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New Technology Research & Development Program
Grant Contract 582-5-65591-0016

Tasks 1, 2, 3 & 4 Deliverable Report
Final Report

The preparation of this report is based on work funded in part
by the State of Texas through a Grant from the
Texas Commission on Environmental Quality.

LUBRIZOL

Fluid technologies for a better world™

November 1, 2006

Mr. Carl Wick
USEPA Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, N. W.
Mail Code: 6405J
Washington, DC 20460

Mr. Wick,

Please find attached the data to support our request for a joint verification of ULSD PuriNOx with a Diesel Oxidation Catalyst. We have shown, through testing at Southwest Research Institute, that we are seeing significant NOx and PM emissions reductions, against a CARB ULSD baseline, by combining the PuriNOx technology with the DOC technology. We seek EPA verification of these findings and publication of emission reduction numbers on your web site.

As with the original PuriNOx verification, we have seen a great deal of variation on an engine by engine basis. However, the pattern observed seems to support the same conclusion, that a ULSD PuriNOx, when combined with a DOC, shows significant emission reductions in off-road engines. We hope you will contact us with any questions that might occur to you and we looking forward to the results of your analysis.

As a side note, we will also be offering these data to TCEQ (project funder) and CARB for their review as well. Both organizations want to examine the data but are looking to your office to evaluate and award an emission reduction value.

Many thanks in advance for your time and efforts in the analysis.

The Lubrizol Corporation
29400 Lakeland Boulevard, Wickliffe, Ohio 44092-2298
Telephone: 440.943.4200 Facsimile: 440.943.5337

www.lubrizol.com

Respectfully,

Kevin Snape, Ph.D.
Lubrizol

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Test Summary for PuriNOx with AZ DOC

	Test description	Test Cycle	Emission Reduction	PM*	NOx	HC	CO	ARB NO2 (device - baseline)	SwRI Test Status
1	**1998 DDC Series 60 (400 hp)**	**FTP- HD Transient**	Mean	48.4%	15.7%	20.8%	61.5%	2%	completed
	PuriNOx & De-greened AZ Purimuffler		CI (upper bound)	52.8%	18.1%	39.6%	63.7%		
			CI (lower bound)	44.0%	13.3%	2.1%	59.2%		
2	**1998 DDC Series 60 (400 hp)**	**SET**	Mean	58.3%	16.0%	50.0%	91.2%	20.0%	completed
	PuriNOx & De-greened AZ Purimuffler		CI (upper bound)	na	na	na	na		
			CI (lower bound)	na	na	na	na		
3*	1998 DDC Series 60 (400hp)	FTP-HD Transient	Mean	56.6%	17.7%	10.8%	55.7%	1%	completed
	PuriNOx & De-greened AZ Purimuffler with CCV		CI (upper bound)	59.8%	20.4%	34.7%	59.4%		
			CI (lower bound)	53.4%	15.1%	-13.1%	52.0%		
4	**1990/1 Cummins C8.3 (275hp)**	**FTP- HD Transient**	Mean	60.5%	24.5%	70.4%	74.6%	-3%	completed
	PuriNOx & De-greened AZ Purimuffler		CI (upper bound)	65.9%	26.2%	74.9%	89.7%		
			CI (lower bound)	55.2%	22.7%	65.9%	59.4%		
5	**1990/1 Cummins C8.3 (275hp)**	**FTP- HD Transient**	Mean	63.1%	23.9%	68.6%	76.1%	-7%	completed
	PuriNOx & Aged AZ Purimuffler		CI (upper bound)	68.5%	25.7%	73.1%	91.2%		
			CI (lower bound)	57.8%	22.2%	64.2%	61.0%		
6	**1999 Navistar 7.3L DIT B250 (250hp)**	**FTP- HD Transient**	Mean	23.5%	11.8%	-157.2%	17.6%	-8%	completed
	PuriNOx & De-greened AZ Purimuffler		CI (upper bound)	27.8%	13.7%	-108.6%	20.9%		
			CI (lower bound)	19.2%	9.9%	-205.8%	14.3%		
7	**1999 Navistar 7.3L DIT B250 (250hp)**	**SET**	Mean	47.4%	17.9%	25.0%	95.5%	11.2%	completed
	PuriNOx & De-greened AZ Purimuffler		CI (upper bound)	53.7%	19.9%	25.0%	95.6%		
			CI (lower bound)	41.2%	15.9%	25.0%	95.3%		
3*	test is additional to those defined in original workstatment								

1998 DDC Series 60 400hp
PuriNOx & De-greened AZ Purimuffler A17-0527
FTP- HD Transient

Baseline Test

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	%	kg	bhp-hr
2316120605C1	Cold-Start	12/06/05	3.15E+00	1.11E+02	1.39E+01	7.13E+01	8.05E+00	7.23E+00	1.77E+01	3.00E+01
2316120605H1	Hot-Start	12/06/05	2.22E+00	1.06E+02	5.43E+00	4.07E+01	7.18E+00	6.77E+00	1.65E+01	2.97E+01
2316120605H2	Hot-Start	12/06/05	2.16E+00	1.05E+02	4.94E+00	3.97E+01	7.72E+00	7.36E+00	1.66E+01	2.96E+01
2316120605H3	Hot-Start	12/06/05	2.13E+00	1.04E+02	5.23E+00	4.01E+01	7.22E+00	6.94E+00	1.66E+01	2.96E+01
2316120605H4	Hot-Start	12/06/05	2.22E+00	1.06E+02	6.25E+00	3.98E+01	7.13E+00	6.72E+00	1.66E+01	2.96E+01

Baseline Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
2316120605H1	Comp 1	12/06/05	7.93E-02	3.60E+00	2.23E-01	1.52E+00	2.46E-01	6.84E+00	5.61E+02	3.00E+01
2316120605H2	Comp 2	12/06/05	7.76E-02	3.57E+00	2.10E-01	1.49E+00	2.62E-01	7.34E+00	5.66E+02	2.97E+01
2316120605H3	Comp 3	12/06/05	7.68E-02	3.55E+00	2.18E-01	1.50E+00	2.47E-01	6.98E+00	5.64E+02	2.96E+01
2316120605H4	Comp 4	12/06/05	7.93E-02	3.60E+00	2.47E-01	1.49E+00	2.45E-01	6.79E+00	5.66E+02	2.96E+01
Mean Baseline Composite Weighted Value =			**7.83E-02**	**3.58E+00**	**2.25E-01**	**1.50E+00**	**2.50E-01**	**6.99E+00**	**5.64E+02**	**2.98E+01**
Standard Deviation =			**1.28E-03**	**2.66E-02**	**1.61E-02**	**1.13E-02**	**8.06E-03**	**2.48E-01**	**2.42E+00**	**1.93E-01**

Control Device Test (De-greened)

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	%	kg	bhp-hr
2316121905C1	Cold-Start	12/19/05	3.32E+00	8.69E+01	1.73E+01	6.61E+01	5.64E+00	6.49E+00	1.65E+01	2.77E+01
2316121905H1	Hot-Start	12/19/05	7.68E-01	8.33E+01	2.94E+00	7.71E+00	7.02E+00	8.43E+00	1.54E+01	2.74E+01
2316121905H2	Hot-Start	12/19/05	7.66E-01	8.16E+01	2.68E+00	7.93E+00	7.11E+00	8.71E+00	1.53E+01	2.74E+01
2316121905H3	Hot-Start	12/19/05	6.84E-01	8.23E+01	2.63E+00	6.79E+00	7.52E+00	9.14E+00	1.53E+01	2.74E+01
2316121905H4	Hot-Start	12/19/05	7.38E-01	8.07E+01	3.12E+00	8.23E+00	7.35E+00	9.11E+00	1.53E+01	2.73E+01
2316121905H5	Hot-Start	12/19/05	7.39E-01	8.18E+01	2.65E+00	6.81E+00	7.74E+00	9.47E+00	1.55E+01	2.74E+01

Device Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
2316121905C1-H1	Comp 1	12/19/05	4.12E-02	3.05E+00	1.82E-01	5.84E-01	2.49E-01	8.14E+00	5.67E+02	2.75E+01
2316121905C1-H2	Comp 2	12/19/05	4.13E-02	3.01E+00	1.74E-01	5.93E-01	2.52E-01	8.38E+00	5.66E+02	2.74E+01
2316121905C1-H3	Comp 3	12/19/05	3.87E-02	3.03E+00	1.73E-01	5.57E-01	2.65E-01	8.75E+00	5.66E+02	2.74E+01
2316121905C1-H4	Comp 4	12/19/05	4.04E-02	2.98E+00	1.88E-01	6.02E-01	2.60E-01	8.71E+00	5.64E+02	2.74E+01
2316121905C1-H5	Comp 5	12/19/05	4.04E-02	3.01E+00	1.73E-01	5.58E-01	2.72E-01	9.02E+00	5.72E+02	2.74E+01
Mean Device Composite Weighted Value =			**4.04E-02**	**3.02E+00**	**1.78E-01**	**5.79E-01**	**2.59E-01**	**8.60E+00**	**5.67E+02**	**2.74E+01**
Standard Deviation =			**1.04E-03**	**2.66E-02**	**6.69E-03**	**2.07E-02**	**9.38E-03**	**3.43E-01**	**3.14E+00**	**3.43E-02**

	PM	NOx	HC	CO
Emission Reduction	48.4%	15.7%	20.8%	61.5%
Degrees of Freedom	2	2	2	2
CI (upper bound)	**52.8%**	**18.1%**	**39.6%**	**63.7%**
CI (lower bound)	**44.0%**	**13.3%**	**2.1%**	**59.2%**

Calculations for Degrees of Freedom			5.45E-07	2.36E-04	8.66E-05	4.24E-05				
			2.66E-01	7.10E-01	6.27E-01	1.49E-01				
			3.62E-07	2.35E-04	1.49E-05	1.43E-04				
			4.12E-13	1.62E-07	9.20E-09	4.05E-09				
			1.49E-13	2.78E-08	3.75E-09	9.00E-10				
			7.10E-02	5.04E-01	3.93E-01	2.21E-02				
			6.56E-14	2.77E-08	1.11E-10	1.02E-08				
			1.53E-13	4.17E-08	3.79E-09	1.12E-09				
			2.69E+00	**3.89E+00**	**2.43E+00**	**3.60E+00**				
Calculations for Confidence		raw	4.84E-01	1.57E-01	2.08E-01	6.15E-01				
		stat #	4.30E+00	4.30E+00	4.30E+00	4.30E+00				
			5.45E-07	2.36E-04	8.66E-05	4.24E-05				
			2.66E-01	7.10E-01	6.27E-01	1.49E-01				
			3.62E-07	2.35E-04	1.49E-05	1.43E-04				
		in sqrt	6.42E-07	4.03E-04	9.59E-05	6.36E-05				
		sqrt answ	8.01E-04	2.01E-02	9.79E-03	7.98E-03				
		divide by	7.83E-02	3.58E+00	2.25E-01	1.50E+00				
		bracketed	4.40E-02	2.41E-02	1.87E-01	2.29E-02				
		answer uppe	5.28E-01	1.81E-01	3.96E-01	6.37E-01				
		answer lowe	4.40E-01	1.33E-01	2.06E-02	5.92E-01				

$$\nu = \frac{\left(s_B^2/n_B + \left(1 - ER_{RAW}\right)^2 s_F^2/n_F\right)^2}{\left[\left(s_B^2/n_B\right)^2/\left(n_B - 1\right)\right] + \left(1 - ER_{RAW}\right)^4 \left[\left(s_F^2/n_F\right)^2/\left(n_F - 1\right)\right]}$$

$$CI\ (upper\ bound) = ER_{RAW} + \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1 - ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1 - ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

1998 DDC Series 60 400hp			
PuriNOx & De-greened AZ Purimuffler A17-0527			
ESC Composite			
Baseline Test			
			PM
			g/bhp-hr
	Composite	01/13/06	1.80E-02
Mean Baseline Composite Weighted Value =			**1.80E-02**
Standard Deviation =			**na**
Control Device Test (Degreened)			
Device Composite Weighted Value			**PM**
			g/bhp-hr
	Composite	01/17/06	6.00E-03
	Composite	01/17/06	9.00E-03
Mean Device Composite Weighted Value =			**7.50E-03**
Standard Deviation =			**2.12E-03**
Reductions			
Mean			**58.3%**

NOx	**HC**	**CO**	**NO_2**	**NO_2/NO_x**	**CO_2**
g/bhp-hr	**g/bhp-hr**	**g/bhp-hr**	**g/bhp-hr**	**%**	**g/bhp-hr**
6.40E+00	2.00E-02	3.40E-01	2.40E-01	4%	4.57E+02
6.40E+00	**2.00E-02**	**3.40E-01**	**2.40E-01**	**3.75E-02**	**4.57E+02**
na	**na**	**na**	**na**	**na**	**na**
NOx	**HC**	**CO**	**NO_2**	**NO_2/NO_x**	**CO_2**
g/bhp-hr	**g/bhp-hr**	**g/bhp-hr**	**g/bhp-hr**	**%**	**g/bhp-hr**
5.33E+00	1.00E-02	3.00E-02	1.29E+00	24%	4.62E+02
5.42E+00	1.00E-02	3.00E-02	1.29E+00	24%	4.62E+02
5.38E+00	**1.00E-02**	**3.00E-02**	**1.29E+00**	**2.40E-01**	**4.62E+02**
6.36E-02	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.84E-03**	**0.00E+00**
16.0%	**50.0%**	**91.2%**			

