

Kansas City PM Characterization Study

Final Report

Appendix E

Dynamometer QA Checks

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
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Table E-1. CVS Propane Injection for July 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	07/25/04	07/25/04	07/25/04	07/25/04	07/25/04	07/25/04
<i>Start Mass (Gm)</i>	792.8	777.8	752	792.8	777.8	752
<i>Finish Mass (Gm)</i>	777.8	752	743.6	777.8	752	743.6
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	114.8	114.8	114.8	114.8	114.8	114.8
<i>Barometric Pressure,</i>	749.00	749.00	749.00	750.50	750.50	750.5
<i>PDP inlet Pressure, "H2O</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	5.00	4.00	4.00	2.70	2.70	2.7
<i>HC sample, ppmC</i>	374.00	169.00	205.00	358.88	167.65	203.77
<i>PDP counts</i>	8850.00	33482.50	8850.00	8850.00	33482.50	8850.00
<i>Vmix</i>	2385.04	9023.42	2385.04	2389.95	9041.99	2389.95
<i>Propane Mass Recovered,</i>	15.23	25.76	8.29	14.73	25.80	8.31
<i>Propane Mass Injected, Gm</i>	15.00	25.80	8.40	15.00	25.80	8.40
<i>% Difference</i>	1.50	-0.17	-1.27	-1.82	0.01	-1.03

Table E-2. CVS Propane Injection for August 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	08/30/04	08/30/04	08/30/04	08/30/04	08/30/04	08/30/04
<i>Start Mass (Gm)</i>	1005	992.3	937	1005	992.3	937
<i>Finish Mass (Gm)</i>	992.3	937	922.8	992.3	937	922.8
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	114.8	114.8	114.8	114.8	114.8	114.8
<i>Barometric Pressure,</i>	747.00	747.00	747.00	747.00	747.00	747.00
<i>PDP inlet Pressure, "H2O</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	2.00	2.00	2.00	2.05	2.05	2.05
<i>HC sample, ppmC</i>	291.00	332.00	329.00	306.20	353.90	329
<i>PDP counts</i>	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
<i>Vmix</i>	2378.50	8998.65	2378.50	2378.50	8998.65	2378.50
<i>Propane Mass Recovered,</i>	11.89	51.37	13.46	12.52	54.77	13.45
<i>Propane Mass Injected, Gm</i>	12.70	55.30	14.20	12.70	55.30	14.20
<i>% Difference</i>	-6.36	-7.10	-5.24	-1.46	-0.95	-5.26

Table E-3. CVS Propane Injection for September 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	09/30/04	09/30/04	09/30/04	09/30/04	09/30/04	09/30/04
<i>Start Mass (Gm)</i>	1020.2	1006.6	947.5	1020.2	1006.6	947.5
<i>Finish Mass (Gm)</i>	1006.6	947.5	936.1	1006.6	947.5	936.1
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	113.5	113.5	113.5	113.5	113.5	113.5
<i>Barometric Pressure,</i>	744.10	744.10	744.10	744.10	744.10	744.10
<i>PDP inlet Pressure, "H2O</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	3.00	3.00	3.00	2.33	2.33	2.33
<i>HC sample, ppmC</i>	325.00	375.00	278.00	323.40	373.60	273.2
<i>PDP counts</i>	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
<i>Vmix</i>	2374.38	8983.05	2374.38	2374.38	8983.05	2374.38
<i>Propane Mass Recovered,</i>	13.23	57.81	11.30	13.19	57.70	11.13
<i>Propane Mass Injected, Gm</i>	13.60	59.10	11.40	13.60	59.10	11.40
<i>% Difference</i>	-2.74	-2.18	-0.91	-3.03	-2.37	-2.40

