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**New Technology Research & Development Program
Grant Contract 582-5-70807-M028**

Final Deliverable 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.



West Virginia University

Department of Mechanical and Aerospace Engineering

December 20, 2006

Mr. Glenn Shankle
Executive Director
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78753

Re: OR-LED2 Biodiesel Alternate Fuel Formulation Test Report

Dear Mr. Shankle:

On November 9, 2006, the Texas Commission on Environmental Quality, per David C. Schanbacher, approved the test protocol submitted by ORYXE Energy International, Inc. for the testing of its OR-LED2 additive in a 20% biodiesel blend (B20) pursuant to 30 T.A.C. §114.315(c) for the purpose of determining emissions equivalency to Texas Low Emission Diesel there under. Pursuant to this approval, testing was conducted at the Engines and Emissions Research Laboratory at West Virginia University between November 14 and November 16, 2006. In connection with this testing, I am enclosing a report entitled, "Texas TCEQ Alternative Biodiesel Fuel Formulation Data Report" prepared by West Virginia University and dated December 20, 2006.

As with the report previously submitted to you, I have included an Appendix C (Individual Test Summary) and calculated the emissions equivalency calculation in accordance with your staff's recommended procedure. Please note that analyses of the reference fuel, untreated candidate fuel and treated B20 blended fuel prepared by Intertek Caleb Brett are included as Appendix A to the report. The portions of the untreated candidate fuel analysis and treated B20 blended fuel analysis that confirms the presence/absence and composition of the components of OR-LED2 are included in a separate envelope marked "*Confidential/Proprietary: inform applicant and seek AG opinion before releasing.*" In addition, there is an appendix to the proprietary portion of the treated B20 blended fuel analysis and additive blending instructions included in the same separate, marked envelope. The individual pages containing proprietary information are similarly marked as noted above.

If you have any questions, please contact me at (304) 293-3111, ext. 2481.

Sincerely,


Gregory Thompson

cc: Morris Brown
Joseph Walton



West Virginia University

Department of Mechanical and Aerospace Engineering

20 December 2006

Glen Shankle
Executive Director
Texas Commissions on Environmental Quality
12100 Park 35 Circle
Austin, TX 78573

Mr. Shankle,

I have performed a quality control review of both the content and the data contained in the report titled "Demonstrating Texas Low Emissions Diesel Equivalency for a 20% Biodiesel Blend," performed by the WVU Center for Alternative Fuels, Engines and Emissions on behalf of ORYXE Energy International, Inc. I found both engine and emissions data to be consistent between the data in the raw laboratory reports and that contained in the final report. I also reviewed the procedures followed by laboratory personnel and was present during several of the actual tests.

During my quality review, I did not find any errors in translation between the raw data and that presented in either the comparative figures or that in the Student's t statistics used for determining equivalency as per TAC 114.315(c)(5).

Regards,



David L. McKain Jr.

ORYXE Energy International, Inc. Emissions Tests
Texas TCEQ Alternative Biodiesel Fuel Formulation Data Report

Presented to:

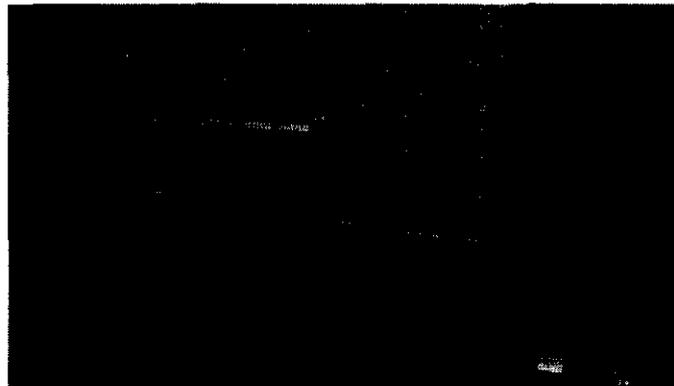
Glenn Shankle
Executive Director
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, TX 78753

On Behalf of:

Frederick L. Jordan
Chief Technology Officer
ORYXE Energy International, Inc.
9805 Research Drive
Irvine, CA 92618

Prepared by:

Gregory Thompson
West Virginia University



December 20, 2006

Introduction

The West Virginia University (WVU) Engine and Emissions Research Laboratory (EERL) evaluated the emissions from a 1992 Detroit Diesel Corporation Series 60 diesel engine for a Texas reference diesel fuel meeting Texas Low Emission Diesel requirements as specified in the Texas Administrative Code (TAC) §114.315 (termed "Reference fuel") and an alternative diesel fuel formulation candidate diesel fuel (termed "Candidate fuel"), blended with 20% biodiesel (termed "B20 Blended Fuel"), treated with ORYXE Energy International Inc.'s OR-LED2 additive (termed "Treated B20 Blended fuel" or "TRT B20 BLEND"). The objective of this study was to examine the emissions of the Treated B20 Blended fuel relative to the Reference fuel. The brake-specific mass emissions of oxides of nitrogen (NO_x), total particulate matter (TPM), carbon monoxide (CO), total hydrocarbons (THC), carbon dioxide (CO₂), and non-methane hydrocarbons (NMHC) along with fuel consumption (FC) were measured with the engine exercised over the Federal Test Procedure (FTP) cycle. The evaluation of both fuels followed the procedures outlined in the Code of Federal Regulations (CFR) Title 40 Part 86 [1]. However, only hot start tests were used throughout the entire test protocol.

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 (TCEQ).

Laboratory Description

Evaluation of the emissions was conducted using a 1992 Detroit Diesel Corporation Series 60 engine connected to a 550 hp GE dynamometer located in the EERL at WVU. The engine model number was 6067GU60 and engine serial number was 06R0105610.

Engine exhaust was ducted to a full-scale dilution tunnel (18 inches in diameter and 20 feet long) based on the critical flow venturi-constant volume sampler (CFV-CVS) concept. Three feet from the tunnel entrance was a 10-inch diameter orifice. This ensured that the dilute exhaust was thoroughly mixed by the time it reached the sampling zone, ten diameters downstream of the orifice. The exhaust was mixed with air and the quantity of diluted exhaust was measured precisely using critical flow venturis. These venturis were placed upstream of a blower that pulled the diluted air at constant mass flowrate once the venturis were under sonic or choked flow conditions at a nominal 2400 scfm. Temperature in the venturi was measured with an exposed fast-respond thermocouple and pressure was measured by an absolute pressure transducer. Heated sampling probes and lines conducted diluted exhaust to a number of different gas analysis instruments. The engine test cell was equipped with a pre-conditioning system for intake air. Microprocessor controlled heated probes and sampling lines were used to draw gaseous samples into the gas analysis bench.

Continuous sampling and analysis of the exhaust stream was done by non-dispersive infrared (NDIR) analyzers for CO and CO₂; a wet chemiluminescent analyzer for NO_x; and a heated flame ionization detector (HFID) for THC. A Varian 3600 gas chromatograph was used to measure the NMHC concentrations from gas sample bags taken during the testing [2]. The gas analysis bench was equipped with exhaust sample conditioning and analysis systems following CFR 40 Part 86 requirements. Data from the exhaust analyzers, sampling trains, double dilution tunnel, and the engine were acquired and archived at a rate of 5 Hz.

A double dilution system was used to measure TPM. A proportional sample was drawn from the main dilution tunnel into a stainless steel 4-inch diameter by 30-inch long secondary dilution tunnel. The dilute

TPM sample was pulled through a stainless steel filter holder that contained two Pallflex 70mm diameter Model T60A20 fluorocarbon-coated glass microfiber filters in series. Two filters, a primary and a secondary, were used in the filter holder to maximize filter trapping efficiency. The diluted sample stream was maintained at temperatures below 125 °F and measured at the inlet of the TPM filter holder. The sample filters were conditioned in an environmentally controlled room to a nominal 22 °C dry bulb, 9.5 °C dew point, and 45% relative humidity, in compliance with requirements as specified in CFR 40 Part 86, and weighed before and after sample collection using a Sartorius SE2-F microbalance. All dilution air was HEPA filtered to minimize the background particulate contribution entering the tunnel. Two HEPA filters, each at a 2400 cfm capacity, were placed in parallel to provide up to 4800 cfm dilution air capacity to the primary tunnel.

Calibration procedures and intervals were followed according to CFR 40 Part 86 requirements. A laboratory checkout following the procedures listed in CFR 40 Part 86 was performed prior to the collection of the data.

Additionally, the engine was instrumented for speed, torque, throttle position, manifold air pressure, air intake restriction, total exhaust backpressure, manifold intake temperature, coolant temperature, oil temperature, and exhaust temperature according to CFR 40 Part 86 requirements.