1998 DDC Series 60 (400hp)
PuriNOx with De-greened AZ Purimuffler A17-0527 + Racor 6000
FTP- HD Transient

Baseline Test

Test Number	Test Type	Test Date	PM	PM + Blowby	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	g	%	kg	bhp-hr
2316120605C1	Cold-Start	12/06/05	3.15E+00	3.39E+00	1.11E+02	1.39E+01	7.13E+01	8.05E+00	7.23E+00	1.77E+01	3.00E+01
2316120605H1	Hot-Start	12/06/05	2.22E+00	2.67E+00	1.06E+02	5.43E+00	4.07E+01	7.18E+00	6.77E+00	1.65E+01	2.97E+01
2316120605H2	Hot-Start	12/06/05	2.16E+00	2.63E+00	1.05E+02	4.94E+00	3.97E+01	7.72E+00	7.36E+00	1.66E+01	2.96E+01
2316120605H3	Hot-Start	12/06/05	2.13E+00	2.60E+00	1.04E+02	5.23E+00	4.01E+01	7.22E+00	6.94E+00	1.66E+01	2.96E+01
2316120605H4	Hot-Start	12/06/05	2.22E+00	2.69E+00	1.06E+02	6.25E+00	3.98E+01	7.13E+00	6.72E+00	1.66E+01	2.96E+01

Baseline Composite Weighted Value			PM	PM + Blowby	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
2316120605C1-H1	Comp 1	12/06/05	7.93E-02	9.33E-02	3.60E+00	2.23E-01	1.52E+00	2.46E-01	6.84E+00	5.61E+02	2.97E+01
2316120605C1-H2	Comp 2	12/06/05	7.76E-02	9.25E-02	3.57E+00	2.10E-01	1.49E+00	2.62E-01	7.34E+00	5.66E+02	2.96E+01
2316120605C1-H3	Comp 3	12/06/05	7.68E-02	9.16E-02	3.55E+00	2.18E-01	1.50E+00	2.47E-01	6.98E+00	5.64E+02	2.96E+01
2316120605C1-H4	Comp 4	12/06/05	7.93E-02	9.42E-02	3.60E+00	2.47E-01	1.49E+00	2.45E-01	6.79E+00	5.66E+02	2.97E+01
Mean Baseline Composite Weighted Value =			**7.83E-02**	**9.29E-02**	**3.58E+00**	**2.25E-01**	**1.50E+00**	**2.50E-01**	**6.99E+00**	**5.64E+02**	**2.97E+01**
Standard Deviation =			**1.28E-03**	**1.10E-03**	**2.66E-02**	**1.61E-02**	**1.13E-02**	**8.06E-03**	**2.48E-01**	**2.42E+00**	**3.24E-02**

Control Devices Tested (PuriNOx with De-greened A17-0527 & Racor 6000)

Test Number	Test Type	Test Date	PM	PM + Blowby	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	g	%	kg	bhp-hr
2316121605C1	Cold-Start	12/16/05	3.31E+00	3.31E+00	8.28E+01	1.65E+01	6.32E+01	5.59E+00	6.76E+00	1.66E+01	2.76E+01
2316121605H1	Hot-Start	12/17/05	7.68E-01	7.68E-01	8.15E+01	3.15E+00	8.78E+00	6.91E+00	8.48E+00	1.57E+01	2.74E+01
2316121605H2	Hot-Start	12/18/05	7.67E-01	7.67E-01	8.16E+01	3.18E+00	1.07E+01	7.26E+00	8.90E+00	1.56E+01	2.74E+01
2316121605H3	Hot-Start	12/19/05	6.85E-01	6.85E-01	7.96E+01	3.64E+00	1.02E+01	6.85E+00	8.61E+00	1.57E+01	2.74E+01
2316121605H4	Hot-Start	12/20/05	7.40E-01	7.40E-01	7.97E+01	3.98E+00	1.17E+01	6.99E+00	8.77E+00	1.52E+01	2.74E+01
2316121605H5	Hot-Start	12/21/05	7.41E-01	7.41E-01	7.98E+01	4.37E+00	1.25E+01	6.87E+00	8.61E+00	1.57E+01	2.75E+01

Device Composite Weighted Value			PM	PM + Blowby	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
2316121605C1-H1	Comp 1	12/16/05	4.12E-02	4.12E-02	2.98E+00	1.85E-01	6.03E-01	2.45E-01	8.23E+00	5.75E+02	2.74E+01
2316121605C1-H2	Comp 2	12/16/05	4.12E-02	4.12E-02	2.98E+00	1.85E-01	6.65E-01	2.56E-01	8.59E+00	5.73E+02	2.74E+01
2316121605C1-H3	Comp 3	12/16/05	3.86E-02	3.86E-02	2.92E+00	2.00E-01	6.48E-01	2.43E-01	8.34E+00	5.78E+02	2.74E+01
2316121605C1-H4	Comp 4	12/16/05	4.03E-02	4.03E-02	2.92E+00	2.10E-01	6.93E-01	2.48E-01	8.47E+00	5.62E+02	2.74E+01
2316121605C1-H5	Comp 5	12/16/05	4.03E-02	4.03E-02	2.92E+00	2.22E-01	7.18E-01	2.43E-01	8.33E+00	5.75E+02	2.75E+01
Mean Device Composite Weighted Value =			**4.03E-02**	**4.03E-02**	**2.94E+00**	**2.01E-01**	**6.65E-01**	**2.47E-01**	**8.39E+00**	**5.73E+02**	**2.74E+01**
Standard Deviation =			**1.05E-03**	**1.05E-03**	**3.30E-02**	**1.62E-02**	**4.38E-02**	**5.37E-03**	**1.39E-01**	**6.39E+00**	**1.48E-02**

	PM	PM + Blowby	NOx	HC	CO
Emission Reduction	48.5%	56.6%	17.7%	10.8%	55.7%
Degrees of Freedom	2	2	2	2	2
CI (upper bound)	**52.9%**	**59.8%**	**20.4%**	**34.7%**	**59.4%**
CI (lower bound)	**44.1%**	**53.4%**	**15.1%**	**-13.1%**	**52.0%**

Calculations for Degrees of Freedom

$$\nu = \frac{\left(s_B^2/n_B + \left(1-ER_{RAW}\right)^2 s_F^2/n_F\right)^2}{\left[\left(s_B^2/n_B\right)^2/\left(n_B-1\right)\right] + \left(1-ER_{RAW}\right)^4\left[\left(s_F^2/n_F\right)^2/\left(n_F-1\right)\right]}$$

5.45E-07	4.05E-07	2.36E-04	8.66E-05	4.24E-05
2.66E-01	1.89E-01	6.77E-01	7.96E-01	1.96E-01
3.65E-07	3.65E-07	3.63E-04	8.72E-05	6.40E-04
4.12E-13	2.24E-13	2.32E-07	2.43E-08	2.83E-08
1.49E-13	8.19E-14	2.78E-08	3.75E-09	9.00E-10
7.06E-02	3.56E-02	4.58E-01	6.33E-01	3.85E-02
6.66E-14	6.66E-14	6.59E-08	3.80E-09	2.05E-07
1.53E-13	8.43E-14	5.79E-08	6.15E-09	8.80E-09
2.69E+00	**2.66E+00**	**4.00E+00**	**3.95E+00**	**3.21E+00**

Calculations for Confidence

$$CI\ (upper\ bound) = ER_{RAW} + \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

raw	4.85E-01	5.66E-01	1.77E-01	1.08E-01	5.57E-01
stat #	4.30E+00	4.30E+00	4.30E+00	4.30E+00	4.30E+00
	5.45E-07	4.05E-07	2.36E-04	8.66E-05	4.24E-05
	2.66E-01	1.89E-01	6.77E-01	7.96E-01	1.96E-01
	3.65E-07	3.65E-07	3.63E-04	8.72E-05	6.40E-04
in sqrt	6.42E-07	4.74E-07	4.81E-04	1.56E-04	1.68E-04
sqrt answ	8.01E-04	6.88E-04	2.19E-02	1.25E-02	1.30E-02
divide by	7.83E-02	9.29E-02	3.58E+00	2.25E-01	1.50E+00
bracketed	4.41E-02	3.19E-02	2.64E-02	2.39E-01	3.72E-02
answer uppe	5.29E-01	5.98E-01	2.04E-01	3.47E-01	5.94E-01
answer lowe	4.41E-01	5.34E-01	1.51E-01	-1.31E-01	5.20E-01

1990/1 Cummins 6CTA8.3 (275hp)
PuriNOx with De-greened AZ Purimuffler P/N A17-0213
FTP- HD Transient

Baseline Test

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	%	kg	bhp-hr
5723011306C1	Cold-Start	01/13/06	5.54E+00	8.98E+01	7.10E+00	2.91E+01	1.89E+01	2.10E+01	1.05E+01	1.84E+01
5723011306H1	Hot-Start	01/13/06	3.19E+00	8.78E+01	6.16E+00	2.30E+01	1.15E+01	1.31E+01	1.02E+01	1.84E+01
5723011306H2	Hot-Start	01/13/06	3.02E+00	8.59E+01	6.30E+00	1.98E+01	7.63E+00	8.88E+00	1.01E+01	1.83E+01
5723011306H3	Hot-Start	01/13/06	2.96E+00	8.60E+01	6.42E+00	1.98E+01	6.89E+00	8.01E+00	1.01E+01	1.83E+01
5723011306H4	Hot-Start	01/13/06	3.01E+00	8.58E+01	6.32E+00	1.96E+01	7.41E+00	8.64E+00	9.99E+00	1.83E+01

Baseline Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
5723011306C1-H1	Comp 1	01/13/06	1.91E-01	4.78E+00	3.41E-01	1.30E+00	6.80E-01	1.42E+01	5.54E+02	1.84E+01
5723011306C1-H2	Comp 2	01/13/06	1.85E-01	4.72E+00	3.50E-01	1.15E+00	5.05E-01	1.06E+01	5.54E+02	1.83E+01
5723011306C1-H3	Comp 3	01/13/06	1.82E-01	4.73E+00	3.56E-01	1.16E+00	4.70E-01	9.87E+00	5.53E+02	1.83E+01
5723011306C1-H4	Comp 4	01/13/06	1.85E-01	4.72E+00	3.52E-01	1.15E+00	4.95E-01	1.04E+01	5.51E+02	1.83E+01
Mean Baseline Composite Weighted Value =			**1.86E-01**	**4.74E+00**	**3.50E-01**	**1.19E+00**	**5.37E-01**	**1.13E+01**	**5.53E+02**	**1.83E+01**
Standard Deviation =			**3.97E-03**	**2.70E-02**	**6.14E-03**	**7.23E-02**	**9.59E-02**	**1.98E+00**	**4.87E-01**	**7.00E-02**

Control Device Test (Degreened)

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g/bhp-hr	%	kg	bhp-hr
5723021406C1	Cold-Start	01/17/06	2.36E+00	6.45E+01	3.16E+00	1.99E+01	6.24E+00	9.68E+00	1.02E+01	1.79E+01
5723021406H1	Hot-Start	01/17/06	1.22E+00	6.67E+01	1.64E+00	2.98E+00	5.92E+00	8.88E+00	1.01E+01	1.85E+01
5723011706H2	Hot-Start	01/17/06	1.16E+00	6.60E+01	1.64E+00	2.58E+00	5.14E+00	7.80E+00	1.00E+01	1.84E+01
5723011706H3	Hot-Start	01/17/06	1.16E+00	6.49E+01	1.67E+00	3.27E+00	5.24E+00	8.07E+00	1.00E+01	1.84E+01
5723011706H4	Hot-Start	01/17/06	1.16E+00	6.55E+01	1.88E+00	3.64E+00	5.02E+00	7.67E+00	1.02E+01	1.84E+01
5723011706H5	Hot-Start	01/18/06	1.18E+00	6.63E+01	1.62E+00	3.26E+00	5.96E+00	9.00E+00	1.02E+01	1.84E+01