Table E-4. CVS Propane Injection for January 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	01/10/05	01/10/05	01/10/05	01/10/05	01/10/05	01/10/05
<i>Start Mass (Gm)</i>	828.6	813.9	794.7	828.6	813.9	794.7
<i>Finish Mass (Gm)</i>	813.9	794.7	781.9	813.9	794.7	781.9
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	111.8	111.8	111.8	111.8	111.8	111.8
<i>Barometric Pressure,</i>	745.80	745.80	745.80	745.80	745.80	745.80
<i>PDP inlet Pressure, "H2O</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	4.00	3.00	3.00	2.36	2.39	2.55
<i>HC sample, ppmC</i>	347.00	124.00	304.00	341.00	120.70	296.2
<i>PDP counts</i>	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
<i>Vmix</i>	2387.03	9032.52	2387.03	2387.03	9032.52	2387.03
<i>Propane Mass Recovered,</i>	14.16	18.91	12.43	13.98	18.49	12.13
<i>Propane Mass Injected, Gm</i>	14.70	19.20	12.80	14.70	19.20	12.80
<i>% Difference</i>	-3.64	-1.52	-2.89	-4.87	-3.71	-5.26

Table E-5. CVS Propane Injection for February, 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	02/24/05	02/24/05	02/24/05	02/24/05	02/24/05	02/24/05
<i>Start Mass (Gm)</i>	760.8	751.9	720.6	760.8	751.9	720.6
<i>Finish Mass (Gm)</i>	751.9	720.6	712.6	751.9	720.6	712.6
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	114.2	114.2	114.2	114.2	114.2	114.2
<i>Barometric Pressure,</i>	749.20	749.20	749.20	749.20	749.20	749.20
<i>PDP inlet Pressure, “H20</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	3.00	2.00	3.00	2.38	2.38	2.38
<i>HC sample, ppmC</i>	220.00	200.00	189.00	210.90	199.20	188.8
<i>PDP counts</i>	8860.00	33526.24	8860.00	8860.00	33526.24	8860.00
<i>Vmix</i>	2390.89	9047.13	2390.89	2390.89	9047.13	2390.89
<i>Propane Mass Recovered,</i>	8.98	30.99	7.69	8.62	30.81	7.71
<i>Propane Mass Injected, Gm</i>	8.90	31.30	8.00	8.90	31.30	8.00
<i>% Difference</i>	0.85	-0.99	-3.83	-3.09	-1.58	-3.62

Table E-6. CVS Propane Injection for March 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
<i>Date</i>	03/29/05	03/29/05	03/29/05	03/29/05	03/29/05	03/29/05
<i>Start Mass (Gm)</i>	975.8	971.1	948.7	975.8	971.1	948.7
<i>Finish Mass (Gm)</i>	971.1	948.7	940.8	971.1	948.7	940.8
<i>Time(Min)</i>	5.00	18.92	5.00	5.00	18.92	5.00
<i>Temperature PDP, F</i>	116.5	116.5	116.5	116.5	116.5	116.5
<i>Barometric Pressure,</i>	736.10	736.10	736.10	736.10	736.10	736.10
<i>PDP inlet Pressure, “H20</i>	11.00	11.00	11.00	11.00	11.00	11
<i>HC bkg, ppmC</i>	2.00	2.00	2.00	1.02	1.02	1.25
<i>HC sample, ppmC</i>	116.00	148.00	197.00	113.60	144.80	194.4
<i>PDP counts</i>	8860.00	33526.24	8860.00	8860.00	33526.24	8860.00
<i>Vmix</i>	2338.55	8849.08	2338.55	2338.55	8849.08	2338.55
<i>Propane Mass Recovered,</i>	4.61	22.35	7.89	4.55	22.01	7.81
<i>Propane Mass Injected, Gm</i>	4.70	22.40	7.90	4.70	22.40	7.90
<i>% Difference</i>	-1.87	-0.22	-0.14	-3.09	-1.74	-1.09

Table E-7. Multipoint Calibration for Dynamometer FID.

