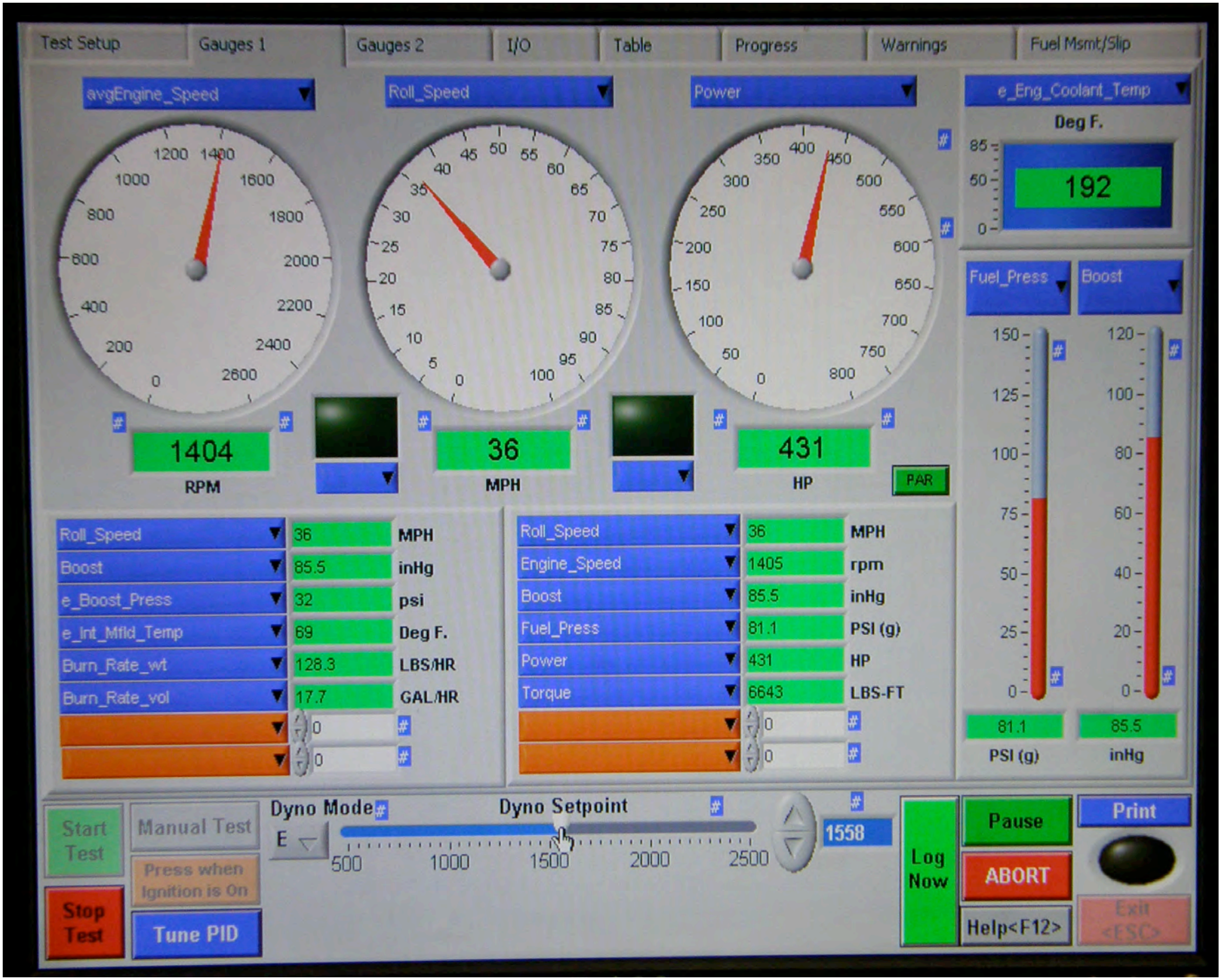
- No fuel additive used

Run 1 Averages

RPM	W/ HP	C/Torq	F/gal	F/wt
1400	423.3	6527	23.12	168.02
1600	408	5456	24.19	175.87
1800	383.8	4525	25.78	187.44
1400/	223.8	3358	14.14	99.82