Test Fuels and Oil

Three different diesel fuels were shipped to WVU in 55 gallon drums. The first fuel was the Reference fuel, the second fuel was the diesel Candidate fuel not treated with OR-LED2, and the third fuel was the neat biodiesel (100% biodiesel) fuel not treated with OR-LED2. WVU and ORYXE Energy International, Inc. personnel recognized that small variations of specifications may have existed from drum to drum for Reference and Candidate Fuels. To minimize these barrel-to-barrel variations, the barrels of Reference fuel were combined in a 600 gallon stainless steel mixing tank and mixed to ensure homogeneity in the Reference lot. Once mixed, the Reference fuel was returned to its original barrels. Likewise, the barrels of Candidate fuel not treated with OR-LED2 were combined in the same 600 gallon stainless steel mixing tank and mixed to ensure homogeneity in the Candidate fuel lot. Once mixed, the Candidate fuel not treated with OR-LED2 was returned to its original barrels. It is noted that the 600 gallon stainless steel mixing tank was cleaned, with steam, before each fuel was mixed.

The Reference fuel was, when needed, transferred from the original 55 gallon drums and into a 16 gallon stainless steel drum (there was one designated for the Reference fuel only). The B20 Blended fuel was made in a new 55 gallon drum by gravimetrically mixing the Candidate fuel and the neat B-100 biodiesel to obtain approximately 41 gallons (290.60 pounds) of the B20 Blended fuel. The B20 Blended fuel was then rolled on the floor over a 20 foot distance 20 times to insure that the diesel and biodiesel were well mixed. Three, one-gallon samples were collected and retained at WVU of the B20 Blended fuel. The remaining B20 Blended fuel not treated with OR-LED2 (269.95 pounds) was then treated with OR-LED2. This Treated B20 Blended fuel was then rolled on the floor over a 20 foot distance 20 times to insure that the additive and B20 blend was well mixed. This drum was used to store this fuel for the subsequent testing. It is noted that WVU personnel dosed the untreated B20 Blended fuel found within this 55 gallon drum with OR-LED2. The same WVU personnel performed this task using a treat rate of 20 ml/gallon and a dosing procedure described on a sheet of paper that has been submitted directly to the TCEQ in a separate envelope and marked: "Confidential/Proprietary: inform applicant and seek AG opinion before releasing." The B20 Blended fuel treated with OR-LED2 was transferred from the

designated 55 gallon drum and into a second 16 gallon stainless steel drum (there was a separate one designated for the B20 Blended fuel treated with OR-LED2).

The engine's fuel system was directly connected to the relevant 16 gallon drum for the fuel under test. The fuel filters were changed prior to the start of this study. Multiple fuel samples were collected from the 55 and 16 gallon drums with samples of the Reference fuel, B20 Blended fuel treated with OR-LED2, neat Candidate fuel not treated with OR-LED2, B20 Blended fuel not treated with OR-LED2, and the neat B100 biodiesel. Samples of the Reference fuel, B20 Blended fuel treated with OR-LED2, B20 Blended fuel not treated with OR-LED2, and neat Candidate fuel not treated with OR-LED2 were shipped to Intertek Caleb Brett in Signal Hill, CA for analysis. The analyses from Intertek Caleb Brett are summarized in Appendix A for the Reference fuel, the neat Candidate fuel not treated with OR-LED2, and the B20 Blended fuel treated with OR-LED2.

The analyses to detect the presence/absence and concentration (where applicable) of each component found within the OR-LED2 additive in the neat Candidate fuel not treated with OR-LED2 and the B20 Blended fuel treated with OR-LED2 are not included in this report. This information has been submitted directly to the TCEQ in a separate envelope and marked: "Confidential/Proprietary: inform applicant and seek AG opinion before releasing." The remaining samples of the Reference fuel, B20 Blended fuel treated with OR-LED2, neat Candidate fuel not treated with OR-LED2, B20 Blended fuel not treated with OR-LED2, and the neat B100 biodiesel were retained at WVU for future analysis, if warranted. The engine oil and oil filters were also changed prior to the commencement of this study. Typical 15W-40 diesel specification engine oil was used as the oil for the oil change that occurred prior to the commencement of this study. WVU personnel did collect and retain an oil sample but did not have the oil analyzed.

Test Procedure

Evaluation of the emissions was conducted using the 1992 Detroit Diesel Corporation Series 60 engine described above and was inspected prior to use in this study. The inspection included visual examination and measurement of engine parameters and review of data from the engine control unit. A Nexiq Technologies ProLink Plus monitor was used to display the engine control unit data and to display any potential problems (error codes) during this testing. In addition, the continuous broadcast of the public messages from the SAE J1708/1587 data link were captured using B&B Electronics VIA HPV100A1 protocol adaptor. There were no error codes generated during this entire testing campaign.

The engine operating parameters were set to within the specifications listed in CFR 40 Part 86 or listed by the engine manufacturer for engine dynamometer testing. An ascending speed engine map (lug curve) was then generated using the Reference fuel. It is noted that the last Reference fuel cycle/engine map run on Day 1 of testing was used for all subsequent tests.

The engine description is listed in Table 1 and the engine map used for the engine load setpoint is shown in Figure 1. The average and one standard deviation of the measured torque for each fuel for each day are shown in Table 2 for three consecutive lug curves.

Table 1 Test engine specifications.

Engine Manufacturer	Detroit Diesel Corp.
Engine Model	Series 60
Model Year	1992
Displacement (liters)	12.7
Power Rating (hp)	360 @ 1810 rpm
Configuration	Inline 6
Bore (in.) x Stroke (in.)	5.12 x 6.30
Induction	Turbocharger with Aftercooler
Fuel Type	Diesel
Engine Strokes per Cycle	Four
Injection	Direct, Electronic

Table 2 Lug curve torque for each test day and fuel. All values are the average of three consecutive lug curves (ascending 8 rpm/s maps). Values in parentheses are one standard deviation of the three tests at that speed.

	Reference	TRT B20 BLEND	TRT B20 BLEND	Reference
Speed	Day1	Day2	Day3	Day3
rpm	ft-lb	ft-lb	ft-lb	ft-lb
600	660 (2)	639 (2)	626 (1)	639 (3)
700	703 (1)	675 (6)	664 (2)	679 (2)
800	683 (2)	665 (1)	650 (2)	663 (3)
900	860 (4)	823 (2)	802 (1)	828 (4)
1000	1057 (4)	997 (3)	978 (1)	1028 (5)
1100	1222 (5)	1197 (2)	1181 (3)	1228 (2)
1200	1356 (2)	1315 (3)	1315 (2)	1352 (3)
1300	1334 (2)	1291 (4)	1290 (2)	1331 (1)
1400	1294 (1)	1254 (1)	1251 (2)	1291 (1)
1500	1285 (3)	1241 (2)	1241 (3)	1285 (8)
1600	1224 (2)	1187 (1)	1183 (2)	1226 (2)
1700	1156 (4)	1110 (2)	1112 (1)	1159 (2)
1800	1096 (1)	1059 (4)	1059 (4)	1098 (7)
1900	406 (4)	388 (0)	388 (6)	412 (0)
1930	41 (1)	28 (0)	31 (1)	42 (2)

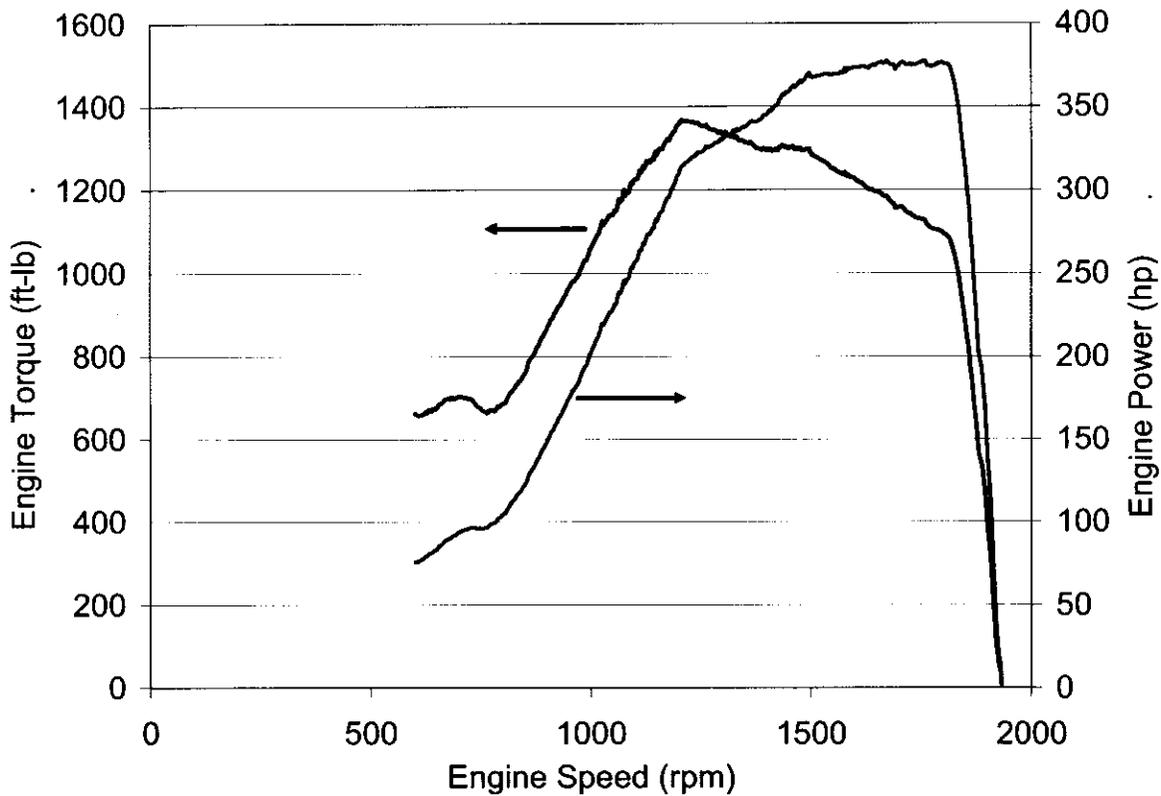


Figure 1 1992 DDC S60 engine lug curve. Note that the last Reference fuel engine map during the first day of testing was used to generate this curve and that this curve was used for all subsequent FTP evaluations.