<i>Instrument</i>	HC1	<i>Date</i>	Aug 30, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
891	891	892.9	0.2
801.9	800	801.8	-0.0
712.8	711	712.7	-0.0
623.7	621	622.6	-0.2
534.6	532	533.4	-0.2
445.5	444	445.3	-0.0
356.4	355	356.2	-0.1
267.3	266	267.1	-0.1
178.2	177	178.0	-0.1
89.1	89	89.8	0.8
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-0.73	
	<i>R</i> ²	0.9999	

Table E-8. Multipoint Calibration for Dynamometer Chemiluminescence.

<i>Instrument</i>	NO _x	<i>Date</i>	Aug 30, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
93.6	93.6	93.8	0.2
84.24	84	84.2	-0.1
74.88	74.7	74.9	-0.0
65.52	65.4	65.6	0.0
56.16	55.8	55.9	-0.4
46.8	46.8	46.9	0.3
37.44	37.2	37.3	-0.3
28.08	27.9	28.0	-0.2
18.72	18.6	18.7	-0.0
9.36	9.3	9.4	0.5
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-0.10	
	<i>R</i> ²	0.9999	

Table E-9. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	CO2	<i>Date</i>	Aug 30, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
2.864	2.864	2.9	-0.1
2.5776	2.578	2.6	-0.1
2.2912	2.295	2.3	0.0
2.0048	2.011	2.0	0.1
1.7184	1.723	1.7	-0.0
1.432	1.441	1.4	0.3
1.1456	1.152	1.1	0.0
0.8592	0.868	0.9	0.3
0.5728	0.581	0.6	0.2
0.2864	0.292	0.3	-0.7
0	0.005		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.01	
	<i>R</i> ²	0.9999	

Table E-10. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	Low CO	<i>Date</i>	Aug 30, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
888	888	890.9	0.3
799.2	793	795.5	-0.5
710.4	709	711.1	0.1
621.6	619	620.7	-0.1
532.8	532	533.3	0.1
444	444	444.9	0.2
355.2	354	354.5	-0.2
266.4	265	265.1	-0.5
177.6	179	178.7	0.6
88.8	91	90.3	1.7
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	1.09	
	<i>R</i> ²	0.9999	

Table E-11. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	High CO	<i>Date</i>	Aug 30, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
912	912	926.7	1.6
820.8	803	817.5	-0.4
729.6	715	729.3	-0.0
638.4	620	634.1	-0.7
547.2	527	540.9	-1.2
456	441	454.7	-0.3
364.8	347	360.5	-1.2
273.6	254	267.3	-2.3
182.4	166	179.1	-1.8
91.2	80	92.9	1.9
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-12.77	
	<i>R</i> ²	0.9994	

Table E-12. Multipoint Calibration for Dynamometer FID.

<i>Instrument</i>	HC1	<i>Date</i>	Oct 4, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
904	904	903.9	-0.0
813.6	813	812.9	-0.1
723.2	725	724.9	0.2
632.8	632	631.9	-0.1
542.4	543	542.9	0.1
452	452	451.9	-0.0
361.6	361	360.9	-0.2
271.2	271	270.9	-0.1
180.8	181	180.9	0.1
90.4	91	90.9	0.6
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.09	
	<i>R</i> ²	0.9999	

Table E-13. Multipoint Calibration for Dynamometer Chemiluminescence.

<i>Instrument</i>	NO_x	<i>Date</i>	Oct 4, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
93.6	93.6	93.7	0.1
84.24	83.9	84.0	-0.3
74.88	74.8	74.9	0.0
65.52	65.5	65.6	0.1
56.16	56.2	56.2	0.2
46.8	46.8	46.8	0.1
37.44	37.4	37.4	-0.1
28.08	28.1	28.1	0.0
18.72	18.8	18.8	0.3
9.36	9.4	9.4	-0.1
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.06	
	<i>R</i> ²	0.9999	

Table E-14. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	CO₂	<i>Date</i>	Oct 4, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
2.9	2.9	2.9	-0.1
2.61	2.608	2.6	-0.2
2.32	2.325	2.3	0.1
2.03	2.031	2.0	-0.1
1.74	1.745	1.7	0.1
1.45	1.46	1.5	0.4
1.16	1.168	1.2	0.3
0.87	0.877	0.9	0.2
0.58	0.587	0.6	0.2
0.29	0.2935	0.3	-0.9
0	0.002		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.01	
	<i>R</i> ²	0.9999	