Device Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
5723021406C1-H1	Comp 1	01/17/06	7.51E-02	3.60E+00	1.01E-01	2.93E-01	3.24E-01	8.99E+00	5.48E+02	1.84E+01
5723011706C1-H2	Comp 2	01/17/06	7.26E-02	3.58E+00	1.01E-01	2.75E-01	2.89E-01	8.06E+00	5.48E+02	1.84E+01
5723011706C1-H3	Comp 3	01/17/06	7.26E-02	3.54E+00	1.03E-01	3.08E-01	2.94E-01	8.30E+00	5.49E+02	1.83E+01
5723011706C1-H4	Comp 4	01/17/06	7.26E-02	3.57E+00	1.12E-01	3.26E-01	2.84E-01	7.96E+00	5.58E+02	1.83E+01
5723011706C1-H5	Comp 5	01/18/06	7.35E-02	3.60E+00	1.00E-01	3.08E-01	3.27E-01	9.09E+00	5.58E+02	1.83E+01
Mean Device Composite Weighted Value =			**7.33E-02**	**3.58E+00**	**1.04E-01**	**3.02E-01**	**3.04E-01**	**8.48E+00**	**5.52E+02**	**1.83E+01**
Standard Deviation =			**1.10E-03**	**2.61E-02**	**5.05E-03**	**1.88E-02**	**2.06E-02**	**5.29E-01**	**5.52E+00**	**4.40E-02**

	PM	NOx	HC	CO
Emission Reduction	60.5%	24.5%	70.4%	74.6%
Degrees of Freedom	2	2	2	2
CI (upper bound)	**65.9%**	**26.2%**	**74.9%**	**89.7%**
CI (lower bound)	**55.2%**	**22.7%**	**65.9%**	**59.4%**

Calculations for Degrees of Freedom

$$\nu = \frac{\left(s_B^2/n_B + \left(1-ER_{RAW}\right)^2 s_F^2/n_F\right)^2}{\left[\left(s_B^2/n_B\right)^2/\left(n_B-1\right)\right] + \left(1-ER_{RAW}\right)^4\left[\left(s_F^2/n_F\right)^2/\left(n_F-1\right)\right]}$$

	PM	NOx	HC	CO
	5.27E-06	2.43E-04	1.26E-05	1.74E-03
	1.56E-01	5.71E-01	8.77E-02	6.47E-02
	4.06E-07	2.26E-04	8.49E-06	1.18E-04
	2.84E-11	1.39E-07	1.77E-10	3.07E-06
	1.39E-11	2.96E-08	7.88E-11	1.52E-06
	2.43E-02	3.26E-01	7.69E-03	4.18E-03
	8.25E-14	2.56E-08	3.60E-11	6.98E-09
	1.39E-11	3.79E-08	7.91E-11	1.52E-06
	2.05E+00	**3.66E+00**	**2.24E+00**	**2.02E+00**

Calculations for Confidence

$$CI\ (upper\ bound) = ER_{RAW} + \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

	PM	NOx	HC	CO
raw	6.05E-01	2.45E-01	7.04E-01	7.46E-01
stat #	4.30E+00	4.30E+00	4.30E+00	4.30E+00
	5.27E-06	2.43E-04	1.26E-05	1.74E-03
	1.56E-01	5.71E-01	8.77E-02	6.47E-02
	4.06E-07	2.26E-04	8.49E-06	1.18E-04
in sqrt	5.33E-06	3.72E-04	1.33E-05	1.75E-03
sqrt answ	2.31E-03	1.93E-02	3.65E-03	4.18E-02
divide by	1.86E-01	4.74E+00	3.50E-01	1.19E+00
bracketed	5.35E-02	1.75E-02	4.49E-02	1.52E-01
answer uppe	6.59E-01	2.62E-01	7.49E-01	8.97E-01
answer lowe	5.52E-01	2.27E-01	6.59E-01	5.94E-01

1990/1 Cummins 6CTA8.3 (275hp)
PuriNOx with Aged AZ Purimuffler P/N A17-0475
FTP- HD Transient

Baseline Test

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	%	kg	bhp-hr
5723011306C1	Cold-Start	01/13/06	5.54E+00	8.98E+01	7.10E+00	2.91E+01	1.89E+01	2.10E+01	1.05E+01	1.84E+01
5723011306H1	Hot-Start	01/13/06	3.19E+00	8.78E+01	6.16E+00	2.30E+01	1.15E+01	1.31E+01	1.02E+01	1.84E+01
5723011306H2	Hot-Start	01/13/06	3.02E+00	8.59E+01	6.30E+00	1.98E+01	7.63E+00	8.88E+00	1.01E+01	1.83E+01
5723011306H3	Hot-Start	01/13/06	2.96E+00	8.60E+01	6.42E+00	1.98E+01	6.89E+00	8.01E+00	1.01E+01	1.83E+01
5723011306H4	Hot-Start	01/13/06	3.01E+00	8.58E+01	6.32E+00	1.96E+01	7.41E+00	8.64E+00	9.99E+00	1.83E+01

Baseline Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
5723011306C1-H1	Comp 1	01/13/06	1.91E-01	4.78E+00	3.41E-01	1.30E+00	6.80E-01	1.42E+01	5.54E+02	1.84E+01
5723011706C1-H2	Comp 2	01/13/06	1.85E-01	4.72E+00	3.50E-01	1.15E+00	5.05E-01	1.06E+01	5.54E+02	1.83E+01
5723011706C1-H3	Comp 3	01/13/06	1.82E-01	4.73E+00	3.56E-01	1.16E+00	4.70E-01	9.87E+00	5.53E+02	1.83E+01
5723011706C1-H4	Comp 4	01/13/06	1.85E-01	4.72E+00	3.52E-01	1.15E+00	4.95E-01	1.04E+01	5.51E+02	1.83E+01
Mean Baseline Composite Weighted Value =			**1.86E-01**	**4.74E+00**	**3.50E-01**	**1.19E+00**	**5.37E-01**	**1.13E+01**	**5.53E+02**	**1.83E+01**
Standard Deviation =			**3.97E-03**	**2.70E-02**	**6.14E-03**	**7.23E-02**	**9.59E-02**	**1.98E+00**	**1.61E+00**	**7.00E-02**

Control Device Test (Degreened)

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g/bhp-hr	%	kg	bhp-hr
5723011706C1	Cold-Start	01/17/06	2.13E+00	6.52E+01	3.11E+00	1.77E+01	3.06E+00	4.68E+00	1.03E+01	1.79E+01
5723011706H1	Hot-Start	01/17/06	1.14E+00	6.69E+01	1.72E+00	2.98E+00	2.65E+00	3.96E+00	1.00E+01	1.84E+01
5723011706H2	Hot-Start	01/17/06	1.06E+00	6.54E+01	1.73E+00	3.05E+00	4.27E+00	6.53E+00	1.00E+01	1.83E+01
5723011706H3	Hot-Start	01/17/06	1.09E+00	6.55E+01	1.85E+00	3.07E+00	2.25E+00	3.44E+00	1.00E+01	1.82E+01
5723011706H4	Hot-Start	01/17/06	1.11E+00	6.46E+01	1.91E+00	3.16E+00	2.32E+00	3.60E+00	9.95E+00	1.82E+01
5723011706H5	Hot-Start	01/18/06	1.09E+00	6.55E+01	1.84E+00	3.07E+00	3.33E+00	5.08E+00	1.00E+01	1.82E+01

Device Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
5723011706C1-H1	Comp 1	01/17/06	6.99E-02	3.64E+00	1.05E-01	2.77E-01	1.48E-01	4.06E+00	5.50E+02	1.83E+01
5723011706C1-H2	Comp 2	01/17/06	6.66E-02	3.59E+00	1.06E-01	2.82E-01	2.25E-01	6.27E+00	5.54E+02	1.82E+01
5723011706C1-H3	Comp 3	01/17/06	6.83E-02	3.61E+00	1.12E-01	2.85E-01	1.31E-01	3.62E+00	5.55E+02	1.81E+01
5723011706C1-H4	Comp 4	01/17/06	6.92E-02	3.57E+00	1.15E-01	2.89E-01	1.34E-01	3.75E+00	5.52E+02	1.81E+01
5723011706C1-H5	Comp 5	01/18/06	6.83E-02	3.61E+00	1.11E-01	2.85E-01	1.81E-01	5.02E+00	5.55E+02	1.81E+01

Mean Device Composite Weighted Value =			**6.85E-02**	**3.61E+00**	**1.10E-01**	**2.84E-01**	**1.64E-01**	**4.54E+00**	**5.53E+02**	**1.82E+01**
Standard Deviation =			**1.26E-03**	**2.56E-02**	**4.28E-03**	**4.20E-03**	**3.97E-02**	**1.11E+00**	**2.08E+00**	**8.24E-02**
			PM	**NOx**	**HC**	**CO**				
Emission Reduction			63.1%	23.9%	68.6%	76.1%				
Degrees of Freedom			2	2	2	2				
CI (upper bound)			**68.5%**	**25.7%**	**73.1%**	**91.2%**				
CI (lower bound)			**57.8%**	**22.2%**	**64.2%**	**61.0%**				
Calculations for Degrees of Freedom			*5.27E-06*	*2.43E-04*	*1.26E-05*	*1.74E-03*				
			1.36E-01	*5.79E-01*	*9.84E-02*	*5.70E-02*				
			5.31E-07	*2.18E-04*	*6.12E-06*	*5.87E-06*				
			2.85E-11	*1.36E-07*	*1.73E-10*	*3.04E-06*				
			1.39E-11	*2.96E-08*	*7.88E-11*	*1.52E-06*				
			1.85E-02	*3.35E-01*	*9.69E-03*	*3.25E-03*				
			1.41E-13	*2.37E-08*	*1.87E-11*	*1.72E-11*				
			1.39E-11	*3.75E-08*	*7.90E-11*	*1.52E-06*				
			2.05E+00	***3.63E+00***	***2.19E+00***	***2.00E+00***				
Calculations for Confidence		*raw*	*6.31E-01*	*2.39E-01*	*6.86E-01*	*7.61E-01*				
		stat #	*4.30E+00*	*4.30E+00*	*4.30E+00*	*4.30E+00*				
			5.27E-06	*2.43E-04*	*1.26E-05*	*1.74E-03*				
			1.36E-01	*5.79E-01*	*9.84E-02*	*5.70E-02*				
			5.31E-07	*2.18E-04*	*6.12E-06*	*5.87E-06*				
		in sqrt	*5.34E-06*	*3.69E-04*	*1.32E-05*	*1.74E-03*				
		sqrt answ	*2.31E-03*	*1.92E-02*	*3.63E-03*	*4.18E-02*				
		divide by	*1.86E-01*	*4.74E+00*	*3.50E-01*	*1.19E+00*				
		bracketed	*5.36E-02*	*1.75E-02*	*4.46E-02*	*1.51E-01*				
		answer uppe	*6.85E-01*	*2.57E-01*	*7.31E-01*	*9.12E-01*				
		answer lowe	*5.78E-01*	*2.22E-01*	*6.42E-01*	*6.10E-01*				

$$\nu = \frac{\left(s_B^2/n_B + \left(1-ER_{RAW}\right)^2 s_F^2/n_F\right)^2}{\left[\left(s_B^2/n_B\right)^2/\left(n_B-1\right)\right] + \left(1-ER_{RAW}\right)^4\left[\left(s_F^2/n_F\right)^2/\left(n_F-1\right)\right]}$$

$$CI\ (upper\ bound) = ER_{RAW} + \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

1999 Navistar 7.3 DIT B250 - OE closed crankcase
PuriNOx with De-greened AZ Purimuffler P/N A17-0213
FTP- HD Transient

Baseline Test

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g	%	kg	bhp-hr
N5700-2C1	Cold-Start	01/13/06	1.55E+00	6.17E+01	4.78E+00	2.43E+01	6.78E+00	1.10E+01	1.03E+01	1.61E+01
N5700-2H1	Hot-Start	01/13/06	1.43E+00	5.87E+01	3.22E+00	1.90E+01	5.05E+00	8.59E+00	1.03E+01	1.63E+01
N5700-2H2	Hot-Start	01/13/06	1.42E+00	5.89E+01	3.27E+00	1.88E+01	5.78E+00	9.81E+00	1.01E+01	1.62E+01
N5700-2H3	Hot-Start	01/13/06	1.44E+00	5.92E+01	3.38E+00	1.84E+01	5.67E+00	9.57E+00	1.02E+01	1.62E+01
N5700-2H4	Hot-Start	01/13/06	1.47E+00	5.84E+01	3.37E+00	1.89E+01	5.83E+00	9.99E+00	1.01E+01	1.62E+01

Baseline Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
N5700-2C1-H1	Comp 1	01/13/06	8.91E-02	3.64E+00	2.12E-01	1.22E+00	3.26E-01	8.94E+00	6.35E+02	1.63E+01
N5700-2C1-H2	Comp 2	01/13/06	8.91E-02	3.67E+00	2.16E-01	1.21E+00	3.66E-01	9.98E+00	6.28E+02	1.62E+01
N5700-2C1-H3	Comp 3	01/13/06	9.00E-02	3.69E+00	2.22E-01	1.19E+00	3.61E-01	9.78E+00	6.32E+02	1.61E+01
N5700-2C1-H4	Comp 4	01/13/06	9.17E-02	3.64E+00	2.21E-01	1.21E+00	3.69E-01	1.01E+01	6.27E+02	1.62E+01
Mean Baseline Composite Weighted Value =			**9.00E-02**	**3.66E+00**	**2.17E-01**	**1.21E+00**	**3.55E-01**	**9.71E+00**	**6.30E+02**	**1.62E+01**
Standard Deviation =			**1.21E-03**	**2.49E-02**	**4.48E-03**	**1.01E-02**	**2.00E-02**	**5.33E-01**	**3.80E+00**	**4.80E-02**