Prior to the start of the first FTP for each fuel evaluation, the analyzers were zeroed and spanned. At the end of each FTP test, the analyzers were checked for zero and span readings. The post test zero and span readings were recorded in the test data sheet prior to adjusting, if required, the analyzers' zero and or span value. It is noted that there were no significant (greater than two percent) drift problems encountered in the analyzers or sampling system during this study.

At the completion of each test day a 20-minute tunnel TPM background was collected to correct the TPM test data. It is noted that the HEPA filters significantly reduced the ambient TPM contribution. However, HEPA filters are only 99.97% efficient at 0.3 μm and their efficiencies at other particle sizes are dependant upon the filter loading history. Also, tunnel shedding and hydrocarbon outgassing does still occur and is most likely the largest contributor to the tunnel background.

When the fuel was switched from one fuel to another, the laboratory's fuel system was purged. The laboratory incorporated a Max Machinery 710 fuel meter system. This system incorporated a primary loop to circulate fuel from the 16 gallon supply drum and a secondary loop to circulate fuel to the engine. The fuel transferred from the primary to secondary side was the measured fuel to the engine. The primary loop was purged by pulling approximately two gallons of fuel that was being tested at the time from the supply drum and returning it to a waste drum. After the primary side was purged, the return line was placed into the fuel to be tested that was located in the 16 gallon supply drum. The secondary loop was purged in a similar manner in that the return line to the fuel meter was diverted and the fuel emptied

into a waste container. However, for the secondary loop, a bypass system around the engine’s lift pump was incorporated from the outlet of the primary fuel filter to the inlet of the secondary fuel filter. During testing, this bypass was disengaged from the fuel system with a quarter-turn valve located at the secondary filter inlet. After approximately two gallons of fuel was extracted from the secondary loop, the return line to the fuel meter was connected. The engine was then started and run to insure that the fuel system was functioning properly and any remaining fuel from the previous run(s) was sufficiently purged.

The order of the evaluation and a description of the testing as performed (and in accordance with the TCEQ-approved Test Plan) are given in Table 3. There were no deviations from the TCEQ-approved Test Plan.

Table 3 Test history as specified in the Test Plan.

Day	Fuel	Description
1	Reference	Six reportable hot start FTPs.
2	Treated B20 Blended Fuel	Six reportable hot start FTPs.
3	Treated B20 Blended Fuel	Three reportable hot start FTPs.
4	Reference	Six hot start FTPs, reported but not used in the calculations.

It is noted that a TCEQ-appointed observer, Mr. Clifford Tyree, was present during the entire testing period, from November 14, 2006 through November 16, 2006. Mr. Tyree witnessed every hot start FTP run, blending of the B20 Blended fuel, treatment of the B20 Blended fuel with the OR-LED2 additive by WVU personnel, and each fuel sample taken to generate the fuel analyses listed in Appendix A, among others.

Results

The results for the evaluation are summarized in the graphs below and in tabular format in Appendix B. The tables in the Appendix contain the test number, test date, test time, start type, comments, integrated work, fuel consumption, brake specific fuel consumption (BSFC), THC, NMHC, CO, CO₂, NO_x, TPM, hot-start average, hot start standard deviation, and the coefficient of variation (COV) for each set of tests. It is noted that the CO data were not required but are reported here. Table 8 and Table 11 contain the summary data for the Reference fuel runs and Table 9 and Table 10 contain the summary data for the B20 Blended fuel treated with OR-LED2 runs.

During the collection of this data, there was one mishandled bag sample (background bag for test E01527-02) on Day 3, resulting in an additional hot start test to be run. The data for this mishandled run is included in the data set but was not used in the determination of the passage criteria. Additionally, one brake-specific CO₂ value (test E0127-04) was identified as an outlier based on the ASTM E178 criteria. However, this test had a high, but less than the allowable CFR, post span value. The high brake-specific CO₂ value was attributed to the drift in the analyzer and this test was maintained in the dataset.

Comparison of Reference Fuel to the B20 Blended Fuel Treated with OR-LED2

The Reference fuel and B20 Blended fuel treated with OR-LED2 will be compared based on the Day 1 Reference fuel runs and the Day 2 and Day 3 B20 Blended fuel treated with OR-LED2 runs. The Day 3 Reference fuel runs were not used in the comparison of the data but are included in the tables and figures as part of the test record. All of the Day 1, Day 2, and Day 3 data gathered are included in Appendix B and Appendix C, herein.

The primary constituent of interest is NO_x and is illustrated in Figure 2 as the average of the hot start FTPs for each test for each noted day. The bars represent one standard deviation of the data for each test for each noted day. Overall, the unadjusted (per the statistical passage criterion described below and shown in Table 4) NO_x values averaged 4.873 g/bhp-hr for the Day 1 Reference fuel and averaged 4.897 g/bhp-hr for the Day 2 and 3 B20 Blended fuel treated with OR-LED2, resulting in a slightly higher NO_x value of approximately 0.5% using the B20 Blended fuel treated with OR-LED2. As illustrated in this figure, the Reference fuel brake-specific NO_x value was consistent over the two calendar days it was tested and agreed to within the test-to-test variability. Likewise, the B20 Blended fuel treated with OR-LED2 brake-specific NO_x value was consistent over the two calendar days it was tested and agreed to within the test-to-test variability.

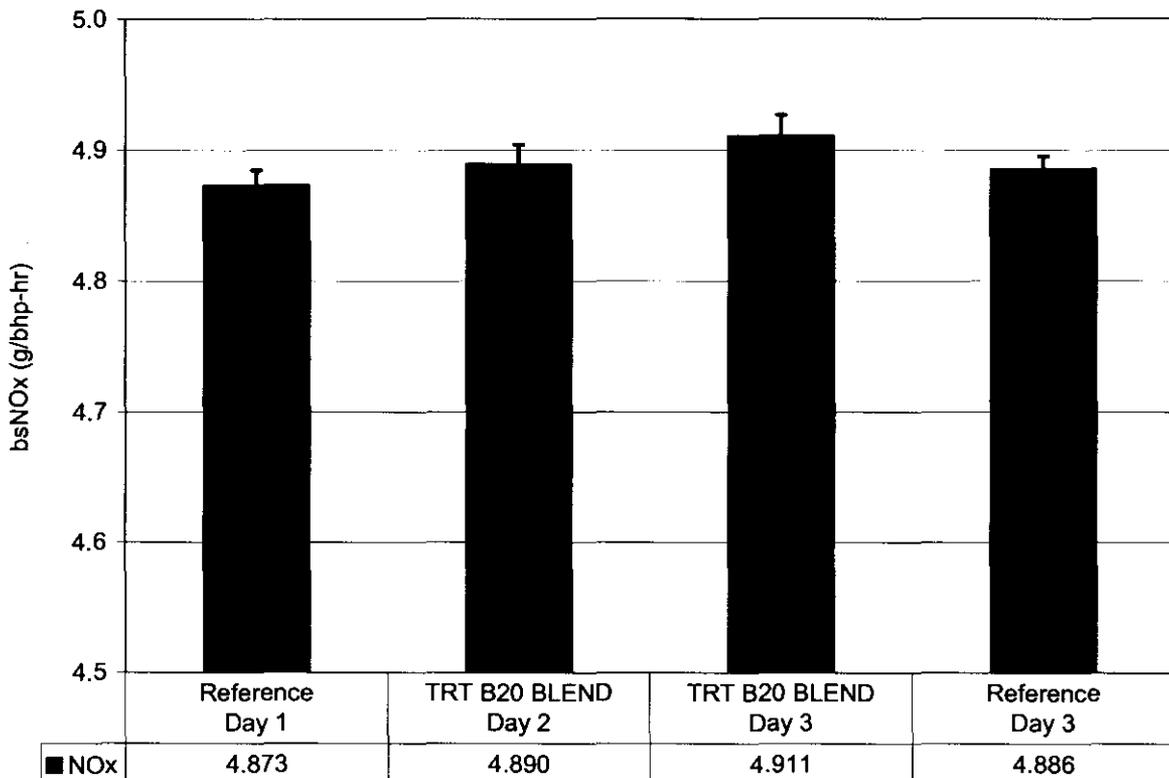


Figure 2 Average NO_x values from hot-start FTP runs. Bars represent one standard deviation of the data for that set of tests. Note the expanded emissions axis.