Table E-15. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	Low CO	<i>Date</i>	Oct 4, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
910	910	915.8	0.6
819	810	815.2	-0.5
728	722	726.6	-0.2
637	630	634.0	-0.5
546	543	546.5	0.1
455	453	455.9	0.2
364	361	363.3	-0.2
273	272	273.8	0.3
182	181	182.2	0.1
91	91	91.6	0.7
0	0		
	<i>Slope</i>	0.99	
	<i>Intercept</i>	-0.05	
	<i>R</i> ²	0.9999	

Table E-16. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	High CO	<i>Date</i>	Oct 4, 2004
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
903	903	915.2	1.3
812.7	803	815.9	0.4
722.4	706	719.5	-0.4
632.1	617	631.1	-0.2
541.8	519	533.8	-1.5
451.5	435	450.4	-0.3
361.2	338	354.0	-2.0
270.9	246	262.6	-3.0
180.6	161	178.2	-1.3
90.3	71	88.8	-1.6
0	0		
	<i>Slope</i>	1.01	
	<i>Intercept</i>	-18.32	
	<i>R</i> ²	0.9992	

Table E-17. Multipoint Calibration for Dynamometer FID.

<i>Instrument</i>	HC1	<i>Date</i>	Jan 10, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
858	858	856.7	-0.2
772.2	767	765.8	-0.8
686.4	692	691.0	0.7
600.6	603	602.1	0.3
514.8	519	518.3	0.7
429	432	431.5	0.6
343.2	345	344.6	0.4
257.4	254	253.8	-1.4
171.6	169	168.9	-1.6
85.8	86	86.1	0.3
0	0		na
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-0.23	
	<i>R²</i>	0.9999	

Table E-18. Multipoint Calibration for Dynamometer Chemiluminescence.

<i>Instrument</i>	NO _x	<i>Date</i>	Jan 10, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
93.57	93.57	93.3	-0.3
84.213	83.4	83.1	-1.3
74.856	75.4	75.1	0.4
65.499	66.9	66.6	1.7
56.142	56.9	56.6	0.8
46.785	46.6	46.3	-1.0
37.428	38.1	37.8	1.0
28.071	28.7	28.4	1.1
18.714	19	18.7	-0.2
9.357	9.4	9.1	-3.2
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.35	
	<i>R²</i>	0.9996	

Table E-19. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	CO2	<i>Date</i>	Jan 10, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
2.909	2.909	2.9	-0.6
2.6181	2.61	2.6	-0.9
2.3272	2.359	2.3	0.7
2.0363	2.064	2.0	0.7
1.7454	1.77	1.8	0.7
1.4545	1.485	1.5	1.3
1.1636	1.186	1.2	1.0
0.8727	0.875	0.9	-0.9
0.5818	0.5808	0.6	-1.8
0.2909	0.294	0.3	-1.8
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.01	
	<i>R</i> ²	0.9998	

Table E-20. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	Low CO	<i>Date</i>	Jan 10, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
905	905	905.0	-0.0
814.5	805	804.9	-1.2
724	730	729.8	0.8
633.5	636	635.7	0.3
543	546	545.6	0.5
452.5	457	456.5	0.9
362	364	363.4	0.4
271.5	268	267.3	-1.5
181	180	179.2	-1.0
90.5	92	91.1	0.7
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.95	
	<i>R</i> ²	0.9998	

Table E-21. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	High CO	<i>Date</i>	Jan 10, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Rep} ppm	Difference, %
908	908	910.0	0.2
817.2	805	806.6	-1.3
726.4	728	729.4	0.4
635.6	639	640.1	0.7
544.8	548	548.8	0.7
454	455	455.6	0.3
363.2	363	363.3	0.0
272.4	269	269.0	-1.3
181.6	180	179.7	-1.0
90.8	93	92.4	1.8
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.86	
	<i>R</i> ²	0.9998	

Table E-22. Multipoint Calibration for Dynamometer FID.