Control Device Test (Degreened)

Test Number	Test Type	Test Date	PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g	g	g	g	g/bhp-hr	%	kg	bhp-hr
N5709-DOCC1	Cold-Start	01/17/06	1.73E+00	5.09E+01	1.42E+01	2.63E+01	1.69E+00	3.32E+00	9.62E+00	1.51E+01
N5709-DOCH1	Hot-Start	01/17/06	9.50E-01	4.90E+01	7.44E+00	1.35E+01	5.36E-01	1.09E+00	9.50E+00	1.53E+01
N5709-DOCH2	Hot-Start	01/17/06	9.64E-01	4.93E+01	8.02E+00	1.34E+01	4.28E-01	8.68E-01	9.52E+00	1.53E+01
N5709-DOCH3	Hot-Start	01/17/06	9.19E-01	4.91E+01	7.38E+00	1.35E+01	1.09E+00	2.21E+00	9.45E+00	1.53E+01
N5709-DOCH4	Hot-Start	01/17/06	9.20E-01	4.88E+01	7.58E+00	1.30E+01	7.82E-01	1.60E+00	9.46E+00	1.53E+01

Device Composite Weighted Value			PM	NOx	HC	CO	NO_2	NO_2/NO_x	CO_2	Work
			g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	g/bhp-hr	%	g/bhp-hr	bhp-hr
N5709-DOCC1-H1	Comp 1	01/17/06	6.95E-02	3.22E+00	5.50E-01	1.01E+00	4.59E-02	1.41E+00	6.23E+02	1.53E+01
N5709-DOCC1-H2	Comp 2	01/17/06	7.03E-02	3.25E+00	5.83E-01	1.00E+00	3.99E-02	1.22E+00	6.24E+02	1.53E+01
N5709-DOCC1-H3	Comp 3	01/17/06	6.78E-02	3.23E+00	5.47E-01	1.00E+00	7.68E-02	2.37E+00	6.20E+02	1.53E+01
N5709-DOCC1-H4	Comp 4	01/17/06	6.77E-02	3.21E+00	5.57E-01	9.74E-01	5.96E-02	1.85E+00	6.20E+02	1.53E+01
Mean Device Composite Weighted Value =			**6.88E-02**	**3.23E+00**	**5.59E-01**	**9.96E-01**	**5.55E-02**	**1.71E+00**	**6.22E+02**	**1.53E+01**
Standard Deviation =			**1.29E-03**	**1.48E-02**	**1.65E-02**	**1.50E-02**	**1.64E-02**	**5.12E-01**	**2.11E+00**	**1.46E-02**

	PM	NOx	HC	CO
Emission Reduction	23.5%	11.8%	-157.2%	17.6%
Degrees of Freedom	2	2	2	2
CI (upper bound)	**27.8%**	**13.7%**	**-108.6%**	**20.9%**
CI (lower bound)	**19.2%**	**9.9%**	**-205.8%**	**14.3%**

Calculations for Degrees of Freedom

$$\nu = \frac{\left(s_B^2/n_B + \left(1-ER_{RAW}\right)^2 s_F^2/n_F\right)^2}{\left[\left(s_B^2/n_B\right)^2/\left(n_B-1\right)\right] + \left(1-ER_{RAW}\right)^4\left[\left(s_F^2/n_F\right)^2/\left(n_F-1\right)\right]}$$

	PM	NOx	HC	CO
	4.91E-07	*2.06E-04*	*6.70E-06*	*3.42E-05*
	5.85E-01	*7.78E-01*	*6.61E+00*	*6.79E-01*
	5.57E-07	*7.34E-05*	*9.02E-05*	*7.45E-05*
	6.68E-13	*6.94E-08*	*3.64E-07*	*7.19E-09*
	1.21E-13	*2.13E-08*	*2.25E-11*	*5.84E-10*
	3.42E-01	*6.06E-01*	*4.37E+01*	*4.61E-01*
	1.55E-13	*2.70E-09*	*4.07E-09*	*2.78E-09*
	1.74E-13	*2.29E-08*	*1.78E-07*	*1.86E-09*
	3.84E+00	***3.03E+00***	***2.04E+00***	***3.86E+00***

Calculations for Confidence

$$CI\ (upper\ bound) = ER_{RAW} + \left\{\left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1-ER_{RAW}\right)^2 \frac{s_F^2}{n_F}}\right) \Big/ \overline{E_B}\right\}$$

	raw	stat #
PM	*2.35E-01*	*4.30E+00*
NOx	*1.18E-01*	*4.30E+00*
HC	*-1.57E+00*	*4.30E+00*
CO	*1.76E-01*	*4.30E+00*
	4.91E-07	
	5.85E-01	
	5.57E-07	

$$CI\ (upper\ bound) = ER_{RAW} + \left\{ \left(t_{\alpha/2} \bullet \sqrt{n_B + (1 - ER_{RAW})^2 \frac{s_F^2}{n_F}} \right) \Big/ E_B \right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{ \left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + (1 - ER_{RAW})^2 \frac{s_F^2}{n_F}} \right) \Big/ E_B \right\}$$

in sqrt	8.17E-07	2.63E-04	6.03E-04	8.48E-05					
sqrt answ	9.04E-04	1.62E-02	2.46E-02	9.21E-03					
divide by	9.00E-02	3.66E+00	2.17E-01	1.21E+00					
bracketed	4.32E-02	1.91E-02	4.86E-01	3.28E-02					
answer uppe	2.78E-01	1.37E-01	-1.09E+00	2.09E-01					
answer lowe	1.92E-01	9.87E-02	-2.06E+00	1.43E-01					

1999 Navistar 7.3 DIT B250 - OE closed crankcase			
PuriNOx with De-greened AZ Purimuffler P/N A17-0213			
SET / ESC Composite Results			
Baseline Test			
			PM
			g/bhp-hr
N5700-ESC1	ESC Comp	01/13/06	5.70E-02
N5700-ESC2	ESC Comp	01/13/06	5.90E-02
Mean Baseline Composite Weighted Value =			**5.80E-02**
Standard Deviation =			**1.41E-03**
Control Device Test (Degreened)			
Device Composite Weighted Value			**PM**
			g/bhp-hr
N5709-DOC-ESC1	ESC Comp	01/17/06	3.10E-02
N5709-DOC-ESC2	ESC Comp	01/17/06	3.00E-02
Mean Device Composite Weighted Value =			**3.05E-02**
Standard Deviation =			**7.07E-04**
			PM
Emission Reduction			47.4%
Degrees of Freedom			2
CI (upper bound)			**53.7%**
CI (lower bound)			**41.2%**
Calculations for Degrees of Freedom			*6.67E-07*
			2.77E-01
			1.67E-07
			5.08E-13
			2.22E-13
			7.65E-02
			1.39E-14
			2.23E-13
			2.28E+00
Calculations for Confidence		*raw*	*4.74E-01*
		stat #	*4.30E+00*
			6.67E-07
			2.77E-01
			1.67E-07
		in sqrt	*7.13E-07*
		sqrt answ	*8.44E-04*
		divide by	*5.80E-02*

$$\nu = \frac{\left(s_B^2 / n_B + \left(1 - ER_{RAW}\right)^2 s_F^2 / n_F\right)^2}{\left[\left(s_B^2 / n_B\right)^2 / \left(n_B - 1\right)\right] + \left(1 - ER_{RAW}\right)^4 \left[\left(s_F^2 / n_F\right)^2 / \left(n_F - 1\right)\right]}$$

$$CI\ (upper\ bound) = ER_{RAW} + \left\{ \left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1 - ER_{RAW}\right)^2 \frac{s_F^2}{n_F}} \right) \Big/ \overline{E_B} \right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{ \left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1 - ER_{RAW}\right)^2 \frac{s_F^2}{n_F}} \right) \Big/ \overline{E_B} \right\}$$

$$CI\ (lower\ bound) = ER_{RAW} - \left\{ \left(t_{\alpha/2} \bullet \sqrt{\frac{s_B^2}{n_B} + \left(1 - ER_{RAW}\right)^2 \frac{s_F^2}{n_F}} \right) \Big/ \overline{E_B} \right\}$$

bracketed	6.26E-02
answer uppe	5.37E-01
answer lowe	4.12E-01

NOx	**HC**	**CO**	**NO_2**	**NO_2/NO_x**	**CO_2**
g/bhp-hr	**g/bhp-hr**	**g/bhp-hr**	**g/bhp-hr**	**%**	**g/bhp-hr**
3.78E+00	1.20E-01	5.50E-01	2.70E-01	7%	6.01E+02
3.82E+00	1.20E-01	5.50E-01	2.70E-01	7%	5.94E+02
3.80E+00	**1.20E-01**	**5.50E-01**	**2.70E-01**	**7.11E-02**	**5.98E+02**
2.83E-02	**0.00E+00**	**0.00E+00**	**0.00E+00**	**5.29E-04**	**4.95E+00**
NOx	**HC**	**CO**	**NO_2**	**NO_2/NO_x**	**CO_2**
g/bhp-hr	**g/bhp-hr**	**g/bhp-hr**	**g/bhp-hr**	**%**	**g/bhp-hr**
3.13E+00	9.00E-02	2.00E-02	6.00E-01	19%	5.92E+02
3.11E+00	9.00E-02	3.00E-02	5.40E-01	17%	5.99E+02
3.12E+00	**9.00E-02**	**2.50E-02**	**5.70E-01**	**1.83E-01**	**5.96E+02**
1.41E-02	**0.00E+00**	**7.07E-03**	**4.24E-02**	**1.28E-02**	**4.95E+00**
NOx	**HC**	**CO**			
17.9%	25.0%	95.5%			
2	2	2			
19.9%	**25.0%**	**95.6%**			
15.9%	**25.0%**	**95.3%**			
2.67E-04	*0.00E+00*	*0.00E+00*			
6.74E-01	*5.63E-01*	*2.07E-03*			
6.67E-05	*0.00E+00*	*1.67E-05*			
9.71E-08	*0.00E+00*	*1.19E-15*			
3.56E-08	*0.00E+00*	*0.00E+00*			
4.54E-01	*3.16E-01*	*4.27E-06*			
2.22E-09	*0.00E+00*	*1.39E-10*			
3.66E-08	*0.00E+00*	*5.93E-16*			
2.66E+00	***#DIV/0!***	***2.00E+00***			
1.79E-01	*2.50E-01*	*9.55E-01*			
4.30E+00	*4.30E+00*	*4.30E+00*			
2.67E-04	*0.00E+00*	*0.00E+00*			
6.74E-01	*5.63E-01*	*2.07E-03*			
6.67E-05	*0.00E+00*	*1.67E-05*			
3.12E-04	*0.00E+00*	*3.44E-08*			
1.77E-02	*0.00E+00*	*1.86E-04*			
3.80E+00	*1.20E-01*	*5.50E-01*			

2.00E-02	0.00E+00	1.45E-03			
1.99E-01	2.50E-01	9.56E-01			
1.59E-01	2.50E-01	9.53E-01			

Manufacturer Name
Manufacturer Code
Mfr Contact1 - First Name
Mfr Contact1 - Last Name
Address1
Address2
Address3
City
State
Zip
Mfr Contact1 - Email
Contact1 Phone Number 1
Contact1 Ph. No. 1 Type
Contact1 Phone Number 2
Contact1 Ph. No. 2 Type
Contact1 Phone Number 3
Contact1 Ph. No. 3 Type
Mfr Contact2 - First Name
Mfr Contact2 - Last Name
Mfr Contact2 - Email
Contact2 Phone Number 1
Contact2 Ph. No. 1 Type
Contact2 Phone Number 2
Contact2 Ph. No. 2 Type
Contact2 Phone Number 3
Contact2 Ph. No. 3 Type
Notes

Revision 2

Manufacturer Name	Engine Control Systems Limited
Manufacturer Code	
Mfr Contact1 - First Name	Kevin
Mfr Contact1 - Last Name	Brown
Address1	165 Pony Drive
Address2	
Address3	
City	Newmarket
State	Ontario, Canada
Zip	L3Y 7V1
Mfr Contact1 - Email	kfb@enginecontrolsystems.com
Contact1 Phone Number 1	(905) 853-5500 ext 316
Contact1 Ph. No. 1 Type	desk via switchboard
Contact1 Phone Number 2	(905) 952-2441
Contact1 Ph. No. 2 Type	desk direct line
Contact1 Phone Number 3	(905) 853-5801
Contact1 Ph. No. 3 Type	fax
Mfr Contact2 - First Name	Ted
Mfr Contact2 - Last Name	Tadrous
Mfr Contact2 - Email	tnta@enginecontrolsystems.com
Contact2 Phone Number 1	(905) 853-5500 X332
Contact2 Ph. No. 1 Type	desk via switchboard
Contact2 Phone Number 2	(905) 853-5801
Contact2 Ph. No. 2 Type	fax
Contact2 Phone Number 3	
Contact2 Ph. No. 3 Type	
Notes	Normal business hours are 8:30 am to 4:30 pm location is on EST

