



# HYDROGEN POWER SYSTEMS BUILDING A BETTER PLANET

Hydrogen Enhanced Combustion Systems that Reduce Fuel Expense and Pollution for Trucks, Autos, Boats and Generators

**Subject:** Hawthorne Truck 1094 Fuel Economy Tests  
Model: 2000 Freightliner FLD120S  
Vehicle VIN: 1FVN FXZB 6YMG 42963  
Serial Number: 2WS25825  
Engine Type: Caterpillar C15 / 500 HP



## SUMMARY OF FIRST TEST

**This initial run showed a 37% improvement in fuel economy over the stated baseline mileage (4.8 / 3.5 = 1.371)**



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On Thursday and Friday March 22 - 23 2012 we ran our first tests with the Hydrogen system on the 1094. This test included local deliveries and a trip to Borrego Springs and back.

**As our mileage baseline for this run we chose 3.5 mpg.** We chose this number because Solomon Jones (The driver with 10 years experience driving this truck) reports that during delivery operations such as this he gets between 500 to 550 miles between fill-ups, giving a baseline average of 3.5 miles per gallon. (550 miles / 160 gallons = 3.5 mpg).

During this first test we drove 305.6 miles and used 64 gallons, resulting in a mileage of 4.8 mpg (305.6 / 64 = 4.8)

This initial run shows a 37% improvement (4.8 / 3.5 = 1.371)

**However we expect the improvement is actually higher** because on the trip back from Borrego Springs **we did not use Hydrogen.**

The system stopped working right after we rolled over some deep, bumpy ruts getting to the equipment in Borrego Springs. I expect an electrical connector shook loose. We will determine the exact cause Monday and fix it.

When the system stopped we recorded the fuel gauge level ( $\frac{3}{4}$ ) and miles traveled to that point (195.6)

When we got back to San Marcos we first fueled the truck back to the  $\frac{3}{4}$  level, which is the fuel needed to travel back from Borrego Springs (43 gallons).

We restarted the pump to determine fuel used Thursday and Friday mornings (21 gallons).

These are the results from our estimates:

Miles traveled with the Hydrogen operating: 195.6

Estimated fuel used: 21 gallons

**Estimated miles per gallon: 9.3 mpg (195.6 / 21 = 9.3)**

Miles traveled with the Hydrogen off: 110 (Trip back from Borrego Springs)

Estimated fuel used: 43 gallons

Estimated miles per gallon: 2.5 mpg (110/43 = 2.5)

If these numbers hold true in upcoming tests we estimate that 1094 should average 6 mpg or better with Hydrogen running full time.



The shop foreman reports this truck has never done better than 5 mpg.

Assuming a 5mpg baseline, that would still deliver a 20% fuel economy increase ( $6/5 = 1.20$  or 20%)

## DETAILS OF TEST

The hydrogen system worked as designed Thursday and Friday all the way up to Borrego Springs. While turning to get to the site in Borrego Springs we had to go over several very bumpy ruts. Right after that the system stopped working. I suspect a connector shook loose because of the vibrations.

During the time the system was working Solomon noticed and reported that:

1. The turbo spooled up noticeably faster,
2. The engine responded more quickly,
3. The engine was running about 60° cooler as reported on the Pyrometer.

Date: Thursday 3/22/12, 10am

Starting Odometer in San Marcos: 412,472.2

Date: Friday 3/23/12 12:15pm

Odometer Reading in Borrego Springs: 412,667.8

Miles traveled in San Marcos and up to Borrego Springs:

$412,667.8 - 412,472.2 = 195.6$

Estimated gallons of fuel for this portion of test: 21

Estimated miles per gallon:  $9.3 \text{ mpg} (195.6/21 = 9.3)$

Date: Friday 3/23/12, 4pm

Ending Odometer: 412,777.8

Total miles traveled:  $412,777.8 - 412,472.2 = 305.6$

Miles traveled on Friday back from Borrego Springs:  $412,777.8 - 412,667.8 = 110$

Estimated gallons of fuel for this portion of test: 43

Estimated miles per gallon:  $2.5 \text{ mpg} (110/43 = 2.5)$



Date: Thursday 3/22/12

Day's work details

1. Left San Marcos Shop 11:13 am with full tanks (160 gallons)
2. Delivered Skip Loader to construction at Hwy 76 in Oceanside
3. Picked up broken Skip Loader at construction at Hwy in Oceanside
4. Returned to San Marcos & unloaded broken Skip Loader
5. Ended day about 1:30pm

Date: Friday 3/23/12

Day's work details

1. Left San Marcos shop at about 6am with skip loader and small dirt hauler.
2. 6:35 am delivered skip loader to construction site at Kit Carson Park Escondido.
3. 7:40 am delivered small dirt hauler to site off Buck Springs Road north of Welk resort.
4. 8:30 Back to shop to get dispatch to pick up loader at Borrego Springs.
5. Delayed until 10am by flat tire repair. On route to Borrego Springs by 9:50 am.
6. Took I-15 to 76 Past Pala Casino Route to Borrego Springs.
7. 12:15pm loading up broken loader.
8. 4pm refueled in San Marcos. 64 gallons total. Estimated 43 gallons used for trip from Borrego back to San Marcos. This leaves 21 gallons for Thursday travel, Friday morning local travel and drive to Borrego Springs.

Total miles driven on Thursday and Friday: 305.6

Total fuel used: 64

Average MPG: 4.8 ( $305.6/64 = 4.8$ )

However:

Hydrogen was on Thursday and Friday up to Borrego Springs.

Miles traveled for this portion of test: 195.6

Estimated fuel used for this portion of test: 21 gallons

Estimated miles per gallon: 9.3 mpg ( $195.6/21 = 9.3$ )

Hydrogen was off for trip back from Borrego Springs

Miles traveled for this portion of test: 110

Estimated fuel used for this portion of test: 43 gallons

Estimated miles per gallon: 2.5 mpg ( $110/43 = 2.5$ )