<i>Instrument</i>	HC1	<i>Date</i>	Feb 24, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Rep} ppm	Difference, %
907	907	909.0	0.2
816.3	814	815.8	-0.1
725.6	723	724.7	-0.1
634.9	632	633.6	-0.2
544.2	542	543.4	-0.1
453.5	453	454.3	0.2
362.8	362	363.2	0.1
272.1	271	272.1	-0.0
181.4	181	181.9	0.3
90.7	89	89.8	-1.0
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-0.68	
	<i>R</i> ²	0.9999	

Table E-23. Multipoint Calibration for Dynamometer Chemiluminescence.

<i>Instrument</i>	NO_x	<i>Date</i>	Feb 24, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
93.6	93.6	93.4	-0.3
84.24	85.8	85.6	1.6
74.88	75	74.9	-0.0
65.52	64.8	64.7	-1.2
56.16	55.5	55.5	-1.2
46.8	46.8	46.8	0.1
37.44	37.2	37.3	-0.4
28.08	28.2	28.3	0.9
18.72	18.3	18.5	-1.2
9.36	9.3	9.5	2.0
0	0		
	<i>Slope</i>	1.01	
	<i>Intercept</i>	-0.30	
	<i>R</i> ²	0.9997	

Table E-24. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	CO₂	<i>Date</i>	Feb 24, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
2.9025	2.9025	2.9	-0.2
2.61225	2.6214	2.6	0.1
2.322	2.329	2.3	-0.0
2.03175	2.045	2.0	0.3
1.7415	1.7507	1.7	0.1
1.45125	1.4526	1.4	-0.5
1.161	1.175	1.2	0.5
0.87075	0.8835	0.9	0.4
0.5805	0.5939	0.6	0.7
0.29025	0.2966	0.3	-1.1
0	0.0045		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	0.01	
	<i>R</i> ²	.9999	

Table E-25. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	Low CO	<i>Date</i>	Feb 24, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Rep} ppm	Difference, %
901	901	904.6	0.4
810.9	807	810.2	-0.1
720.8	717	719.9	-0.1
630.7	626	628.6	-0.3
540.6	537	539.3	-0.2
450.5	449	451.0	0.1
360.4	358	359.6	-0.2
270.3	268	269.3	-0.4
180.2	181	182.0	1.0
90.1	90	90.7	0.6
0	0		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-0.36	
	<i>R</i> ²	0.9999	

Table E-26. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	High CO	<i>Date</i>	Feb 24, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Rep} ppm	Difference, %
905	905	917.7	1.4
814.5	803	815.7	0.1
724	710	722.7	-0.2
633.5	618	630.7	-0.4
543	525	537.7	-1.0
452.5	431	443.7	-1.9
362	341	353.7	-2.3
271.5	264	276.7	1.9
181	162	174.7	-3.5
90.5	76.4	89.1	-1.5
0	2.34		
	<i>Slope</i>	1.00	
	<i>Intercept</i>	-12.74	
	<i>R</i> ²	0.9993	

Table E-27. Multipoint Calibration for Dynamometer FID.

<i>Instrument</i>	HC1	<i>Date</i>	Mar 28, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
907	907	915.7	1.0
816.3	809	816.4	0.0
725.6	713	719.1	-0.9
634.9	621	625.9	-1.4
544.2	534	537.7	-1.2
453.5	454	456.7	0.7
362.8	370	371.6	2.4
272.1	277	277.3	1.9
181.4	184	183.1	0.9
90.7	91	88.8	-2.0
0	0		
	<i>Slope</i>	0.99	
	<i>Intercept</i>	3.36	
	<i>R</i> ²	0.9996	

Table E-28. Multipoint Calibration for Dynamometer Chemiluminescence.

