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September 14, 2012

Purpose of Evaluation

The evaluation had two purposes, 1) to evaluate the positive effect that EnerBurn use has on DPF's and their regeneration rate and 2) to measure the fuel efficiency improvement rate.

Product Tested: EnerBurn® EC5931A (EnerBurn)

Evaluation For:

Customer name withheld per customer's instructions. Reference available upon request.

Equipment Evaluated

Engine Manufacturer: Mack
Model Number: 713 Titan Heavy Duty Haul Truck
Power Output: 605hp

Evaluation Analyst:

The customer performed the evaluation themselves using data from the equipment's ECU (Engine Control Unit)

Evaluation Protocols

Historical data on both MPG and DPF filter regeneration was taken from the trucks ECU (Electronic Control Unit). The data was plotted to determine variability. The variability was within the 5% threshold, so the truck was a viable candidate for testing.

EnerBurn treatment began on May 3, 2012 and was monitored by the customer and their staff.

At the onset of the evaluation the trucks MPG was an overall average of 3.6 MPG and the PDF filter was regenerating every 533 miles on average, totaling 441 regenerations over the 235,055 miles driven.

Evaluation Summary

On August 17, 2012 the ceramic filter was replaced at 261,915 miles per Mack's recommendation. Between 235,055 miles and 261,915 miles the filter was not regenerated. From historical data this filter would have been regenerated 50 times but none were necessary.

Also on August 17, 2012 the ECU was downloaded showing an overall life mileage of 3.9 MPG. This is an improvement of 8.33% in accumulated mileage. At \$3.80 per gallon of diesel this would be a saving of .32¢ per gallon off the cost of diesel.

To get the average MPG to move from an average of 3.6 MPG at 235,085 total miles to 3.9 MPG at 261,915 total miles, the truck would have had to average at least 4.4 MPG during the time it was driven the last 26,830 miles. This is a 22.3% improvement in average MPG during that period.

The DPF filter appears to be passively regenerating not needing manual regeneration due to the use of EnerBurn and the trucks fuel efficiency has improved by at least 10+%.

The data from the ECU's are shown in the tables that follow.

Repair order No:

93260

VIN:

1M2BD02Y5AM001019

M998
1019

Life and trip reports - 8/17/2012 10:16:06 AM

Total, table

	Time h	Fuel gal (US)	Distance miles	Consumption mpg(US)
1. Moving	4 710.1	66 375.4	259 308.8	3.9
2. Cruise control	1 658.2	27 153.3	115 135.8	4.2
3. Idle (All)	2 826.2	3 184.5	--	--
4. Idle (True)	2 628.9	2 887.2	--	--
5. Qualified Idle	2 653.6	3 011.0	--	--
6. PTO 1	0.0	0.0	--	--
7. PTO 2	0.0	0.0	--	--
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	158.2	672.3	1 133.6	1.7
11. Sweet Spot	1 916.0	12 414.9	111 224.6	9.0
12. Total:	7 536.2	69 944.5	259 308.8	3.7

Service Trip, table

	Time min	Fuel gal (US)	Distance miles	Consumption mpg(US)
1. Moving	285 446.4	66 733.8	261 915.3	3.9
2. Cruise control	100 539.3	27 308.9	116 267.6	4.3
3. Idle (All)	170 496.0	3 204.0	--	--
4. Idle (True)	158 514.0	2 902.3	--	--
5. Qualified Idle	159 953.9	3 026.8	--	--
6. PTO1	0.0	0.0	--	--
7. PTO2	0.0	0.0	--	--
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	9 595.5	675.1	1 134.3	1.7
11. Sweet Spot	117 480.8	12 741.5	113 731.6	8.9
12. Total:	455 938.1	70 322.4	261 915.3	3.7

Life and trip reports - 8/17/2012 10:17:03 AM

Total, table

	Time h	Fuel gal (US)	Distance miles	Consumption mpg(US)
1. Moving	4 710.1	66 375.4	259 308.8	3.9
2. Cruise control	1 658.2	27 153.3	115 135.8	4.2
3. Idle (All)	2 826.2	3 184.5	--	--
4. Idle (True)	2 628.9	2 887.2	--	--
5. Qualified Idle	2 653.6	3 011.0	--	--
6. PTO 1	0.0	0.0	--	--
7. PTO 2	0.0	0.0	--	--
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	158.2	672.3	1 133.6	1.7
11. Sweet Spot	1 916.0	12 414.9	111 224.6	9.0
12. Total:	7 536.2	69 944.5	259 308.8	3.7

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	Time min	Fuel gal (US)	Distance miles	Consumption mpg(US)
1. Moving	285 446.4	66 733.8	261 915.3	3.9
2. Cruise control	100 539.3	27 308.9	116 267.6	4.3
3. Idle (All)	170 496.0	3 204.0	--	--
4. Idle (True)	158 514.0	2 902.3	--	--
5. Qualified Idle	159 953.9	3 026.8	--	--
6. PTO1	0.0	0.0	--	--
7. PTO2	0.0	0.0	--	--
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	9 595.5	675.1	1 134.3	1.7
11. Sweet Spot	117 480.8	12 741.5	113 731.6	8.9

12. Total:	455 938.1	70 322.4	261 915.3	3.7
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Life and trip reports - 8/17/2012 10:17:50 AM