The results for THC and NMHC are shown in Figure 3 as the average of the hot start FTPs for each test for each noted day. The bars represent one standard deviation of the data for each test for each noted day.

It is noted that the THC data was recorded from the continuous HFID analyzer while the NMHC data was inferred from the bag samples using the gas chromatograph and using the SAE J1151 procedure. Overall, the unadjusted THC values averaged 0.1168 g/bhp-hr for the Day 1 Reference fuel and averaged 0.0964 g/bhp-hr for the Day 2 and 3 B20 Blended fuel treated with OR-LED2, resulting in a 17.5% reduction in the THC value using the B20 Blended fuel treated with OR-LED2. Overall, the unadjusted NMHC values averaged 0.1175 g/bhp-hr for the Day 1 Reference fuel and 0.0975 g/bhp-hr for the Day 2 and 3 B20 Blended fuel treated with OR-LED2, resulting in a 17.0% reduction in the NMHC value using the B20 Blended fuel treated with OR-LED2. The THC and NMHC data matched to within the standard deviation for each set of tests. The THC and NMHC values should be equivalent for a compression ignition engine using a conventional No. 2 diesel fuel or a 20% biodiesel blend. As illustrated in this figure, the Reference fuel brake-specific THC and NMHC values were consistent over the two calendar days they were tested and generally agreed to within the test-to-test variability. The B20 Blended fuel treated with OR-LED2 brake-specific THC and NMHC values were consistent over the two calendar days they were tested and agreed to within the test-to-test variability.

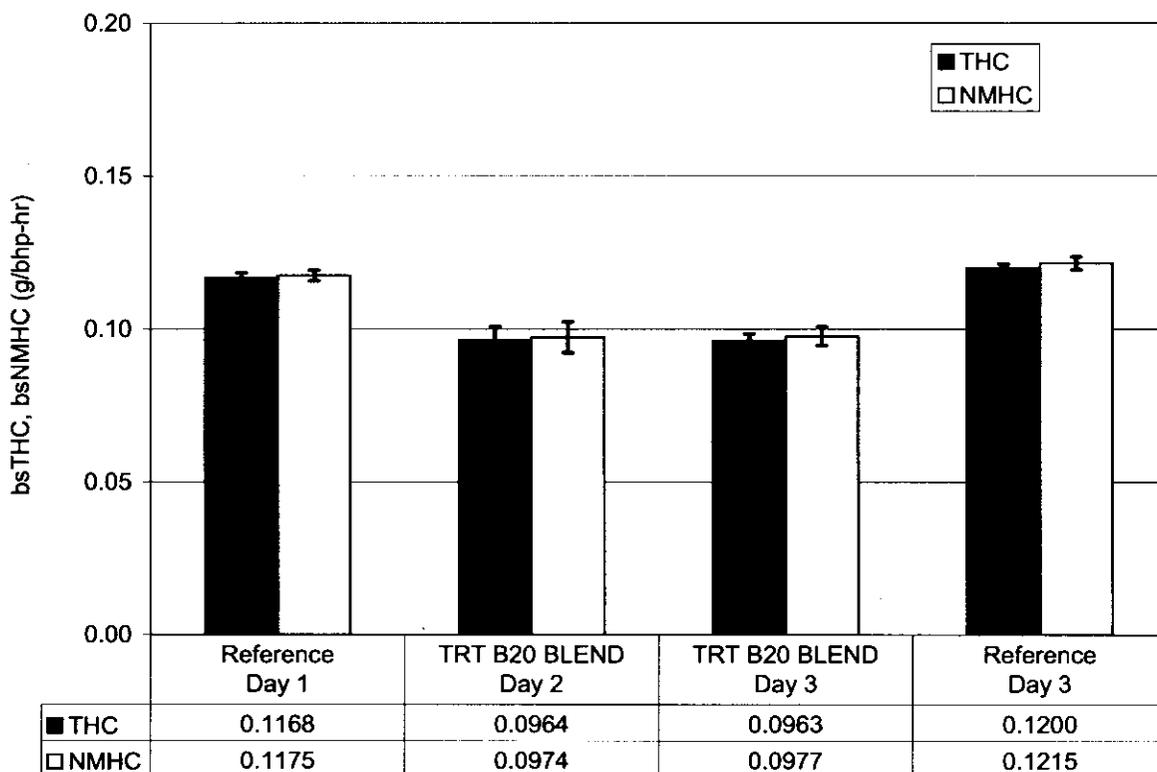


Figure 3 Average THC and NMHC values from hot-start FTP runs. Bars represent one standard deviation of the data for that fuel.

The results for TPM are shown in Figure 4 as the average of the hot start FTPs for each test for each noted day. The bars represent one standard deviation of the data for each test for each noted day. Overall, the unadjusted TPM values averaged 0.2449 g/bhp-hr for the Day 1 Reference fuel and 0.1744 g/bhp-hr for the Day 2 and 3 B20 Blended fuel treated with OR-LED2, resulting in a 28.8% reduction in the TPM value using the B20 Blended fuel treated with OR-LED2. As illustrated in this figure, the Reference fuel brake-specific TPM value was consistent over the two calendar days it was tested and agreed to within the test-to-test variability. The B20 Blended fuel treated with OR-LED2 brake-specific

TPM value was consistent over the two calendar days it was tested and agreed to within the test-to-test variability.

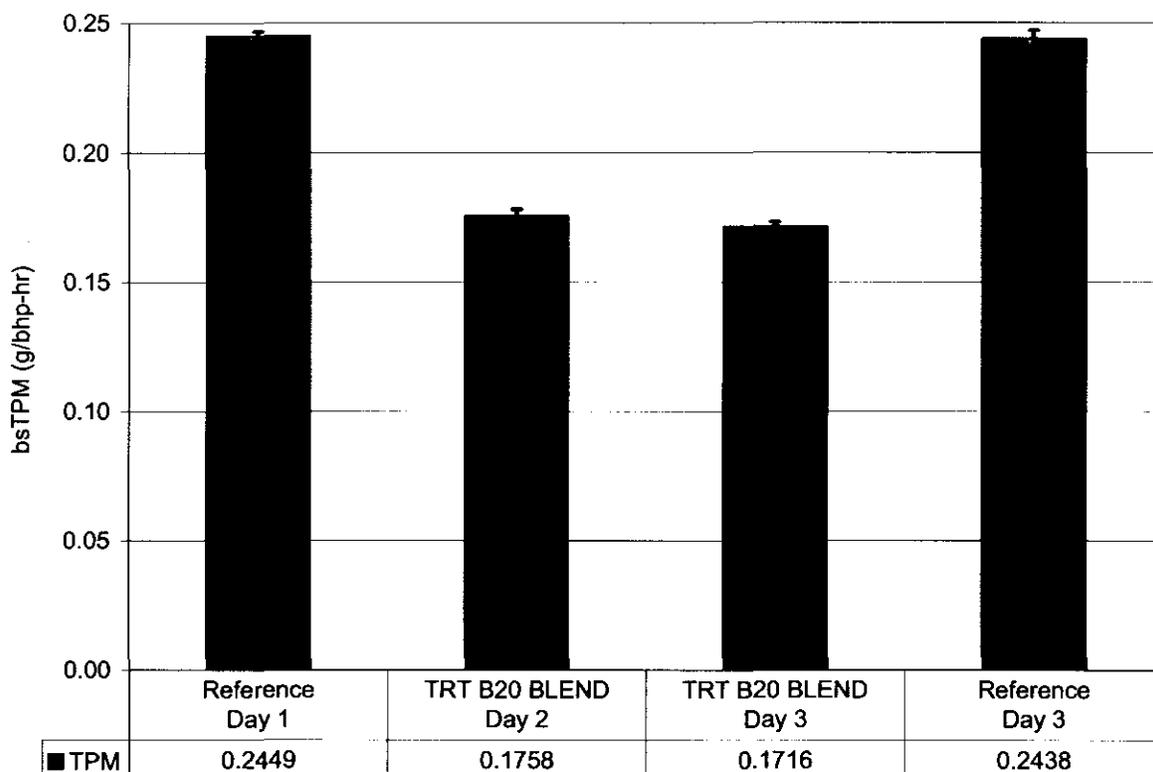


Figure 4 Average TPM values from hot-start FTP runs. Bars represent one standard deviation of the data for that fuel. Note the expanded emissions axis.

The results for fuel consumption are shown in Figure 5 and the results for BSFC are shown in Figure 6. The bars represent one standard deviation of the data for each test for each noted day. The fuel consumed values were the direct measurement from the fuel meter. The BSFC values use the consumed measurement and the integrated work from the dynamometer. The data uses specific or API gravity to determine the fuel consumed values. As shown in the fuel consumption and BSFC data, there was a 2.6% difference in the amount of fuel required to exercise the engine over hot-start FTP cycles between the Reference fuel and the B20 Blended fuel treated with OR-LED2. Overall, the unadjusted average BSFC value was 0.3802 lb/bhp-hr for the Day 1 Reference fuel and 0.3913 lb/bhp-hr for the Day 2 and 3 B20 Blended fuel treated with OR-LED2, resulting in a 2.9% increase in the BSFC value for the B20 Blended fuel treated with OR-LED2. It is noted that there was no significant difference in the overall average integrated work value between the Reference fuel (24.75 bhp-hr) and B20 Blended fuel treated with OR-LED2 (24.64 bhp-hr).