Revision 2

Product Name
Product Number
Product Version
Submission Type
Technology Type
Product Description
Application Category
Application SubCategory
Application Engines
Application Boxes
Exhaust - Minimum Temp.
Exhaust - Minimum Temp.
Exhaust - Minimum Time at Temp.
Exhaust - Minimum Time at Temp. Units
Exhaust - Minimum Time and Temp. - Supporting Data
Engine Operating Conditions
Regeneration Type
Regeneration Description
Engine Performance Effects
Fuel Consumption Effects
Engine Backpressure Effects
Oil Consumption Effects
Secondary Emissions
Secondary Emissions Procedures
Fuel Requirements
Fuel Sulfur Requirements
Misfueling Considerations
Maintenance Requirement 1
Maintenance Requirement 1 - Interval
Maintenance Requirement 2
Maintenance Requirement 2 - Interval
Maintenance Requirement 3
Maintenance Requirement 3 - Interval
Maintenance Requirement 4
Maintenance Requirement 4 - Interval
Useful Life
Useful Life Units
Est. Date 500 Sold

In-Use Test Plan
Warranty
Operating Instructions
Installation Requirements
Installation Procedure
Product Label
Contact for Replacement Parts and Supplies
Failure Modes
Safety Issues
Engine Manufacturer Comments
Notes
Claimed THC Reduction
Claimed CO Reduction
Claimed NOx Reduction
Claimed PM Reduction
Emissions Reductions Supplementary Data
Reagent Consumption Rate
Reagent Consumption Rate Units
Reagent Replensishment Interval

Revision 2

Lubrizol Engine Control Systems

Purifilter Verification Application

Product Name	AZ Purifier			
Product Number	part numbers A16-0001 thru A16-9999			
Product Version	Original DEC7-C formulation verified by EPA			
Submission Type	extension			
Technology Type	Diesel Oxidation Catalyst in converter format			
Product Description	Corning or NGK Cordierite large frontal area monoliths (300 cpsi for all HD converters)	Substrates coated by Delphi Catalyst Operations in Tulsa, OK (formerly ASEC) with zeolite/alumina washcoat and Pt loading of 10 g/ft3	Converter Muffler Design, Manufacturing by Lubrizol Engine Control Systems in Newmarket, Ontario, Canada or Reno, Nevada	
Application Category	On-hwy			
Application SubCategory	HHDE			
Application Engines	as per DOC Design Guide worksheet			
Application Boxes	OH-4, OH-5, OH-7, OH-10			
Exhaust - Minimum Temp.	none			
Exhaust - Minimum Temp.	degrees Celsius			
Exhaust - Minimum Time at Temp.	not applicable			
Exhaust - Minimum Time at Temp. Units	percent			
Exhaust - Minimum Time and Temp. - Supporting Data	not applicable			
Engine Operating Conditions	The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer. The engine must be operated with a fuel that contains a sulfur content of no more than 30 ppm.			
Regeneration Type	not applicable			
Regeneration Description	not applicable			
Engine Performance Effects	0 - 3% performance loss			
Fuel Consumption Effects	0-1% fuel consumption increase			
Engine Backpressure Effects	will not exceed engine manufacturer's maximum allowable exhaust restriction			
Oil Consumption Effects	No effects on oil consumption should be observed			
Secondary Emissions	none known			
Secondary Emissions Procedures				
Fuel Requirements	Highway Diesel Fuel blends; biodiesel; e-diesel, Fischer-Tropsch, emulsion			
Fuel Sulfur Requirements	<30ppm			
Misfueling Considerations	reduced PM reduction, potential for sulfate production			
Maintenance Requirement 1	inspection of exhaust system for presence of oil,			
Maintenance Requirement 1 - Interval	procedure should be performed I) at prescribed preventative maintenance periods recommended by Engine Manufacturer, ii) when blue smoke is observed..			
Maintenance Requirement 2	check device mounting and exhaust connections			
Maintenance Requirement 2 - Interval	every preventative maintenance			
Maintenance Requirement 3				

Lubrizol Engine Control Systems

Purifilter Verification Application

Maintenance Requirement 3 - Interval				
Maintenance Requirement 4				
Maintenance Requirement 4 - Interval				
Useful Life	150,000 miles or 4 years, whichever may come first			
Useful Life Units	miles / years			
Est. Date 500 Sold				
In-Use Test Plan				
Warranty	Manufacturing defect warranty of 2 years	GVWR >33,000 lbs:emissions performance warranty of 150,000 miles or 4 years, whichever shall come first.	GVWR >14,000lbs and <33,000 lbs:emissions performance warranty of 100,000 miles or 4 years, whichever shall come first.	GVWR <14,000lbs: emissions performance warranty of 50,000 miles or 4 years, whichever shall come first
Operating Instructions	as per product manual- see attached			
Installation Requirements	Installation will take 1 to 2 hours, Units typically installed 12 to 18" ahead of original muffler.Refer to the manual for example inst			
Installation Procedure	as per product manual- see previous extension application			
Product Label	same as current			
Contact for Replacement Parts and Supplies	Eastern US Customer Service Line- 1-800-661-9963 , Western US Customer Service Line: 1-800-331-9247			
Failure Modes	plugging as indicated by exhaust restriction higher than maximum allowed by engine manufacturer or loss of substrate retention			
Safety Issues	loss of fuel injector tip may cause ignition of unburnt fuel over catalyst			
Engine Manufacturer Comments	competitive product, engine manufacturer comments not being sought			
Notes	See AZ Catalyst Design Guide			
Claimed THC Reduction	see emulsion prod info			
Claimed CO Reduction	see emulsion prod info			
Claimed NOx Reduction	see emulsion prod info			
Claimed PM Reduction	see emulsion prod info			
Emissions Reductions Supplementary Data	see attached sheets			
Reagent Consumption Rate	not applicable			
Reagent Consumption Rate Units	not applicable			
Reagent Replensishment Interval	not applicable			
Revision 2				

Lubrizol Engine Control Systems

Purifilter Verification Application

Product Name	AZ Purimuffler			
Product Number	part numbers A17-0001 thru A17-9999; A18 pre-fix code indicated part is UL spark arresting			
Product Version	Original DEC7-C			
Submission Type				
Technology Type	Diesel Oxidation Catalyst in converter muffler format			
Product Description	Corning or NGK Cordierite large frontal area monoliths (300 cpsi for all HD converter muffler models except for 3xAZ26 which uses a 350 cpsi thin wall substrate- 350 cpsi has cell with same cell area only thinner cell walls)	Substrates coated by Delphi Catalyst Operations in Tulsa, OK (formerly ASEC) with zeolite/alumina washcoat and Pt loading of 10 g/ft3	Converter Muffler Design, Manufacturing by Lubrizol Engine Control Systems in Newmarket, Ontario, Canada or Reno, Nevada	
Application Category	On-hwy			
Application SubCategory	HHDE			
Application Engines	as per information in DOC Design Guide worksheet			
Application Boxes	OH-4, OH-5, OH-7, OH-10			
Exhaust - Minimum Temp.	none			
Exhaust - Minimum Temp.	degrees Celsius			
Exhaust - Minimum Time at Temp.	not applicable			
Exhaust - Minimum Time at Temp. Units	percent			
Exhaust - Minimum Time and Temp. - Supporting Data	not applicable			
Engine Operating Conditions	The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer. The engine must be operated with a fuel that contains a sulfur content of no more than 30 ppm.			
Regeneration Type	not applicable			
Regeneration Description	not applicable			
Engine Performance Effects	0 - 3% performance loss			
Fuel Consumption Effects	0-1% fuel consumption increase			
Engine Backpressure Effects	will not exceed engine manufacturer's maximum allowable exhaust restriction			
Oil Consumption Effects	No effects on oil consumption should be observed			
Secondary Emissions	none known			
Secondary Emissions Procedures				
Fuel Requirements	Highway Diesel Fuel blends; biodiesel; e-diesel; Fischer-Tropsch			
Fuel Sulfur Requirements	<30ppm			
Misfueling Considerations	reduced PM reduction, potential for sulfate production			
Maintenance Requirement 1	inspection of exhaust system for presence of oil,			
Maintenance Requirement 1 - Interval	procedure should be performed I) at prescribed preventative maintenance periods recommended by Engine Manufacturer, ii) when blue smoke is observed..			
Maintenance Requirement 2	check device mounting and exhaust connections			
Maintenance Requirement 2 - Interval	every preventative maintenance			
Maintenance Requirement 3				

Lubrizol Engine Control Systems

Purifilter Verification Application

Maintenance Requirement 3 - Interval				
Maintenance Requirement 4				
Maintenance Requirement 4 - Interval				
Useful Life	150,000 miles or 4 years, whichever may come first			
Useful Life Units	miles / years			
Est. Date 500 Sold	Summer 2004			
In-Use Test Plan	recovery of selected purifier and purimuffler units from school buses or other trucks during summer of 2004			
Warranty	Manufacturing defect warranty of 2 years	GVWR >33,000 lbs:emissions performance warranty of 150,000 miles or 4 years, whichever shall come first.	GVWR >14,000lbs and <33,000 lbs:emissions performance warranty of 100,000 miles or 4 years, whichever shall come first.	GVWR <14,000lbs: emissions performance warranty of 50,000 miles or 4 years, whichever shall come first
Operating Instructions	as per product manual- see attached			
Installation Requirements	Installation will take 30 minutes to 1 hour, Units typically installed in place of original muffler.Refer to the manual for example inst			
Installation Procedure	as per product manual- see attached			
Product Label	attached			
Contact for Replacement Parts and Supplies	Eastern US Customer Service Line- 1-800-661-9963 , Western US Customer Service Line: 1-800-331-9247			
Failure Modes	plugging as indicated by exhaust restriction higher than maximum allowed by engine manufacturer or loss of substrate retention			
Safety Issues	loss of fuel injector tip may cause ignition of unburnt fuel over catalyst			
Engine Manufacturer Comments	competitive product, engine manufacturer comments not being sought			
Notes	See AZ Catalyst Design Guide for Muffler Types and Cross Sections			
Claimed THC Reduction	see emulsion prod info			
Claimed CO Reduction	see emulsion prod info			
Claimed NOx Reduction	see emulsion prod info			
Claimed PM Reduction	see emulsion prod info			
Emissions Reductions Supplementary Data	see attached sheets			
Reagent Consumption Rate	not applicable			
Reagent Consumption Rate Units	not applicable			
Reagent Replensishment Interval	not applicable			
Revision 2				