- 225hp
- Transmission temperature 180.5
- Differential temperatures 139.0

Dyno Project


Test Setup
Gauges 1
Gauges 2
I/O
Table
Progress
Warnings
Fuel Msmt/Slip
avgEngine_Speed
Roll_Speed
Power
e_Eng_Coolant_Temp
Deg F.
192
1404
RPM
36
MPH
431
HP
PAR
Fuel_Press
Boost
81.1
PSI (g)
85.5
inHg
Roll_Speed 36 MPH
Boost 85.5 inHg
e_Boost_Press 32 psi
e_Int_Mfld_Temp 69 Deg F.
Burn_Rate_wt 128.3 LBS/HR
Burn_Rate_vol 17.7 GAL/HR
Roll_Speed 36 MPH
Engine_Speed 1405 rpm
Boost 85.5 inHg
Fuel_Press 81.1 PSI (g)
Power 431 HP
Torque 6643 LBS-FT
Start Test
Manual Test
Press when Ignition is On
Stop Test
Tune PID
Dyno Mode
E
Dyno Setpoint
500
1000
1500
2000
2500
1558
Log Now
Pause
ABORT
Help<F12>
Print
Exit <ESC>

Dyno Project - Lubes

- Final test December 8, 2008
- Mileage 720,843
- Lubes Changed to Schaeffer's Products:

- Engine 9000 5W40
- Trans 239S 50W
- Diffs 268 (ISO 320)

- Fuel additive Diesel Treat 2000 ULSW

Schaeffer's Products

- We ran this truck 27,143 miles on these products.
- Truck received one (1) additional engine oil change.

Product Changes

Product Changes

Run 2 Averages

RPM	W/HP	C/Torq	F/gal	F/wt
1400	429	6629	21.62	156.88
1600	414	5547	22.97	166.70
1800	393.6	4647	24.35	176.80
1400/ 225hp	225.6	3369	13.56	98.52

- Transmission temp. 153.5 (-16.6%)
- Differential temps. 123.5 (-11.2%)

Comparisons

	1st run averages				2nd run averages			
RPM	HP	Torq	F/v	F/wt	HP	Torq	F/v	F/wt
1400	423.3	6527	23.12	168.02	429	6629	21.62	156.88
1600	408	5456	24.19	175.87	414	5547	22.97	166.70
1800	383.8	4525	25.78	187.44	393.6	4647	24.35	176.80
1400/ 225hp	223.8	3358	14.14	99.82	225.6	3369	13.56	98.52

- Gearing temperature reduction (trans and differentials)

11/3/2008		12/8/2008	
Trans	differentials	trans	differentials
180.5	139	153.5	123.5

percent temp reduction = 16.6% 11.2%

Conclusion

- Excerpts from Dr. Noonan's letter;
  - The overall average of fuel burn reduction by weight when Schaeffer's products were used was 7.23% while the increase in horsepower was 1.89%. This additional horsepower gain when factored into the fuel savings raises the total fuel savings to 8.97%.
  - The addition of Schaeffer's products provides a significant savings in fuel costs.

Savings

8.97%

Savings

- This vehicles travels 1100 miles per day (2 drivers)
- Average fuel economy is 4.8 mpg
- Truck uses 229.2 gallons of diesel fuel per day
- A fuel savings of 8.97% equals 20.56 gallons per day

		(daily)	(annual)
Fuel cost of	$ 2.50 =	$ 51.40	($ 13,364)
	3.00 =	$ 61.68	($ 16,037)
	3.50 =	$ 71.96	($ 18,710)
	4.00 =	$ 82.24	($ 21,382)

- Annual savings is based on 5 day per week operation but does not show fuel additive cost.

Results of Dynamometer Tests
Schaeffer Oil Company

Introduction

Tests were conducted on a Peterbilt Truck with a C-15 Caterpillar Engine with 693,200 miles on engine, transmission and differentials. This truck was using and had always used lubrication products other than Schaeffer's and had never used a diesel fuel additive. The purpose of these tests were to evaluate the effects of engine oil, transmission oil, differential and fuel additives formulated by and supplied by Schaeffer Manufacturing Company of St. Louis, Mo on fuel burn rate (Lbs/Hr), wheel horsepower output and any reductions in transmission and differential temperature reductions. The initial test was performed on 3 November 2008 prior to any change and the final test was performed on 8 December after all lubricants were changed to Schaeffer's including their fuel additive. Both tests were run on same fuel which was previously purchased, the same dynamometer and operator to maintain consistency.