<i>Instrument</i>	NO_x	<i>Date</i>	Mar 28, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
93.6	93.6	93.4	-0.3
84.24	85.8	85.6	1.6
74.88	75	74.9	-0.0
65.52	64.8	64.7	-1.2
56.16	55.5	55.5	-1.2
46.8	46.8	46.8	0.1
37.44	37.2	37.3	-0.4
28.08	28.2	28.3	0.9
18.72	18.3	18.5	-1.2
9.36	9.3	9.5	2.0
0	0		
	<i>Slope</i>	1.01	
	<i>Intercept</i>	-0.30	
	<i>R</i> ²	0.9997	

Table E-29. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	CO2	<i>Date</i>	Mar 28, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
2.9025	2.9025	2.9	0.9
2.61225	2.5907	2.6	-0.0
2.322	2.2869	2.3	-0.8
2.03175	1.9928	2.0	-1.3
1.7415	1.7118	1.7	-1.2
1.45125	1.4582	1.5	0.8
1.161	1.1864	1.2	2.3
0.87075	0.8938	0.9	2.3
0.5805	0.5939	0.6	1.0
0.29025	0.2951	0.3	-2.5
0	0.0045		
	<i>Slope</i>	0.99	
	<i>Intercept</i>	0.02	
	<i>R</i> ²	0.9996	

Table E-30. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	Low CO	<i>Date</i>	Mar 28, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
901	900	915.3	1.6
810.9	795	808.3	-0.3
720.8	703	714.5	-0.9
630.7	611	620.8	-1.6
540.6	525	533.2	-1.4
450.5	445	451.6	0.3
360.4	362	367.1	1.9
270.3	270	273.3	1.1
180.2	181	182.7	1.4
90.1	91	90.9	0.9
0	0		
	<i>Slope</i>	0.98	
	<i>Intercept</i>	1.77	
	<i>R</i> ²	0.9995	

Table E-31. Multipoint Calibration for Dynamometer NDIR.

<i>Instrument</i>	High CO	<i>Date</i>	Mar 28, 2005
Conc_{Std}, ppm	Conc_{Meas} ppm	Conc_{Ref} ppm	Difference, %
905	899.26	925.8	2.3
814.5	793.03	816.9	0.3
724	694.79	716.1	-1.1
633.5	600.29	619.2	-2.3
543	513.25	529.9	-2.4
452.5	433.39	448.0	-1.0
362	353	365.6	1.0
271.5	264.88	275.2	1.4
181	174.93	183.0	1.1
90.5	85.1	90.8	0.4
0	2.34		
	<i>Slope</i>	0.98	
	<i>Intercept</i>	-3.57	
	<i>R</i> ²	0.9989	

Table E-33. Daily PDP and Dynamometer QA Checks.