					PURIFIER / Converter format		PURIMUFFLER / Converter Muffler format								
AZ Model	Catalyst Configuration	Catalyst Dimensions (dia. X length-inches)	Catalyst Volume (Liters)	Cell Density (cpsi)	Inlet / Outlet Pipe Diameter (in.)	Engine Intake Air Flow Range (SCFM)	Inlet / Outlet Pipe Diameter (in.)	Engine Intake Air Flow Range (SCFM)	Four stroke Engine Displacement Range***	Maximum Engine Speed (rpm)	Typical Muffler Types	Typical Muffler Cross Section	Engine Family Examples	Service Class	PRODUCT SIZING
25		5.66 x 4.66	1.9	350	all	120 - 170	all	120 - 170	<2.2 L	all	1,2, 6, 9, 10	6"	light duty passenger car only		Step 1: If available, use the actual Engine Intake Airflow (SCFM) from the original engine manufacturer (OEM) and locate this value in the sizing chart (left). If you do not have the actual OEM Engine Intake Airflow (SCFM), but have the Exhaust Airflow (SCFM), divide this value by 2.2 to determine the approximate Intake Airflow. The approximate Engine Intake Airflow can also be obtained using the general
26		5.66 x 6	2.5	350	all	150 - 205	all	150 - 205	2.2 to 3.3 L	all	1,2, 6, 9, 10	6"	light duty passenger car only		
27		7.5 x 5	3.6	300	3	200 - 320	3	200 - 320	3.3 to 4.8 L	2100 to 2600	1,2,6,9,10	8" round	Cummins B3.9, Hino 3.8, Isuzu 4BD2TC, Mercedes OM364LA, Mitsubishi 4D34T3, Nissan TD42T1, Perkins 110TI,	LHD, MHD	
					3.5	200 - 360	3.5	200 - 360				9" round			
					4	200 - 360	4	200 - 375							
28		7.5 x 7	5.1	300	3.5	315 - 400	3.5	315 - 490	4.8 to 6.6 L	2100 to 2600	1, 2, 6, 9, 10	8", 9" round	Caterpillar 3116, Cummins B5.9, ISB, GM 6.2, 6.5, Hino 6.5, Isuzu 6.5, Mercedes OM366LA, Mack/Renault E3, Mitsubishi 6D31T2, Navistar DT360, Perkins 180TI		Step 2: If the Engine Intake Airflow is found in the range of two models of purifier or purimuffler, exhaust backpressure and equipment duty cycle should be used as a guide to choose the appropriate product model. In general, the larger model purifier or purimuffler will provide improved emissions reductions and lower exhaust backpressure.
					4	315 - 425	4	315 - 515				10, 11" round			
					4.5	315 - 480	4	315 - 515				8.25x11.5 oval 9" x14" oval			
29	**1 X AZ29**	9.5 x 6	7	300	4	380 - 555	4	450 - 650	6.7 to 8.8 L	2000 to 2600	1,2,6,9,10	10", 11" round	Caterpillar 3126, Cummins C8.3, ISC, ISL,Detroit Series 50, Ford 7.8, Isuzu 6HE1XN, Mitsubishi 6D16T, Navistar DT406, DT444, DT466, DT530, 7.3, Nissan FE6TA, Volvo D7,	LHD, MHD, HHD	Engine Intake Airflow (SCFM) = Exhaust Flow / 2.2
					4.5	460 - 615	4.5	450 - 685				12" x15" oval			
					5	450 - 665	5	450 - 690							
	2 X AZ27	7.5 x 5	7.2	300	Not Applicable		3	450 - 600	6.7 to 8.8 L	2000 to 2600	2,3, 4,6,9	10" x15" oval 9" x 14" oval			
							3.5	450 - 620							
							4	450 - 650							
							5	450 - 690							
	3 X AZ26	5.66x6	7.5	350	Not Applicable		3	450 - 600	6.7 to 8.8 L	2000 to 2600	2.3, 4,6,9	8.25"x11.5" oval 10" x15" oval 10" round			
							3.5	450 - 620							
							4	450 - 650							
							5	450 - 690							
30		10.5 x 6	8.5	300	4	550 - 650	4	675 - 800	8.8 to 11.1 L	1800 to 2300	1,2,3,4,6,9,10	11" round	Caterpillar C10, 3176, 3306, Cummins ISL, L10, M11, ISM, Detroit Series 60 (11.1L), Mercedes OM449LA,	HHD	or
					4.5	580 - 700	4.5	675 - 830				12" x15" oval			= [Engine Displacement in Liters X RPM X V_E] / 14.16 X Engir
					5	630 - 750	5	675 - 865							
31	**1 X AZ31**	11.25 x 6	9.8	300	5	730 - 1050	5	800 - 1050	10 to 13 L	1800 to 2300	1,2,4,6,9,10	12" round 12"x15" oval	Caterpillar 3176, C12, 3306, 3406, Cummins M11. ISM, N14, ISX, Detroit Series 60, 6V71, 6L71, Mack E7, Mercedes OM447LA, Volvo D12,		Where RPM = maximum rated or governed engine speed
	2 X AZ28	2 (7.5 x 7)	10.2	300	Not Applicable		4	630 - 1030	10 to 14 L	1800 to 2300	2,4,6,9	10"x15" oval			V_E = 2 for turbocharged engines with charge air cooling
							5	630 - 1100							
	3 X AZ27	3 (7.5 x 5)	10.8	300			4	630 - 1030	10 to 14.6 L	1800 to 2300	2,4,6,9	10" round			Notes:
							5	630 - 1140				10"x15" oval			Engine Cycle = 4 for Four Stroke Engines; 2 for Two Stroke Engines
33	**1 X AZ33**	12.5 x 6	12	300	5	1000 - 1250	5	1000 - 1250	12.5 to 15.8 L	1800 to 2100	1,2,6,9,10	13" round 14" round	High Power ratings (>500hp) of Caterpillar 3406, C15, Cummins N14, ISX. Detroit Series 60, Detroit 6V92TA, Mack E7,		V_E = 0.85 for normally aspirated four stroke engines
	2 X AZ29	2 (9.5 x 6)	14	300	Not Applicable		5	1100 - 1400	12 to 16 L	1800 to 2100	2,4,6,9	12"x23" oval, 12"x15" oval			* For exhaust systems with dual converter mufflers or a single converter muffler containing dual substrates
	3 X AZ28	3 (7.5 x 7)	15.3	300	Not Applicable		5	1100 - 1400	12 to 16 L	1800 to 2100	2,4,6,9	10"x15" oval, 12"x14" racetrack			** For single converter mufflers containing three substrates
2xAZ30*	**2XAZ30**	2(10.5x6)	17	300	Not Applicable		5	1400 - 1700	16 to 20 L	1800 to 2100	2,4,6,9	12" x15" oval	Detroit 8V92TA, Mack E9,		*** assumes maximum rpm of 2100 and Volumetric Efficiency of 2- actual values vary

ne Cycle

Test Number	2316120605C1	2316120605H1	2316120605H2	2316120605H3
Test Date				
Test Time				
Test Type	HD FTP			
Test Cycle	Cold Start	Hot Start 1	Hot Start 2	Hot Start 3
Test Reason 1	baseline	baseline	baseline	baseline
Test Reason2	de-greened;			
Test Purpose				
Test Procedure	40CFR part 86, Subpart N with ARB NO2 measure protocol			
Test Device Age	de-greened- 15;			
Test Device Age Units	hrs			
Test Device History	Model AZ31; de-greened for 15 hrs on test engine over 3 mode c			
Test Engine Family Name	WDDXH12.7EGD			
Test Engine ID	serial #: 06R0422316			
Test Engine Model	Series 60; Model: 6067TK60			
Test Engine Manufacturer	Detroit Diesel Corp.			
Test Engine Type	4 cycle			
Test Eng. PM Cert. Category	0.10 g/hp-hr			
Test Engine CertificationType	On-hwy			
Test Engine - Model Year	1998			
Test Engine - Date Manufactured	April 1998			
Test Eng. - Rated Hp	400			
Test Eng. - Displacement	12.7L			
Test Fuel	baseline: <15ppm; controlled <15 ppm,			
Test Fuel Sulfur Level	baseline: <15ppm; controlled <15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell	16			
Test results units	g/bhp-hr			
HC/OMHCE	0.463	0.183	0.167	0.177
CO	2.373	1.372	1.344	1.357
NOx	3.708	3.576	3.546	3.518
PM	0.105	0.075	0.073	0.072
CO2	588	556	562	560
Reference Work				
Reference Work Units	hp-hr			
Work	30.04	29.65	29.57	29.57
Work Units	hp-hr			
NMHC/ONMHCE				
HC + NOx				
Formaldehyde				

NO2		0.268	0.242	0.261	0.244
Exhaust Backpressure		2.8			
Exhaust Backpressure Units	"Hg				
Max Exhaust Temperature					
Max Exhaust Temperature Units	degrees F				
Exhaust Flow					
Exhaust Flow Units					
Fuel Consumption		0.428	0.402	0.397	0.398
Fuel Consumption Units	lb/hp-hr				
PM SOF (%)		67%	38%	39%	37%
Test Engine Power		400			
Test Engine Power Units	hp				
Peak Torque		1550			
Peak Torque Units	lb-ft				
Test Comments	AZ Purimuffler Part Number: A17-0527				
	De-greened unit:				

Revision 2

2316120605H4		2316121905-C1	2316121915-H1	2316121915-H2	2316121915-H3	2316121915-H4
Hot Start 4 baseline	Weighted baseline	Cold Start de-greened	Hot Start 1 de-greened	Hot Start 2 de-greened	Hot Start 3 de-greened	Hot Start 4 de-greened

cycle at SwRI; previously used with Cummins FTP testing

0.211	0.22	0.627	0.107	0.098	0.096	0.114
1.344	1.50	2.390	0.281	0.290	0.248	0.301
3.587	3.58	3.143	3.037	2.984	3.008	2.953
0.075	0.078	0.120	0.028	0.028	0.025	0.027
562	564	597	562	561	561	558
29.6	29.66	27.66	27.44	27.35	27.36	27.34

	0.241	0.25	0.204	0.256	0.260	0.275	0.269
		"Hg					
		degrees F					
		0.403	0.417	0.389	0.389	0.389	0.387
no test		tbd	tbd	tbd	tbd	tbd	
		hp					
		lb-ft					

2316121915-H5

Hot Start 5 de-greened	Weighted de-greened	Percent Reduction

		Percent Reduction
0.097	0.18	18%
0.249	0.58	61%
2.988	3.02	16%
0.027	0.04	49%
568	567	-0.5%
27.36	27.41	

	0.283	0.260
	0.394	0.394
tbd	tbd	

Test Number	2316120605C1	2316120605H1	2316120605H2	2316120605H3
Test Date				
Test Time				
Test Type	HD FTP			
Test Cycle	Cold Start	Hot Start 1	Hot Start 2	Hot Start 3
Test Reason 1	baseline	baseline	baseline	baseline
Test Reason2	de-greened;			
Test Purpose				
Test Procedure	40CFR part 86, Subpart N with ARB NO2 measure protocol			
Test Device Age	de-greened- 15;			
Test Device Age Units	hrs			
Test Device History	Model AZ31; de-greened for 15 hrs on test engine over 3 mode c			
Test Engine Family Name	WDDXH12.7EGD			
Test Engine ID	serial #: 06R0422316			
Test Engine Model	Series 60; Model: 6067TK60			
Test Engine Manufacturer	Detroit Diesel Corp.			
Test Engine Type	4 cycle			
Test Eng. PM Cert. Category	0.10 g/hp-hr			
Test Engine CertificationType	On-hwy			
Test Engine - Model Year	1998			
Test Engine - Date Manufactured	April 1998			
Test Eng. - Rated Hp	400			
Test Eng. - Displacement	12.7L			
Test Fuel	baseline: <15ppm; controlled <15 ppm,			
Test Fuel Sulfur Level	baseline: <15ppm; controlled <15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell	16			
Test results units	g/bhp-hr			
HC/OMHCE	0.463	0.183	0.167	0.177
CO	2.373	1.372	1.344	1.357
NOx	3.708	3.576	3.546	3.518
PM	0.105	0.075	0.073	0.072
PM + Blowby	0.113	0.09	0.089	0.088
CO2	588	556	562	560
Reference Work				
Reference Work Units	hp-hr			
Work	30.04	29.65	29.57	29.57
Work Units	hp-hr			
NMHC/ONMHCE				
HC + NOx				

Formaldehyde					
NO2		0.268	0.242	0.261	0.244
Exhaust Backpressure		2.8			
Exhaust Backpressure Units	"Hg				
Max Exhaust Temperature					
Max Exhaust Temperature Units	degrees F				
Exhaust Flow					
Exhaust Flow Units					
Fuel Consumption		0.428	0.402	0.397	0.398
Fuel Consumption Units	lb/hp-hr				
PM SOF (%)		67%	38%	39%	37%
Test Engine Power		400			
Test Engine Power Units	hp				
Peak Torque		1550			
Peak Torque Units	lb-ft				
Test Comments	AZ Purimuffler Part Number: A17-0527 De-greened unit: ECS CCV6000				

2316120605H4		2316121605-C1	2316121605-H1	2316121605-H2	2316121605-H3	2316121605-H4
Hot Start 4 baseline	Weighted baseline	Cold Start de-greened	Hot Start 1 de-greened	Hot Start 2 de-greened	Hot Start 3 de-greened	Hot Start 4 de-greened

cycle at SwRI; previously used with Cummins FTP testing

0.211	0.22	0.600	0.115	0.116	0.133	0.145
1.344	1.50	2.293	0.320	0.392	0.372	0.425
3.587	3.58	3.004	2.972	2.979	2.904	2.907
0.075	0.078	0.105	0.03	0.025	0.029	0.03
0.091	0.093	0.105	0.03	0.025	0.029	0.03
562	564	601	571	568	574	555
29.6	29.66	27.56	27.43	27.4	27.4	27.42

	0.241	0.25	0.203	0.252	0.265	0.250	0.255
		"Hg					
		degrees F					
		0.403	0.420	0.396	0.394	0.399	0.385
no test		tbd	tbd	tbd	tbd	tbd	
		hp					
		lb-ft					

2316121605-H5

Hot Start 5 de-greened	Weighted de-greened	Percent Reduction
		Percent Reduction
0.159	0.20	9%
0.454	0.66	56%
2.905	2.94	18%
0.026	0.039	50%
0.026	0.039	58%
571	573	-1.6%
27.46	27.44	