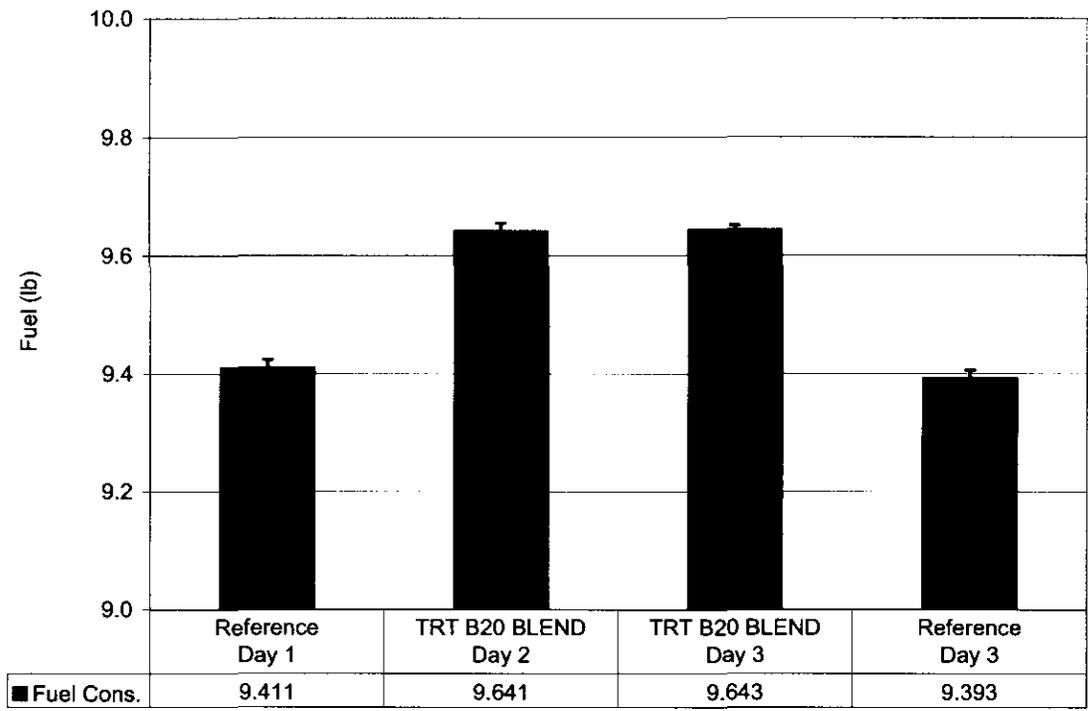


Figure 5 Average fuel consumption values from hot-start FTP runs. Bars represent one standard deviation of the data for that fuel. Note the expanded axis.

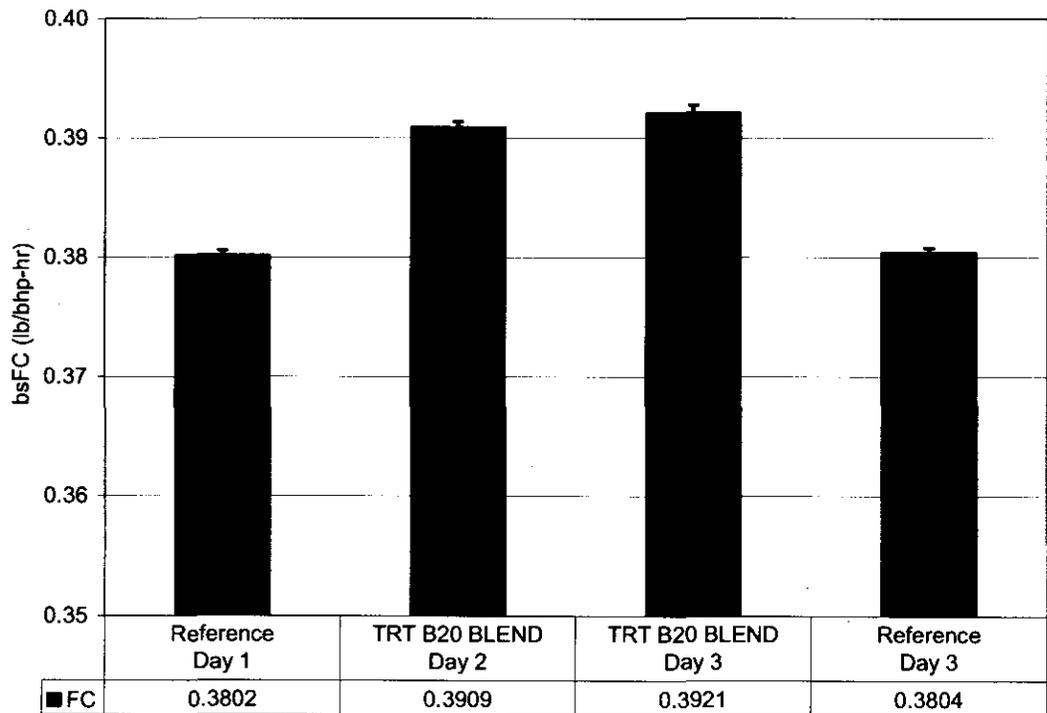


Figure 6 Average brake specific fuel consumption (BSFC) values from hot-start FTP runs. Bars represent one standard deviation of the data for that fuel. Note the expanded axis.

B20 Blended Fuel Treated with OR-LED2 Emissions Passage Criteria

The average emission level of the B20 Blended fuel treated with OR-LED2 was compared to the average emission level of the Reference fuel using the one-sided Student's t statistics shown in Equation (1).

$$\bar{X}_C \leq \bar{X}_R + \delta - S_P \sqrt{2/n} t(a, 2n - 2) \quad (1)$$

Rewriting the right hand side (RHS) as Equation (2).

$$\text{RHS} = \bar{X}_R + \delta - S_P \sqrt{2/n} t(a, 2n - 2) \quad (2)$$

The B20 Blended fuel treated with OR-LED2 must satisfy Equation (3)

$$\bar{X}_C \leq \text{RHS} \quad (3)$$

The average emissions of the B20 Blended fuel treated with OR-LED2 and the Reference fuel are shown in Table 4. In addition and in accordance with TAC §114.315(c)(5), the tolerance level, δ , pooled standard deviation, S_P , and Student's t statistics are given in the table. The calculations presented in Table 4 are based on the recommended procedure by the TCEQ. As shown in this table, all of the tested pollutants as defined in TAC §114.315(c)(4)(E), namely NO_x, THC, NMHC, and TPM, for the B20 Blended fuel treated with OR-LED2 were less than those of the Reference fuel when using the one-sided Student's t test and hence pass the criteria for each pollutant.

Table 4 Determination of B20 Blended fuel treated with OR-LED2 emissions passage.

	Average X_C (g/bhp-hr)	Average X_R (g/bhp-hr)	δ (%)	N_C (-)	N_R (-)	n (-)	S_P (g/bhp-hr)	$Sqr[2/n]$ (-)	df (-)	$t(2^*.15, df)$ (-)	RHS (g/bhp-hr)	Satisfy Criteria?
THC	0.0964	0.1168	2	9	6	15	0.00085	0.3651	28	1.0560	0.1188	Yes
NMHC	0.0975	0.1175	2	9	6	15	0.00098	0.3651	28	1.0560	0.1195	Yes
NO _x	4.897	4.873	1	9	6	15	0.00437	0.3651	28	1.0560	4.920	Yes
TPM	0.1744	0.2449	2	9	6	15	0.00070	0.3651	28	1.0560	0.2495	Yes

Conclusions

A B20 Blended diesel fuel (20% neat biodiesel and 80% petroleum diesel, by volume) treated with ORYXE Energy International, Inc.'s OR-LED2 additive was compared to a Reference diesel fuel meeting the specifications of TAC §114.315. The emissions of NO_x, THC, NMHC, and TPM were compared between the two fuels. For all the required emission constituents, the average values from the B20 Blended diesel fuel treated with OR-LED2 were less than those from the Reference fuel using the one-sided Student's t test. The average integrated work and BSFC values for the B20 Blended fuel treated with OR-LED2 were within 0.3% and 2.9%, respectively, of those from the Reference fuel.

References

- 1 *Title 40 Code of Federal Regulations, Part 86*, U.S. Government Printing Office, Washington, DC, 2000.
- 2 *Methane Measurement Using Gas Chromatograph*, Society of Automotive Engineers, Recommended Practice SAE J1151, Warrendale, PA, 1991.

Appendix A – Fuel Analyses

Table 5 Reference fuel analysis.