Total, table

	Time h	Fuel gal (US)	Distance miles	Consumption mpg(US)
1. Moving	4 710.1	66 375.4	259 308.8	3.9
2. Cruise control	1 658.2	27 153.3	115 135.8	4.2
3. Idle (All)	2 826.2	3 184.5	-	-
4. Idle (True)	2 628.9	2 887.2	-	-
5. Qualified Idle	2 653.6	3 011.0	-	-
6. PTO 1	0.0	0.0	-	-
7. PTO 2	0.0	0.0	-	-
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	158.2	672.3	1 133.6	1.7
11. Sweet Spot	1 916.0	12 414.9	111 224.6	9.0
12. Total:	7 536.2	69 944.5	259 308.8	3.7

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4. Idle (True)	158 514.0	2 902.3	-	-
5. Qualified Idle	159 953.9	3 026.8	-	-
6. PTO1	0.0	0.0	-	-
7. PTO2	0.0	0.0	-	-
8. PTO1 Moving	0.0	0.0	0.0	0.0
9. PTO2 Moving	0.0	0.0	0.0	0.0
10. Electronic Hand Throttle	9 595.5	675.1	1 134.3	1.7
11. Sweet Spot	117 480.8	12 741.5	113 731.6	8.9
12. Total:	455 938.1	70 322.4	261 915.3	3.7

Repair order No:

91808

VIN:

1M2BD02Y8AM001019

M898
1019

Operation number
2545-08-03-04

Title
Exhaust Aftertreatment System Logged Data

User
M033253

Date
5/3/2012

Time
12:41:52 PM

DPF Regeneration Event Log - 5/3/2012 12:42:14 PM

DPF Regeneration Event Log

	Beginning Soot %	Ending Soot %	Beginning Engine Time h	Ending Engine Time h	Start Reason	Stop Reason	Duration h
1. Event 1	100.0	97.0	6 805.9	6 805.9	Automatic- Soot (2)	Transition to Parked	0.0
2. Event 2	97.0	6.0	6 805.9	6 806.3	Manual Request	Completed	0.3
3. Event 3	100.0	7.0	6 837.2	6 837.6	Automatic- Fuel	Completed	0.4
4. Event 4	103.0	9.0	6 859.5	6 859.8	Automatic- Fuel	Completed	0.3
5. Event 5	100.0	15.0	6 874.1	6 874.4	Automatic- Fuel	Completed	0.3
6. Event 6	100.0	46.0	6 787.3	6 787.5	Automatic- Soot (2)	Transition to Parked	0.2
7. Event 7	46.0	3.0	6 787.5	6 787.8	Manual Request	Completed	0.3
8. Event 8	100.0	22.0	6 798.7	6 799.0	Automatic- Soot (2)	Completed	0.3
9. Event 9	100.0	31.0	6 802.4	6 802.8	Automatic- Soot (2)	Completed	0.3
10. Last Successful	100.0	15.0	6 874.1	6 874.4	Automatic- Fuel	Completed	0.3

DPF Regeneration Inhibit Event Log - 5/3/2012 12:42:14 PM

DPF Regeneration Inhibit Event Log

	Beginning Soot %	Ending Soot %	Beginning Engine Time h	Ending Engine Time h	Distance Driven miles	Soot Status
1. Event 1	0.0	81.0	0.0	5 048.4	174 450.7	Normal
2. Event 2	0.0	81.0	0.0	5 048.5	174 450.7	Normal
3. Event 3	0.0	81.0	0.0	5 048.5	174 450.7	Normal
4. Event 4	0.0	100.0	0.0	6 054.0	174 625.7	Normal
5. Event 5	0.0	85.0	0.0	5 538.8	191 241.9	Normal
6. Event 6	0.0	87.0	0.0	6 006.0	207 213.2	Normal
7. Event 7	0.0	87.0	0.0	6 420.6	216 656.1	Normal
8. Event 8	0.0	81.0	0.0	6 857.7	236 065.5	Normal

Current Values - 5/3/2012 12:42:14 PM

Time	h - Engine Time	miles - Engine Distance	% - Soot Ratio
4.2	6 889.7	236 349.4	58.0

Latest Critically-High Soot Level Event - 5/3/2012 12:42:14 PM

Time	h - Engine Time	miles - Engine Distance	Inhibit Status
4.6	2 505.3	88 291.7	0.0

Regeneration Inhibit Totals - 5/3/2012 12:42:14 PM

Time	Inhibit Activations	Regenerations Inhibited
4.9	6	6

Aftertreatment-Fuel System Activation History - 5/3/2012 12:42:14 PM

Time	Aftertreatment Fuel Shut-Off Valve Activations	min - Aftertreatment Injector Activation Time
5.2	5 580	354 062

Regeneration Triggers - 5/3/2012 12:42:14 PM

Regeneration Triggers- Log

	Events
1. Fuel Trigger	106
2. Time Trigger	157
3. Distance Trigger	16
4. Soot Trigger (1)	12
5. Soot Trigger (2)	200
6. Manual Regenerations	250

Regeneration Completion History - 5/3/2012 12:42:14 PM

Regen Percentags Completed %	Number of times
< 10	247.0
10-20	5.0
20-30	7.0
30-40	5.0
40-50	4.0
50-60	3.0
60-70	4.0
70-80	5.0
80-90	7.0
90-100	13.0
> 100	441.0

MANUAL

Regeneration Interval History - 5/3/2012 12:42:14 PM

Regeneration Interval History h	Number of times
< 3	200.0
3-4	29.0
4-6	46.0
6-8	32.0
8-10	49.0
10-12	36.0
12-14	37.0
14-16	40.0
16-20	69.0
20-24	48.0
24-28	27.0
28-32	19.0
32-36	11.0
36-40	3.0
> 40	3.0