	0.250	0.240
	0.396	0.398
tbd	tbd	

Test Number				
Test Date				
Test Time				
Test Type				
	Baseline	Baseline	Baseline	Baseline
Test Cycle	ESC			
Test Reason 1				
Test Reason2	de-greened DOC with emulsion;			
Test Order	1	2	3	4
Engine Speed (rpm)				
	600	1186	1401	1403
Target Load (%)	0	100	50	75
Torque (lb-ft)	0	1575	802	1209
Test Purpose				
Test Procedure				
Test Device Age	de-greened- 15;			
Test Device Age Units	hrs			
Test Device History	Model AZ31; de-greened for 15 hrs on test engine over 3			
Test Engine Family Name	WDDXH12.7EGD			
Test Engine ID	serial #: 06R0422316			
Test Engine Model	Series 60; Model: 6067TK60			
Test Engine Manufacturer	Detroit Diesel Corp.			
Test Engine Type	4 cycle			
Test Eng. PM Cert. Category	0.10 g/hp-hr			
Test Engine CertificationType	On-hwy			
Test Engine - Model Year	1998			
Test Engine - Date Manufactured	April 1998			
Test Eng. - Rated Hp	400			
Test Eng. - Displacement	12.7L			
Test Fuel	baseline: <15ppm; controlled Emulsion<15 ppm,			
Test Fuel Sulfur Level	baseline: <15ppm; controlled Emulsion<15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell	16			
Test results units	g/bhp-hr			
HC/OMHCE	na	0.00	0.00	0.00
CO	na	0.55	0.22	0.29
NOx	na	6.20	7.24	6.95
PM	na	na	na	na
CO2	na	455	450	440

Reference Work					
Reference Work Units	hp-hr				
Work					
Work Units	hp-hr				
NMHC/ONMHCE					
HC + NOx					
Formaldehyde					
NO2 (%)		na	3%	3%	4%
Exhaust Backpressure		2.8			
Exhaust Backpressure Units	"Hg				
Max Exhaust Temperature					
Max Exhaust Temperature Units	degrees F				
Exhaust Flow					
Exhaust Flow Units					
Fuel Consumption		2.0	112.6	67.0	98.8
Fuel Consumption Units	lb/hr				
PM SOF (%)					
Test Engine Power		400			
Test Engine Power Units	hp				
Peak Torque		1550			
Peak Torque Units	lb-ft				
Test Comments	AZ Purimuffler Part Number: A17-0527 De-greened unit: ECS CCV6000				

Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
5	6	7	8	9	10	11	12
1185	1184	1185	1401	1402	1621	1619	1620
50	75	25	100	25	100	25	75
785	1184	396	1606	401	1435	354	1076

mode cycle at SwRI; previously used with Cummins FTP testing

0.05	0.05	0.21	0.03	0.11	0.02	0.05	0.00
0.35	0.69	0.46	0.23	0.50	0.18	0.61	0.18
6.44	6.42	7.19	6.31	6.63	5.61	5.79	5.99
na	na	na	na	na	na	na	na
459	448	478	448	482	464	510	451

2%	3%	6%	4%	6%	3%	8%	4%
56.6	83.5	29.8	133.6	36.0	142.9	38.8	104.1

Baseline	Baseline	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC
13	Composite	1	2	3	4	5	6
1621	Baseline	600	1184	1402	1402	1186	1184
50		0	100	50	75	50	75
717		0	1386	784	1163	777	1102
0.00	0.02	na	0.01	0.01	0.01	0.00	0.01
0.20	0.34	na	0.03	0.04	0.03	0.04	0.03
6.21	6.40	na	4.94	6.55	5.57	5.83	5.55
na	0.018	na	na	na	na	na	na
453	457	na	448	464	440	465	448

4%	4%	na	23%	26%	24%	33%	28%
69.8							

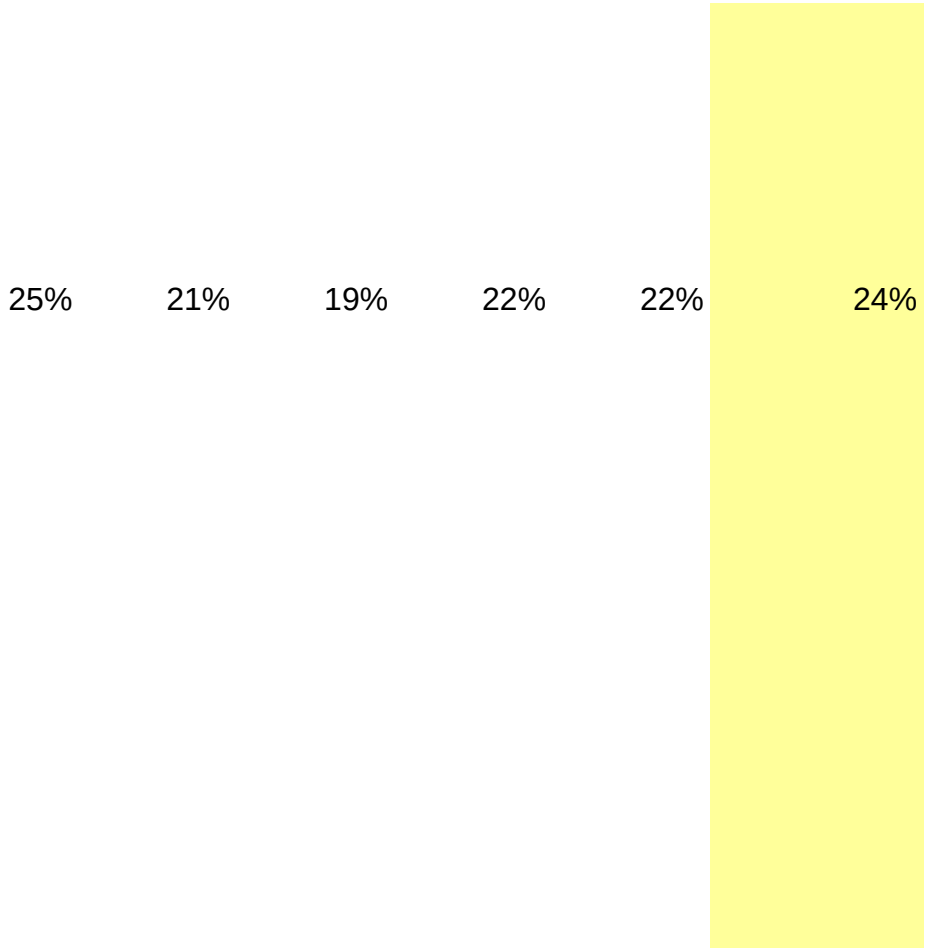
Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC	Emulsion & DOC
7	8	9	10	11	12	13	Composite Emulsion & DOC
1185	1402	1401	1619	1619	1620	1621	
25	100	25	100	25	75	50	
386	1392	384	1242	354	1054	678	
							Composite (
0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01
0.06	0.03	0.05	0.03	0.06	0.03	0.03	0.03
6.36	5.05	6.03	4.54	5.14	4.70	5.40	5.33
na	na	na	na	na	na	na	0.006
498	450	486	465	527	460	489	462

29% 23% 25% 22% 19% 21% 22% 24%

	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)
	1	2	3	4	5	6	7	8
	600	1185	1400	1403	1184	1184	1182	1401
	0	100	50	75	50	75	25	100
	0	1390	778	1152	767	1061	381	1405
(1)								
	na	0.01	0.01	0.01	0.00	0.01	0.00	0.01
	na	0.02	0.02	0.02	0.03	0.03	0.05	0.02
	na	5.02	6.67	5.73	6.04	5.92	6.45	5.13
	na	na	na	na	na	na	na	na
	na	448	469	442	473	469	507	445

na	22%	26%	24%	32%	27%	30%	23%

Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)
9	10	11	12	13	Composite Emulsion & DOC
1400	1620	1619	1619	1619	
25	100	25	75	50	
397	1251	352	1064	709	
0.01	0.01	0.03	0.01	0.01	0.01
0.05	0.03	0.05	0.03	0.03	0.03
5.90	4.61	5.00	4.78	5.23	5.42
na	na	na	na	na	0.009
499	459	523	460	468	462


25%
21%
19%
22%
22%
24%

Test Number	5723011306C1	5723011306H1	’23011306H2	23011306H3
Test Date	1/13/2006	1/13/2006	1/13/2006	1/13/2006
Test Time				
Test Type	HD FTP			
Test Cycle	Cold Start	Hot Start 1	Hot Start 2	Hot Start 3
Test Reason 1	baseline	baseline	baseline	baseline
Test Reason2	de-greened; aged			
Test Purpose				
Test Procedure	40CFR part 86, Subpart N with ARB NO2 measurement and blowby			
Test Device Age	DOC: de-greened- 25; aged ca. 12 months			
Test Device Age Units	hrs / months			
Test Device History	Model AZ29; originally de-greened for 25 hrs at ECS on a 1995 DD(			
Test Engine Family Name	MCE0505FAA2			
Test Engine ID	serial- 44535723, CPL-1262			
Test Engine Model	6CTA8.3: D41			
Test Engine Manufacturer	Cummins Engine Company			
Test Engine Type	4 cycle			
Test Eng. PM Cert. Category	0.25 g/bhp-hr			
Test Engine CertificationType	On-hwy			
Test Engine - Model Year	1990	engine has 1991 hwy calibration and comp		
Test Engine - Date Manufactured	1990			
Test Eng. - Rated Hp	275			
Test Eng. - Displacement	8.3L			
Test Fuel	Baseline: ULSD	Control: ULSD		
Test Fuel Sulfur Level	baseline and controlled <15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell	16			
Test results units	g/bhp-hr			
HC/OMHCE	0.386	0.334	0.344	0.351
CO	1.585	1.248	1.081	1.084
NOx	4.884	4.761	4.694	4.704
PM	0.301	0.173	0.165	0.162
CO2	572	551	5551	550
Reference Work				
Reference Work Units	hp-hr			
Work	18.39	18.44	18.30	18.28
Work Units	hp-hr			
NMHC/ONMHCE				
HC + NOx				
Formaldehyde				

NO2		1.027	0.622	0.417	0.377
Exhaust Backpressure					
Exhaust Backpressure Units	"Hg				
Max Exhaust Temperature					
Max Exhaust Temperature Units	degrees F				
Exhaust Flow					
Exhaust Flow Units					
Fuel Consumption		0.399	0.384	0.383	0.383
Fuel Consumption Units	lb/hp-hr				
PM SOF (% of PM)		75	58	64	65
Test Engine Power		275			
Test Engine Power Units	hp				
Peak Torque		800			
Peak Torque Units	lb-ft				
Test Comments	De-greened Part Number: A17-0213 De-greened unit: Serial B48532 Aged Part Number: A17-0475 Aged Unit: Serial B64117 SwRI report in Section 1 of binder				

23011306H4		5723021406C1	5723021406H1	5723021406H2	5723021406H3
1/13/2006		2/14/2006	2/14/2006	2/14/2006	2/14/2006
Hot Start 4 baseline	Weighted baseline	Cold Start de-greened	Hot Start 1 de-greened	Hot Start 2 de-greened	Hot Start 3 de-greened

y protocols

C 6V92TA DDECIII engine at 350 C in 2003. Part has been used in previous verification acti

lies with 1991 hwy standards

0.346	0.35	0.177	0.089	0.089	0.091
1.072	1.19	1.114	0.161	0.140	0.178
4.697	4.74	3.607	3.603	3.579	3.531
0.165	0.186	0.132	0.066	0.063	0.063
547	553	572	544	544	545
18.26	18.33	17.87	18.51	18.44	18.39

0.406	0.54	0.349	0.320	0.279	0.285
		"Hg			
		degrees F			
0.381	0.385	0.398	0.377	0.377	0.378
59	63	85	81	84	78
		hp			
		lb-ft			

5723021406H4 2/14/2006	5723021406H5 2/14/2006			5723021506C1 2/15/2006	5723021506H1 2/15/2006
Hot Start 4 de-greened	Hot Start 5 de-greened	Weighted de-greened	Percent Reduction	Cold Start aged	Hot Start 1 aged

ivities on the same test engine. CCV unit de-greened on test engine. Aged DOC recovered

			Percent Reduction		
0.102	0.088	0.100	71.4%	0.174	0.094
0.198	0.177	0.3	74.8%	0.99	0.162
3.559	3.601	3.57	24.7%	3.651	3.638
0.063	0.064	0.074	60.2%	0.119	0.062
556	556	551	0.4%	576	546
18.39	18.4	18.35	-0.1%	17.87	18.39

0.273	0.324	0.290	0.171	0.144
			"Hg	
			degrees F	
0.385	0.383	0.382	0.401	0.379
78	79	81	81	79

5723021506H2 2/15/2006	5723021506H3 2/15/2006	5723021506H4 2/15/2006	5723021506H5 2/15/2006		
Hot Start 2 aged	Hot Start 3 aged	Hot Start 4 aged	Hot Start 5 aged	Weighted aged	Percent Reduction
from Cat 3126 powered schoolbus after ca. 12 months in service.					
0.095	0.102	0.105	0.101	0.110	68.6%
0.167	0.169	0.174	0.169	1.19	0.0%
3.583	3.607	3.558	3.604	3.60	24.1%
0.058	0.06	0.061	0.06	0.069	62.9%
550	552	548	551	553	0.0%
18.25	18.17	18.16	18.18	18.19	0.8%