Intertek Caleb Brett
REPORT OF ANALYSIS

Vessel : SUBMITTED SAMPLE AND ANALYSIS
Port/Terminal : WEST VIRGINIA UNIVERSITY
Customer Reference : WVFUEL00781.00782
Our Reference : 260-0005584
Date Sample Taken : —
Date Submitted : 11/20/06
Date Tested : 11/20-22/06
Sample Designated As : DIESEL FUEL
Drawn By : AS SUBMITTED
Representing : TCEQ REFERENCE FUEL
Lab Reference : 06-40183

TEST	METHOD	RESULT	UNITS
Gravity, API	D 287	36.4	—
Viscosity @ 40°C	D 445	2.916	cSt
Flash Point (P.M.C.C.)	D 93A	190	°F
Cloud Point	D 2500	-7	°C
Ash Content	D 482	< 0.001	Wt%
Sulfur Content	D 5453	12	ppm
Nitrogen Content	D 4629	2	ppm
Total Aromatics by SFC	D 5186	9.1	Wt%
Total Aromatics by SFC	D 5186	9.7	Vol%
PNA by SFC	D 5186	0.7	Wt%
Carbon Residue, Ramsbottom (10%Btms)	D 524	0.03	Wt%
Cetane Number	D 613	50.7	—
Water & Sediment	D 1798	0	Vol%
Distillation			
-Initial Boiling Point	D 86	420	°F
-5% Recovered	D 86	445	°F
-10% Recovered	D 86	453	°F
-20% Recovered	D 86	466	°F
-30% Recovered	D 86	476	°F
-40% Recovered	D 86	487	°F
-50% Recovered	D 86	498	°F
-60% Recovered	D 86	509	°F
-70% Recovered	D 86	522	°F
-80% Recovered	D 86	537	°F
-90% Recovered	D 86	565	°F
-95% Recovered	D 86	599	°F
-End Point	D 86	620	°F
-%Recovered	D 86	97.9	Vol%
-%Residue	D 86	1.0	Vol%
-%Loss	D 86	1.1	Vol%
Copper Corrosion (3hrs @ 50°C)	D 130	1a	---
Carbon Content	D 5291	86.84	Wt%
Hydrogen Content	D 5291	12.80	Wt%



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Table 6 Untreated Candidate fuel analysis.

Intertek
Caleb Brett
REPORT OF ANALYSIS

Vessel : SUBMITTED SAMPLE AND ANALYSIS
Port/Terminal : WEST VIRGINIA UNIVERSITY
Customer Reference : WVFUJEL00787, 00788, 00789
Our Reference : 260-0005584
Date Sample Taken : —
Date Submitted : 11/20/06
Date Tested : 11/20-22, 30/06, 12/01-06/06
Sample Designated As : DIESEL FUEL
Drawn By : AS SUBMITTED
Representing : UNTREATED CANDIDATE FUEL
Lab Reference : 06-40182B

TEST	METHOD	RESULT	UNITS
Gravity, API	D 287	38.3 / 38.3 / 38.3	---
Viscosity @ 40°C	D 445	2.176 / 2.176 / 2.180	cSt
Flash Point (P.M.C.C.)	D 93A	153 / 153 / 153	°F
Cloud Point	D 2500	-8	°C
Ash Content	D 482	< 0.001	Wt%
Sulfur Content	D 5453	3 / 3 / 3	ppm
Nitrogen Content	D 4629	4 / 4 / 4	ppm
Total Aromatics by SFC	D 5186	30.4 / 30.3 / 30.2	Wt%
Total Aromatics by SFC	D 5186	29.2 / 29.1 / 29.0	Vol%
PNA by SFC	D 5186	4.6 / 4.6 / 4.5	Wt%
Carbon Residue, Ramsbottom (10%Btms)	D 524	0.07	Wt%
Cetane Number	D 613	48.1 / 48.4 / 48.2	---
Water & Sediment	D 1798	0.005	Vol%
Distillation			
-Initial Boiling Point	D 86	359 / 363 / 356	°F
-5% Recovered	D 86	396 / 395 / 396	°F
-10% Recovered	D 86	404 / 402 / 401	°F
-20% Recovered	D 86	421 / 420 / 420	°F
-30% Recovered	D 86	438 / 438 / 437	°F
-40% Recovered	D 86	458 / 458 / 458	°F
-50% Recovered	D 86	480 / 481 / 481	°F
-60% Recovered	D 86	504 / 504 / 505	°F
-70% Recovered	D 86	528 / 528 / 529	°F
-80% Recovered	D 86	554 / 555 / 555	°F
-90% Recovered	D 86	594 / 595 / 595	°F
-95% Recovered	D 86	631 / 637 / 634	°F
-End Point	D 86	648 / 653 / 650	°F
-%Recovered	D 86	97.4 / 97.5 / 97.5	Vol%
-%Residue	D 86	1.4 / 1.3 / 1.4	Vol%
-%Loss	D 86	1.2 / 1.2 / 1.1	Vol%
Copper Corrosion (3hrs @ 50°C)	D 130	1a	---
Carbon Content	D 5291	86.80	Wt%
Hydrogen Content	D 5291	12.40	Wt%
Oxygen Content	D 5291	0.80	Wt%


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Table 7 B20 Blended fuel treated with OR-LED2 analysis.

Intertek Caleb Brett
REPORT OF ANALYSIS

Vessel : SUBMITTED SAMPLE AND ANALYSIS
 Port/Terminal : WEST VIRGINIA UNIVERSITY
 Customer Reference : WVFUEL00799, 00800, 00801
 Our Reference : 260-0005584
 Date Sample Taken : —
 Date Submitted : 11/20/06
 Date Tested : 11/20-22/06, 12/01-04/06
 Sample Designated As : DIESEL FUEL
 Drawn By : AS SUBMITTED
 Representing : TCEQ B20 TRT; TREATED CAND/BIO BLENDED FUEL
 Lab Reference : 06-40184B

TEST	METHOD	RESULT	UNITS
Gravity, API	D 287	36.7 / 36.7 / 36.7	—
Viscosity @ 40°C	D 445	2.508 / 2.498 / 2.500	cSt
Flash Point (P.M.C.C.)	D 93A	158 / 158 / 158	°F
Cloud Point	D 2500	-5	°C
Ash Content	D 482	< 0.001	Wt%
Sulfur Content	D 5453	5 / 5 / 5	ppm
Nitrogen Content	D 4829	268 / 268 / 269	ppm
Total Aromatics by SFC	D 5186	30.5 / 30.3 / 30.3	Wt%
Total Aromatics by SFC	D 5186	29.3 / 29.1 / 29.0	Vol%
PNA by SFC	D 5186	4.5 / 4.4 / 4.5	Wt%
Carbon Residue, Ramsbottom (10%Btms)	D 524	0.10	Wt%
Cetane Number	D 613	58.4 / 58.7 / 58.7	—
Water & Sediment	D 1796	0.005	Vol%
Distillation			
-Initial Boiling Point	D 86	354 / 359 / 356	°F
-5% Recovered	D 86	396 / 401 / 396	°F
-10% Recovered	D 86	409 / 413 / 413	°F
-20% Recovered	D 86	433 / 437 / 438	°F
-30% Recovered	D 86	459 / 463 / 463	°F
-40% Recovered	D 86	489 / 492 / 492	°F
-50% Recovered	D 86	519 / 522 / 522	°F
-60% Recovered	D 86	548 / 550 / 551	°F
-70% Recovered	D 86	577 / 578 / 578	°F
-80% Recovered	D 86	605 / 605 / 606	°F
-90% Recovered	D 86	630 / 629 / 630	°F
-95% Recovered	D 86	649 / 647 / 649	°F
-End Point	D 86	656 / 661 / 657	°F
-%Recovered	D 86	98.2 / 97.9 / 98.3	Vol%
-%Residue	D 86	0.8 / 1.3 / 0.8	Vol%
-%Loss	D 86	1.0 / 0.8 / 0.9	Vol%
Copper Corrosion (3hrs @ 50°C)	D 130	1a	—
Carbon Content	D 5291	85.35	Wt%
Hydrogen Content	D 5291	11.88	Wt%
Oxygen Content	D 5291	2.77	Wt%


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Appendix B – Emissions Summary Tables

Table 8 Summary of the Reference fuel Day 1 emissions data.

Fuel: Reference Day 1				Work	Fuel Cons.	bsFC	bsTHC	bsNMHC	bsCO	bsCO2	bsNOx	bsNOx2	bsTPM
Date	Time	Test No.	Start Type	bhp-hr	lb	lb/bhp-hr	g/bhp-hr						
11/14/06	11:18	E01523-02	Hot	24.74	9.421	0.3808	0.1158	0.1172	3.343	528.5	4.869	4.851	0.2433
11/14/06	11:58	E01523-03	Hot	24.76	9.409	0.3801	0.1159	0.1191	3.380	528.9	4.856	4.859	0.2454
11/14/06	12:38	E01523-04	Hot	24.77	9.412	0.3800	0.1176	0.1174	3.373	528.4	4.885	4.874	0.2457
11/14/06	13:18	E01523-05	Hot	24.77	9.423	0.3804	0.1146	0.1152	3.375	528.2	4.868	4.858	0.2445
11/14/06	13:58	E01523-06	Hot	24.76	9.414	0.3802	0.1179	0.1161	3.363	530.7	4.888	4.872	0.2432
11/14/06	14:38	E01523-07	Hot	24.72	9.385	0.3797	0.1191	0.1198	3.373	529.6	4.874	4.859	0.2476
Hot Start Average				24.75	9.411	0.3802	0.1168	0.1175	3.368	529.0	4.873	4.862	0.2449
Hot Start Std Dev				0.02	0.014	0.0004	0.0017	0.0017	0.013	0.9	0.012	0.009	0.0017
COV (%)				0.08	0.15	0.10	1.42	1.48	0.40	0.18	0.24	0.18	0.68

Comments:

Table 9 Summary of B20 Blended fuel treated with OR-LED2 Day 2 emissions data.