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
July 15, 2004	1766	1942	50.0	50.1	23.52
July 16, 2004	1769	1952	50.2	50.1	22.78
July 17, 2004	1767	1980	51.0	50.8	23.3
July 18, 2004	1767	1970	50.7	50.5	-
July 19, 2004	1767	1934	49.8	49.5	22.38
July 20, 2004	1767	1948	50.1	50.1	24.38
July 21, 2004	1768	1942	50.0	49.8	23.73
July 22, 2004	1748	1956	50.3	49.7	24.37
July 23, 2004	1765	2004	51.6	51.2	24.62
July 24, 2004	1767	1964	50.5	50.4	23.6
July 26, 2004	1772	1984	51.1	50.9	23.63
July 27, 2004	1767	1980	51.0	50.5	23.69
July 28, 2004	1770	1982	51.0	50.8	23.7
July 29, 2004	1768	1946	50.1	50	23.66
July 30, 2004	1770	1962	50.5	50.6	23.85
July 31, 2004	1768	1946	50.1	49.8	23.24
August 2, 2004	1770	1934	49.8	49.7	23.83
August 3, 2004	1770	1951	50.2	50	23.78
August 4, 2004	1768	1948	50.1	50.1	24.03
August 5, 2004	1770	1952	50.2	50.2	23.16
August 6, 2004	1768	1946	50.1	50	23.28
August 7, 2004	1768	1956	50.3	50.2	23.4
August 9, 2004	1770	1959	50.4	50.1	23.8
August 10, 2004	1770	1952	50.2	50.1	22.87
August 11, 2004	1770	1945	50.1	49.9	23.31
August 12, 2004	1770	1960	50.4	50.3	23.47
August 13, 2004	1770	1948	50.1	50	23.51
August 14, 2004	1768	1947	50.1	50	23.37
August 16, 2004	1768	1953	50.3	50.1	23.03
August 17, 2004	1770	1946	50.1	50	23.83
August 18, 2004	1768	1950	50.2	50.1	23.05
August 19, 2004	1770	1952	50.2	50.1	23.02
August 20, 2004	1769	1960	50.2	50.2	22.91
August 21, 2004	1769	1940	49.9	49.8	23.79
August 23, 2004	1772	1952	50.2	50.2	23.76
August 24, 2004	1772	1936	49.8	49.6	23.5
August 25, 2004	1768	1953	50.3	50.2	23.63
August 26, 2004	1768	1943	50.0	49.9	24.26
August 27, 2004	1768	1950	50.2	50.1	23.85
August 28, 2004	1768	1952	50.2	49.9	23.6
August 30, 2004	1768	1954	50.3	50.1	23.05

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
August 31,2004	1768	1959	50.4	50.3	23.17
Sept 1, 2004	1770	1942	50.0	49.9	23.15
Sept 2, 2004	1768	1936	49.8	49.6	23.9
Sept 8, 2004	1768	1954	50.3	50.1	23.04
Sept 9, 2004	1770	1941	50.0	49.8	23
Sept 10, 2004	1769	1958	50.4	50	23.5
Sept 11, 2004	1768	1953	50.3	50	23.33
Sept 13, 2004	1770	1946	50.1	49.9	23.02
Sept 14, 2004	1768	1964	50.5	50.4	23.75
Sept 15, 2004	1772	1933	49.7	49.6	23.73
Sept 16, 2004	1770	1956	50.3	50.2	22.77
Sept 17, 2004	1770	1938	49.9	49.7	23.95
Sept 18, 2004	1770	1942	50.0	49.9	23.74
Sept 20, 2004	1770	1966	50.6	50.5	23.54
Sept 21, 2004	1770	1976	50.9	50.6	23.78
Sept 22, 2004	1769	1953	50.3	50.3	23.72
Sept 23, 2004	1769	1954	50.3	50.2	23.28
Sept 24, 2004	1769	1958	50.4	50.2	23.12
Sept 25, 2004	1769	1944	50.0	49.8	22.92
Sept 27, 2004	1770	1944	50.0	49.9	23.72
Sept 28, 2004	1770	1957	50.4	50	23.72
Sept 29, 2004	1768	1958	50.4	50.3	23.21
Sept 30, 2004	1772	1952	50.2	50.1	23.24
Oct 1, 2004	1770	1966	50.6	50.4	23.79
Jan 11,2005	1770	1962	50.5	50.3	-
Jan 12, 2005	1774	1956	50.3	50.1	22.8
Jan 13, 2005	1772	1956	50.3	49.9	22.82
Jan 14, 2005	1772	1928	49.6	49.4	20.2
Jan 15, 2005	1776	1958	50.4	50.4	20.89
Jan 17, 2005	1768	1974	50.8	50.4	20.5
Jan 18,2005	1768	1940	49.9	50.3	20.89
Jan 19,2005	1772	1962	50.5	50.2	21.59
Jan 20,2005	1770	1954	50.3	50	22.09
Jan 21,2005	1770	1955	50.3	49.9	21.44
Jan 22,2005	1770	1977	50.9	50.3	21.74
Jan 25,2005	1773	1957	50.4	50	21.13
Jan 26,2005	1774	1988	51.2	50.8	21.56
Jan 27,2005	1770	1970	50.7	50.3	21.41
Jan 28,2005	1772	1964	50.5	50.2	21.21
Jan 29,2005	1771	1969	50.7	50.3	21.25
Jan 31,2005	1772	1962	50.5	50.2	22.18
Feb 1,2005	1772	1969	50.7	50.3	22.24