0.234	0.124	0.128	0.183	0.160
0.382	0.382	0.38	0.381	0.384
83	77	78	78	79

Test Number		N5700-2C1	N5700-2H1	N5700-2H2
Test Date		2/27/2006	2/27/2006	2/27/2006
Test Time				
Test Type	HD FTP			
Test Cycle		Cold Start	Hot Start 1	Hot Start 2
Test Reason 1		baseline	baseline	baseline
Test Reason2				
		OE closed crankcase	OE closed crankcase	OE closed crankcase
Test Purpose	Initial			
Test Procedure	40CFR part 86, Subpart N with ARB NO2 measurement and			
Test Device Age		25		
Test Device Age Units	hrs			
Test Device History	Model AZ29; originally de-greened for 25 hrs at ECS on a 19			
Test Engine Family Name	XNVXH07.3ANE			
Test Engine ID	98-02 / 7.4JU2U0960428			
Test Engine Model	B250 (Ford Powerstroke)			
Test Engine Manufacturer	Navistar International Trans. Corp.			
Test Engine Type	4 cycle,TA, ECM			
Test Eng. PM Cert. Category	0.1 g/bhp-hr			
Test Engine CertificationType	On-highway			
Test Engine - Model Year		1999		
Test Engine - Date Manufactured		Feb-99		
Test Eng. - Rated Hp		243.5		
Test Eng. - Displacement	7.3L			
Test Fuel	ULSD,			
Test Fuel Sulfur Level	<15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell		16		
Test results units				
	g/bhp-hr			
HC/OMHCE		0.297	0.198	0.202
CO		1.51	1.167	1.161
NOx		3.830	3.607	3.638
PM		0.096	0.088	0.088
CO2		642	634	626
Reference Work				
Reference Work Units	hp-hr			
Work		16.10	16.28	16.18

Work Units	hp-hr			
NMHC/ONMHCE				
HC + NOx				
Formaldehyde				
NO2		0.421	0.310	0.357
Exhaust Backpressure				
Exhaust Backpressure Units	"Hg			
Max Exhaust Temperature				
Max Exhaust Temperature Units	degrees F			
Exhaust Flow				
Exhaust Flow Units				
Fuel Consumption		0.451	0.435	0.436
Fuel Consumption Units	lb/hp-hr			
PM SOF (% of PM)				
Test Engine Power		239		
Test Engine Power Units	hp			
Peak Torque		508		
Peak Torque Units	lb-ft			
Test Comments	Part Number: A17-0213 De-greened unit: Serial B48532			

Revision 2

N5700-2H3 2/27/2006	N5700-2H4 2/27/2006		N5709-DOCC1	N5709-DOCH1	N5709-DOCH2
Hot Start 3 baseline	Hot Start 4 baseline	Weighted baseline	Cold Start DOC	Hot Start 1 DOC	Hot Start 2 DOC
OE closed crankcase	OE closed crankcase	OE closed crankcase	OE closed crankcase	OE closed crankcase	OE closed crankcase

blowby protocols

995 DDC 6V92TA DDECIII engine at 350 C in 2003. Part has been used in previous ve

0.209	0.208	0.220	0.942	0.486	0.524
1.141	1.165	1.21	1.747	0.884	0.879
3.666	3.605	3.66	3.374	3.197	3.224
0.089	0.091	0.090	0.115	0.062	0.063
630	624	630	638	620	622
16.15	16.19	16.19	15.08	15.32	15.3

0.351	0.360	0.360	0.112	0.035	0.028
0.434		0.437	0.446	0.431	0.433

N5709-DOCH3	N5709-DOCH4			
Hot Start 3 DOC	Hot Start 4 DOC	Weighted Controlled	% Reduction	
OE closed crankcase	OE closed crankcase	OE closed crankcase	wrt OE closed crankcase	

erification activities on the same test engine. CCV unit de-greened on test engine. Aged DOC

			% Reduction wrt OE closed crankcase	
0.482	0.494	0.560	-154.5%	HC/OMHCE
0.881	0.847	1.00	17.4%	CO
3.207	3.183	3.23	11.7%	NOx
0.060	0.060	0.069	23.3%	PM
617	617	622	1.3%	CO2
15.31	15.34	15.28	5.6%	

0.071	0.051	0.06
0.430	0.429	0.433

recovered from Cat 3126 powered schoolbus after ca. 12 months in service.

Test Number				
Test Date				
Test Time				
Test Type				
		baseline (1)	baseline (1)	baseline (1)
Test Cycle				
Test Reason 1				
Test Reason2				
Test Order				
		1	2	3
Engine Speed (rpm)		680	1914	2392
Target Load (%)		0	100	50
Torque (lb-ft)		32.7	514.3	255.7
Test Purpose	Initial			
Test Procedure				
Test Device Age		25		
Test Device Age Units	hrs			
Test Device History	Model AZ29; originally de-greened for 25 hrs at ECS on a			
Test Engine Family Name	XNVXH07.3ANE			
Test Engine ID	98-02 / 7.4JU2U0960428			
Test Engine Model	B250 (Ford Powerstroke)			
Test Engine Manufacturer	Navistar International Trans. Corp.			
Test Engine Type	4 cycle,TA, ECM			
Test Eng. PM Cert. Category	0.1 g/bhp-hr			
Test Engine CertificationType	On-highway			
Test Engine - Model Year		1999		
Test Engine - Date Manufactured		Feb-99		
Test Eng. - Rated Hp		243.5		
Test Eng. - Displacement	7.3L			
Test Fuel	ULSD,			
Test Fuel Sulfur Level	<15 ppm,			
Test Laboratory Name	Southwest Research Institute			
Test Laboratory City	San Antonio			
Test Laboratory State	TX			
Test Cell		16		
Test results units	g/bhp-hr			
HC/OMHCE		0.8	0.15	0.09
CO		3.73	0.24	0.43
NOx		6.16	5.03	3.59
PM		na	na	na
CO2		1037	509	594
Reference Work				

Reference Work Units	hp-hr			
Work				
Work Units	hp-hr			
NMHC/ONMHCE				
HC + NOx				
Formaldehyde				
NO2 (%)		20	4	7
Exhaust Backpressure				
Exhaust Backpressure Units	"Hg			
Max Exhaust Temperature				
Max Exhaust Temperature Units	degrees F			
Exhaust Flow				
Exhaust Flow Units				
Fuel Consumption		3.1	66.2	48.0
Fuel Consumption Units	lb/hr			
PM SOF (% of PM)				
Test Engine Power		239		
Test Engine Power Units	hp			
Peak Torque		508		
Peak Torque Units	lb-ft			
Test Comments	Part Number: A17-0213 De-greened unit: Serial B48532			

baseline (1)	baseline (1)	baseline (1)	baseline (1)	baseline (1)	baseline (1)	baseline (1)	baseline (1)
4	5	6	7	8	9	10	11
2392	1914	1914	1914	2392	2392	2871	2871
75	50	75	25	100	25	100	25
383.1	257.2	383.9	128.3	514.4	127.9	440.5	109.8

ι 1995 DDC 6V92TA DDECIII engine at 350 C in 2003. Part has been used in previous ve

0.05	0.24	0.14	0.29	0.06	0.42	0.04	0.57
0.37	0.37	0.23	1.05	0.35	1.71	0.46	2.76
3.31	4.53	4.43	4.62	3.74	3.83	3.46	3.52
na	na	na	na	na	na	na	na
583	535	521	614	556	699	615	862

6	6	5	12	6	16	7	22
70.6	34.8	50.6	20.0	90.4	28.4	102.7	36.1

baseline (1)	baseline (1)	baseline (1)	baseline (2)	baseline (2)	baseline (2)	baseline (2)	baseline (2)
12	13	Composite (1)	1	2	3	4	5
2871	2871		680	1914	2392	2392	1914
75	50		0	100	50	75	50
327.8	218.6		48.4	514.3	255.5	382.3	255.2

rification activities on the same test engine. Aged DOC recovered from Cat 3126 powered s

0.06	0.12	0.12	0.49	0.15	0.1	0.05	0.25
0.55	0.75	0.55	2.74	0.25	0.44	0.38	0.38
2.93	3.02	3.78	5.44	5.08	3.64	3.33	4.64
na	na	0.057	na	na	na	na	na
652	806	601	793	509	592	580	534

9	11	7%	16	4	7	6	6
81.1	66.9		3.5	66.2	47.8	70.1	34.5

baseline (2)	baseline (2)	baseline (2)	baseline (2)	baseline (2)	baseline (2)	baseline (2)	baseline (2)
6	7	8	9	10	11	12	13
1914	1914	2392	2392	2871	2871	2871	2871
75	25	100	25	100	25	75	50
382.8	128.7	512.7	126.9	440.1	108.1	327.3	218.5

schoolbus after ca. 12 months in service.

0.14	0.26	0.05	0.30	0.03	0.66	0.06	0.12
0.24	1.03	0.35	1.68	0.46	2.97	0.56	0.74
4.50	4.65	3.76	3.81	3.48	3.55	2.99	3.06
na	na	na	na	na	na	na	na
520	612	558	692	614	866	652	698

5	11	6	16	7	22	8	11
50.4	20.0	90.3	27.9	102.5	35.7	81.0	57.9

baseline (2)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)
Composite (2)	1	2	3	4	5	6	7
	680	1914	2392	2392	1914	1914	1914
	0	100	50	75	50	75	25
	34.0	424.9	256.0	331.3	255.2	361.3	127.9
0.12	0.00	0.03	0.06	0.05	0.02	0.03	0.07
0.55	0.00	0.00	0.01	0.02	0.01	0.01	0.00
3.82	4.82	4.13	2.74	2.63	3.61	3.78	3.76
0.059	na	na	na	na	na	na	na
594	1364	500	599	571	535	510	636

7%	44%	18%	18%	21%	20%	23%	11%
	4.5	56.3	50.7	62.5	36.2	48.8	21.6

Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (1)	Emulsion & DOC (2)
8	9	10	11	12	13	Composite (1)	1
2392	2392	2871	2871	2871	2871		680
100	25	100	25	75	50		0
426.0	127.2	359.9	109.4	293	218.6		55.1
0.06	0.20	0.06	0.37	0.12	0.16	0.08	0.00
0.02	0.02	0.03	0.08	0.03	0.03	0.02	0.00
3.11	3.18	2.95	3.18	2.74	2.55	3.13	3.69
na	na	na	na	na	na	0.031	na
536	719	596	877	628	695	592	741

19%	10%	21%	10%	21%	21%	19%	32%
75.5	30.3	85.1	38.2	73.0	60.3		3.7

Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)
2	3	4	5	6	7	8	9
1914	2392	2392	1914	1914	1914	2392	2392
100	50	75	50	75	25	100	25
423.2	256.3	333.5	255.1	360.3	129.5	426.5	126.5
0.05	0.09	0.07	0.05	0.05	0.11	0.07	0.23
0.02	0.03	0.03	0.02	0.02	0.01	0.02	0.04
4.06	2.69	2.67	3.63	3.78	3.67	3.10	3.13
na	na	na	na	na	na	na	na
511	608	583	539	520	619	551	709

17%	17%	20%	18%	20%	11%	18%	8%
54.6	49.2	61.4	34.7	47.3	20.2	74.2	28.3

Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)	Emulsion & DOC (2)
10	11	12	13	Composite (2)
2871	2871	2871	2871	
100	25	75	50	
357.2	108.9	296.3	219.7	
0.08	0.33	0.09	0.1	0.09
0.03	0.07	0.04	0.05	0.03
2.94	3.15	2.72	2.53	3.11
na	na	na	na	0.030
615	874	638	706	599

19%	9%	19%	19%	17%
83.3	36.1	71.7	58.8	

For DDC S60 tests

AZ Purimuffler

Component Part Number	A17-0527	
Component Part Description	integrated catalytic converter muffler which replaces standard vertical truck muffler	Model AZ31 catalyst

Racor CCV

Component Part Number	CCV6001-08L	
Component Part Description	Racor CCV closed crankcase filter ventilation system	CCV55274-08 high efficiency dual media filter cartridge

For Cummins 6CTA8.3 test

AZ Purimuffler

Component Part Number	A17-0213	
Component Part Number	A17-0475	
Component Part Descriptions	integrated catalytic converter muffler which replaces standard vertical truck muffler (A17-0213) or horizontal	Model AZ29 catalyst

For International B250 7.3L tests

AZ Purimuffler

Component Part Number	A17-0213	
Component Part Description	integrated catalytic converter muffler which replaces standard vertical truck muffler	Model AZ29 catalyst

employed 3x AZ27 catalyst configuration as per DOC Design Guide	20 hr de-greened unit
originally de-greened in previous verifications	25 hr de-greened unit
recovered from 1998 or 2001 Thomas (Caterpillar 3126 powered) schoolbus in Fairfax, VA, one year old	1 year old aged unit
employed 1x AZ29 catalyst configuration as per DOC Design Guide	
employed 1x AZ29 catalyst configuration as per DOC Design Guide	25 hr de-greened unit