Fuel: TRT B20 BLEND Day 2				Work	Fuel Cons.	bsFC	bsTHC	bsNMHC	bsCO	bsCO2	bsNOx	bsNOx2	bsTPM
Date	Time	Test No.	Start Type	bhp-hr	lb	lb/bhp-hr	g/bhp-hr						
11/15/06	9:28	E01525-02	Hot	24.66	9.652	0.3913	0.0891	0.0898	2.517	534.7	4.867	4.862	0.1786
11/15/06	10:08	E01525-03	Hot	24.64	9.641	0.3913	0.0959	0.0935	2.514	536.3	4.895	4.888	0.1749
11/15/06	10:48	E01525-04	Hot	24.67	9.628	0.3902	0.1002	0.1015	2.470	535.1	4.910	4.883	0.1772
11/15/06	11:28	E01525-05	Hot	24.71	9.661	0.3910	0.0949	0.0970	2.458	534.2	4.881	4.855	0.1717
11/15/06	12:08	E01525-06	Hot	24.65	9.628	0.3905	0.0966	0.0992	2.451	534.5	4.897	4.876	0.1755
11/15/06	12:49	E01525-07	Hot	24.63	9.638	0.3912	0.1017	0.1033	2.491	536.0	4.887	4.866	0.1772
Hot Start Average				24.66	9.641	0.3909	0.0964	0.0974	2.484	535.1	4.890	4.872	0.1758
Hot Start Std Dev				0.03	0.013	0.0005	0.0044	0.0051	0.028	0.8	0.015	0.013	0.0024
COV (%)				0.11	0.14	0.12	4.60	5.20	1.14	0.16	0.30	0.26	1.37

Comments:

Table 10 Summary of B20 Blended fuel treated with OR-LED2 Day 3 emissions data.

Fuel: TRT B20 BLEND Day 3				Work	Fuel Cons.	bsFC	bsTHC	bsNMHC	bsCO	bsCO2	bsNOx	bsNOx2	bsTPM
Date	Time	Test No.	Start Type	bhp-hr	lb	lb/bhp-hr	g/bhp-hr						
11/16/06	9:36	E01527-02	Hot	24.64	9.652	0.3928	0.0976	0.0990	2.677	574.5	4.914	4.913	0.1792
11/16/06	10:16	E01527-03	Hot	24.62	9.641	0.3916	0.0975	0.0990	2.540	534.2	4.895	4.903	0.1723
11/16/06	10:56	E01527-04	Hot	24.59	9.637	0.3919	0.0976	0.0999	2.553	541.8	4.911	4.898	0.1729
11/16/06	11:36	E01527-05	Hot	24.57	9.652	0.3928	0.0937	0.0942	2.546	535.3	4.927	4.923	0.1697

Hot Start Average	24.59	9.643	0.3921	0.0963	0.0977	2.546	537.1	4.911	4.908	0.1716
Hot Start Std Dev	0.03	0.008	0.0006	0.0022	0.0031	0.007	4.1	0.016	0.013	0.0017
COV (%)	0.10	0.08	0.16	2.31	3.14	0.26	0.77	0.33	0.27	0.98

Comments:

Test E01527-02 was invalid. Background bag was not connected into the bench after the warm start test (E01527-01). Could not record background nor fill NMHC background bags. An extra hot start (E01527-05) was run in place of this run. Note that the Work, Fuel Consumed, bsFC and bsTPM for E01527-02 is similar to the other hot start tests but that the gaseous emissions are all higher due to the lack of background subtraction.

Note that Test E01527-04 brake specific CO₂ was high. The post test span for CO₂ was 1.5% high. Although this was atypical for this analyzer, it was less than the 2% allowed by the CFR. This point was not deemed to be an outlier since the post test span value was high.

Table 11 Summary of Reference fuel Day 3 emissions data.

Fuel: Reference Day 3				Work	Fuel Cons.	bsFC	bsTHC	bsNMHC	bsCO	bsCO2	bsNOx	bsNOx2	bsTPM
Date	Time	Test No.	Start Type	bhp-hr	lb	lb/bhp-hr	g/bhp-hr						
11/16/06	14:19	E01529-02	Hot	24.71	9.414	0.3810	0.1220	0.1235	3.474	528.3	4.899	4.898	0.2446
11/16/06	14:59	E01529-03	Hot	24.71	9.401	0.3805	0.1203	0.1242	3.514	528.3	4.874	4.876	0.2481
11/16/06	15:39	E01529-04	Hot	24.66	9.382	0.3805	0.1189	0.1194	3.395	530.6	4.893	4.898	0.2385
11/16/06	16:19	E01529-05	Hot	24.71	9.385	0.3798	0.1207	0.1210	3.404	529.1	4.889	4.877	0.2430
11/16/06	17:00	E01529-06	Hot	24.68	9.383	0.3802	0.1197	0.1192	3.372	529.8	4.882	4.888	0.2433
11/16/06	17:40	E01529-07	Hot	24.70	9.394	0.3803	0.1183	0.1216	3.413	528.9	4.877	4.887	0.2454
Hot Start Average				24.70	9.393	0.3804	0.1200	0.1215	3.429	529.2	4.886	4.887	0.2438
Hot Start Std Dev				0.02	0.013	0.0004	0.0013	0.0021	0.054	0.9	0.010	0.010	0.0032
COV (%)				0.08	0.13	0.10	1.10	1.70	1.57	0.17	0.20	0.20	1.31

Comments:

Appendix C – Individual Test Summary

E01523-01 Taken on 11/14/06 at 10:37 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.351	0.091	6.030	0.081	7.237	0.1138
CO	1.434	0.079	64.422	3.647	64.535	3.470
CO2	424.783	36.662	6605.030	563.565	6661.475	530.672
NOx	0.177	0.016	53.120	5.060	52.784	4.849
NOx2	0.114	0.010	52.217	4.980	52.326	4.809
SecHC	-0.007	0.000	-0.007	0.000	-0.023	-0.0005
PM						0.2611

Warm Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Cold Start
 Volume of total mixture: 43,369.7 SCF
 Dilution factor: 19.90
 Work actual/reference: 24.73/25.31 BhpHr
 Brake specific fuel con.: 0.3777 lb/BhpHr
 Fuel consumption: 9.339 lb
 Fuel recovered: 9.162 lb
 MT temp Ave/Max/Min: 193/370/94 °F
 Fltr face temp Ave/Max/Min: 103/118/89 °F
 Fuel temp Ave/Max/Min: 92/103/79 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 75/77/74 °F
 Exhaust Temp Ave/Max/Min: 491/857/227 °F
 Cat Inlet temp Ave/Max/Min: 80/91/76 °F
 Cat Outlet temp Ave/Max/Min: 77/80/75 °F
 Average Intake Air Mass: 458.0 lb
 Average Humidity Factor: 1.006
 Average Relative Humidity: 53.92%
 Intake Absolute Humidity: 77.3 grain/lb
 Barometric Pressure: 28.79 in. Hg
 Total Flow Through Filter: 35.63 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Cold start diesel cycle FTP test taken on 11/14/06 at 10:37 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.92	0 -- 100	pass
Slope of Reg.	0.9985	0.97 -- 1.03	pass
Y Intercept	7.41	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.32	0 -- 177.76	pass
Slope of Reg.	0.9589	0.77 -- 1.03	pass
Y Intercept	1.09	±15	pass
Coeff. of Reg.	0.9685	0.85 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.38	0 -- 30.15	pass
Slope of Reg.	0.9716	0.87 -- 1.03	pass
Y Intercept	-1.24	±5	pass
Coeff. of Reg.	0.9604	0.91 -- 1	pass
Integrated BHP	24.454	21.511 -- 26.573	pass

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E01523-02 Taken on 11/14/06 at 11:18 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.236	0.088	6.062	0.085	7.205	0.1158
CO	1.300	0.071	61.934	3.505	62.187	3.343
CO2	421.330	36.318	6549.778	558.020	6639.161	528.510
NOx	0.179	0.016	53.045	5.019	53.329	4.869
NOx2	0.071	0.006	52.698	4.996	53.067	4.851
SecHC	0.000	0.000	-0.005	0.000	-0.023	-0.0007
PM						0.2433