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
Feb 2,2005	1773	1970	50.7	50.4	21.72
Feb 3,2005	1771	1960	50.4	50.1	21.52
Feb 4,2005	1772	1964	50.5	50.2	22.14
Feb 5,2005	1772	1958	50.4	50.1	22.68
Feb 7,2005	1780	1962	50.5	50.2	22.6
Feb 8,2005	1772	1968	50.6	50.3	22.13
Feb 9,2005	1772	1952	50.2	49.9	21.65
Feb 20,2005	1772	1968	50.6	50.3	21.73
Feb 11,2005	1771	1983	50.7	50.7	21.59
Feb 12,2005	1772	1968	50.6	50.2	22.61
Feb 14,2005	1771	1961	50.5	50.1	21.91
Feb 15,2005	1772	1955	50.3	50	22.4
Feb 16,2005	1771	1980	51.0	50.5	21.76
Feb 17,2005	1772	1960	50.4	50.1	22.07
Feb 18,2005	1772	1974	50.8	50.4	21.72
Feb 19,2005	1772	1951	50.2	49.9	21.91
Feb 21,2005	1772	1967	50.6	50.6	22.33
Feb 22,2005	1772	1971	50.7	50.4	22.6
Feb 23,2005	1771	1959	50.4	50.1	22.57
Feb 24, 2005	1772	1952	50.2	49.5	22.57
Feb 25, 2005	1772	1963	50.5	50.5	22.07
Feb 26,2005	1772	1948	50.1	50.2	21.89
Feb 28,2005	1772	1946	50.1	50.1	21.47
March 1,2005	1772	1940	49.9	49.9	21.26
March 2,2005	1772	1957	50.4	50.4	21.31
March 3,2005	1771	1944	50.0	50.1	21.38
March 4,2005	1772	1925	49.5	49.6	21.86
March 5,2005	1772	1946	50.1	50.2	21.6
March 7,2005	1772	1942	50.0	50.1	22.58
March 8,2005	1772	1956	50.3	50.4	21.39
March 9,2005	1772	1952	50.2	50.3	21.57
March 10,2005	1772	1925	49.5	49.6	21.8
March 11,2005	1772	1954	50.3	50.4	21.8
March 12,2005	1772	1952	50.2	50.3	21.91
March 14,2005	1772	1949	50.2	50.2	22.13
March 15,2005	1773	1938	49.9	50	21.59
March 16,2005	1772	1958	50.4	50.5	21.57
March 17,2005	1773	1942	50.0	50.1	22.55
March 18,2005	1773	1938	49.9	49.8	22.13
March 19,2005	1772	1938	49.9	49.8	22.59
March 21,2005	1772	1948	50.1	50.3	22.44
March 22,2005	1771	1948	50.1	50.3	22.4
March 23,2005	1772	1950	50.2	50.3	22.24

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
March 24,2005	1774	1930	49.7	49.8	22.16
March 25,2005	1773	1933	49.7	49.9	22.41
March 26,2005	1772	1924	49.5	49.6	22.16
March 28,2005	1773	1943	50.0	50.1	22.28
March 29,2005	1773	1930	49.7	49.8	22.7
March 30,2005	1772	1946	50.1	50.3	22.4
March 31,2005	1772	1932	49.7	49.9	22.32
April 1,2005	1772	1946	50.1	50.3	22.47
April 2,2005	1772	1940	49.9	50.1	-
April 4,2005	1773	1940	49.9	50.1	22.52
April 5,2005	1772	1924	49.5	49.8	23.09
April 6,2005	1772	1923	49.5	49.8	22.57
April 7,2005	1772	1944	50.0	50.3	22.89
April 8,2005	1772	1932	49.7	49.9	22.26