Setup and Tests

Tests were conducted using the Taylor Dynamometer, model CM51 FR-60 at Michigan Caterpillar's Grand Rapids facility. The truck was restrained within the dynamometer, the fuel cell was filled with the locally purchased #2 diesel test fuel, air inlet piping was removed to eliminate any air restriction and tire pressures were checked to eliminate any drag. After the vehicle was run to bring operating temperatures to a stabilized condition the following parameters were measured (rpm, roll speed, wheel horsepower, torque, boost pressure and fuel burn rate measured by volume (Gal/Hr) and weight (Lbs/Hr). The tests were run at 1400, 1600 and 1800 rpm at maximum load and at 1400 rpm at a 225 wheel horsepower sustained load. A minimum of five data points were measured at each rpm/load condition.

Additionally transmission and differential temperatures were checked for temperature reductions

Test Results

The tabulated data was scanned and digitized for analysis. A cursory check of horsepower, torque and roll speed appears to be consistent with the size tires used on over-the-road trucks and this check was used to establish confidence in the validity of the test data. The test data was averaged for each of the data samples at each rpm. The effects of fuel additives and lubricants are presented in Figures 1 and 2. The overall average of fuel burn reduction (Lbs/Hr) for all of the measured test conditions when Schaeffer's lubricants and fuel additives were applied was 7.23% less than when the Schaeffer's products were not used. The overall increase in wheel horsepower for the test condition was 1.89%. This increase in horsepower due to the Schaeffer's products was used to estimate the additional savings in fuel and is presented as normalized data in Figure 1. A total reduction of 8.97% was extrapolated based on engines developing equal horsepower. Additionally, transmission temperatures were reduced by 16.6% and differential temperatures were reduced by 11.2%

Conclusion

The addition of Schaeffer's fuel additive, diesel engine oil, transmission oil and differential oils used in the truck tested at the Michigan Caterpillar facility had a significant reduction in burn rate and should lead to significant savings in fuel cost over a protracted length of time.

This data was reviewed, analyzed and presented by:

Dr. William E. Noonan
Mechanical Engineer

Donald W. Bowles CLS
Vice-President

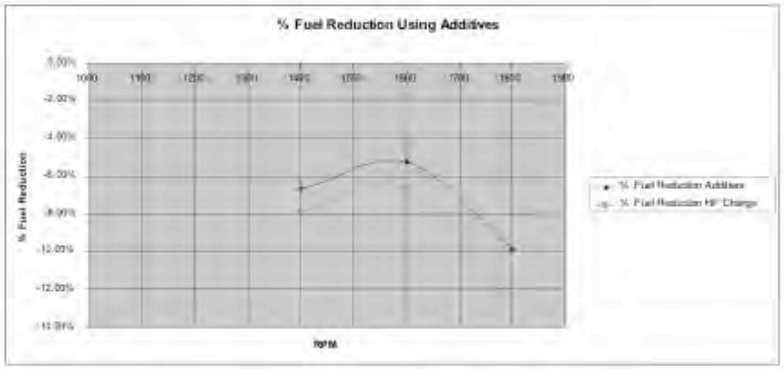


Figure 1 Percent Fuel Reduction

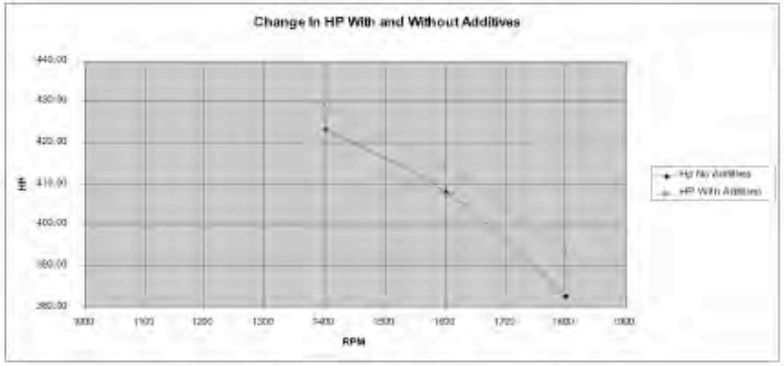


Figure 2 Effects of Additives on HP

The Beginning