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,333.2 SCF
 Dilution factor: 19.97
 Work actual/reference: 24.74/25.31 BhpHr
 Brake specific fuel con.: 0.3808 lb/BhpHr
 Fuel consumption: 9.421 lb
 Fuel recovered: 9.127 lb
 MT temp Ave/Max/Min: 193/371/91 °F
 Fltr face temp Ave/Max/Min: 102/114/85 °F
 Fuel temp Ave/Max/Min: 92/98/76 °F
 MA temp Ave/Max/Min: 87/120/81 °F
 Intake Air Temp Ave/Max/Min: 76/79/75 °F
 Exhaust Temp Ave/Max/Min: 492/853/243 °F
 Cat Inlet temp Ave/Max/Min: 80/92/75 °F
 Cat Outlet temp Ave/Max/Min: 78/80/74 °F
 Average Intake Air Mass: 458.0 lb
 Average Humidity Factor: 1.001
 Average Relative Humidity: 51.61%
 Intake Absolute Humidity: 75.3 grain/lb
 Barometric Pressure: 28.79 in. Hg
 Total Flow Through Filter: 35.53 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 11:18 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.81	0 -- 100	pass
Slope of Reg.	0.9991	0.97 -- 1.03	pass
Y Intercept	6.39	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	65.83	0 -- 177.76	pass
Slope of Reg.	0.9638	0.83 -- 1.03	pass
Y Intercept	0.13	±15	pass
Coeff. of Reg.	0.9700	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	22.98	0 -- 30.15	pass
Slope of Reg.	0.9752	0.89 -- 1.03	pass
Y Intercept	-1.40	±5	pass
Coeff. of Reg.	0.9620	0.91 -- 1	pass
Integrated BHP	24.492	21.511 -- 26.573	pass

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E01523-03 Taken on 11/14/06 at 11:58 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.190	0.086	6.010	0.085	7.166	0.1159
CO	1.247	0.068	62.138	3.516	62.827	3.380
CO2	423.402	36.454	6557.228	557.918	6648.964	528.868
NOx	0.258	0.023	53.529	5.039	53.488	4.856
NOx2	0.070	0.006	52.941	5.000	53.379	4.859
SecHC	-0.003	0.000	-0.005	0.000	-0.023	-0.0006
PM						0.2454

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,311.0 SCF
 Dilution factor: 19.94
 Work actual/reference: 24.76/25.31 BhpHr
 Brake specific fuel con.: 0.3801 lb/BhpHr
 Fuel consumption: 9.409 lb
 Fuel recovered: 9.140 lb
 MT temp Ave/Max/Min: 192/373/94 °F
 Fltr face temp Ave/Max/Min: 102/115/85 °F
 Fuel temp Ave/Max/Min: 92/97/79 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 76/81/73 °F
 Exhaust Temp Ave/Max/Min: 491/851/243 °F
 Cat Inlet temp Ave/Max/Min: 80/90/75 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 457.9 lb
 Average Humidity Factor: 0.998
 Average Relative Humidity: 50.18%
 Intake Absolute Humidity: 74.2 grain/lb
 Barometric Pressure: 28.78 in. Hg
 Total Flow Through Filter: 35.50 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 11:58 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.82	0 -- 100	pass
Slope of Reg.	0.9986	0.97 -- 1.03	pass
Y Intercept	7.16	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	65.80	0 -- 177.76	pass
Slope of Reg.	0.9628	0.83 -- 1.03	pass
Y Intercept	0.50	±15	pass
Coeff. of Reg.	0.9701	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.04	0 -- 30.15	pass
Slope of Reg.	0.9744	0.89 -- 1.03	pass
Y Intercept	-1.33	±5	pass
Coeff. of Reg.	0.9616	0.91 -- 1	pass
Integrated BHP	24.502	21.511 -- 26.573	pass

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E01523-04 Taken on 11/14/06 at 12:38 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.231	0.087	6.096	0.086	7.263	0.1176
CO	1.049	0.057	62.258	3.529	62.592	3.373
CO2	412.282	35.451	6546.317	557.123	6641.258	528.428
NOx	0.168	0.015	53.650	5.044	53.894	4.885
NOx2	0.083	0.007	53.218	5.011	53.732	4.874
SecHC	-0.003	0.000	-0.005	0.000	-0.023	-0.0006
PM						0.2457

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,277.9 SCF
 Dilution factor: 19.97
 Work actual/reference: 24.77/25.31 BhpHr
 Brake specific fuel con.: 0.3800 lb/BhpHr
 Fuel consumption: 9.412 lb
 Fuel recovered: 9.138 lb
 MT temp Ave/Max/Min: 192/372/87 °F
 Fltr face temp Ave/Max/Min: 103/116/85 °F
 Fuel temp Ave/Max/Min: 92/98/74 °F
 MA temp Ave/Max/Min: 88/109/81 °F
 Intake Air Temp Ave/Max/Min: 77/78/74 °F
 Exhaust Temp Ave/Max/Min: 493/853/250 °F
 Cat Inlet temp Ave/Max/Min: 81/92/76 °F
 Cat Outlet temp Ave/Max/Min: 78/81/75 °F
 Average Intake Air Mass: 457.3 lb
 Average Humidity Factor: 0.997
 Average Relative Humidity: 49.61%
 Intake Absolute Humidity: 73.7 grain/lb
 Barometric Pressure: 28.77 in. Hg
 Total Flow Through Filter: 35.46 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 12:38 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.28	0 -- 100	pass
Slope of Reg.	0.9983	0.97 -- 1.03	pass
Y Intercept	7.65	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.33	0 -- 177.76	pass
Slope of Reg.	0.9595	0.83 -- 1.03	pass
Y Intercept	1.27	±15	pass
Coeff. of Reg.	0.9686	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.40	0 -- 30.15	pass
Slope of Reg.	0.9734	0.89 -- 1.03	pass
Y Intercept	-1.26	±5	pass
Coeff. of Reg.	0.9603	0.91 -- 1	pass
Integrated BHP	24.526	21.511 -- 26.573	pass

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E01523-05 Taken on 11/14/06 at 1:18 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.041	0.082	5.895	0.085	6.993	0.1146
CO	1.253	0.068	62.640	3.533	63.007	3.375
CO2	415.199	35.627	6547.677	555.937	6662.375	528.199
NOx	0.231	0.021	53.330	5.051	53.277	4.868
NOx2	0.078	0.007	52.620	4.997	53.061	4.858
SecHC	-0.002	0.000	-0.007	0.000	-0.023	-0.0006
PM						0.2444

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,201.8 SCF
 Dilution factor: 19.90
 Work actual/reference: 24.77/25.31 BhpHr
 Brake specific fuel con.: 0.3804 lb/BhpHr
 Fuel consumption: 9.423 lb
 Fuel recovered: 9.135 lb
 MT temp Ave/Max/Min: 194/374/92 °F
 Fltr face temp Ave/Max/Min: 103/115/85 °F
 Fuel temp Ave/Max/Min: 92/97/78 °F
 MA temp Ave/Max/Min: 88/121/80 °F
 Intake Air Temp Ave/Max/Min: 77/79/76 °F
 Exhaust Temp Ave/Max/Min: 493/853/242 °F
 Cat Inlet temp Ave/Max/Min: 80/91/74 °F
 Cat Outlet temp Ave/Max/Min: 78/81/75 °F
 Average Intake Air Mass: 457.0 lb
 Average Humidity Factor: 1.007
 Average Relative Humidity: 50.94%
 Intake Absolute Humidity: 77.6 grain/lb
 Barometric Pressure: 28.75 in. Hg
 Total Flow Through Filter: 35.40 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 1:18 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.49	0 -- 100	pass
Slope of Reg.	0.9988	0.97 -- 1.03	pass
Y Intercept	6.93	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	65.66	0 -- 177.76	pass
Slope of Reg.	0.9631	0.83 -- 1.03	pass
Y Intercept	1.16	±15	pass
Coeff. of Reg.	0.9701	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	22.98	0 -- 30.15	pass
Slope of Reg.	0.9745	0.89 -- 1.03	pass
Y Intercept	-1.21	±5	pass
Coeff. of Reg.	0.9619	0.91 -- 1	pass
Integrated BHP	24.517	21.511 -- 26.573	pass

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E01523-06 Taken on 11/14/06 at 1:58 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.058	0.082	5.966	0.087	7.122	0.1179
CO	0.949	0.052	61.706	3.499	62.431	3.363
CO2	414.946	35.636	6537.726	555.634	6683.176	530.722
NOx	0.259	0.023	53.075	5.019	53.558	4.888
NOx2	0.090	0.008	52.673	4.996	53.249	4.872
SecHC	0.000	0.000	-0.004	0.000	-0.023	-0.0007
PM						0.2432

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,219.9 SCF
 Dilution factor: 19.84
 Work actual/reference: 24.76/25.31 BhpHr
 Brake specific fuel con.: 0.3802 lb/BhpHr
 Fuel consumption: 9.414 lb
 Fuel recovered: 9.172 lb
 MT temp Ave/Max/Min: 193/374/96 °F
 Fltr face temp Ave/Max/Min: 103/117/85 °F
 Fuel temp Ave/Max/Min: 92/97/73 °F
 MA temp Ave/Max/Min: 87/110/79 °F
 Intake Air Temp Ave/Max/Min: 77/78/75 °F
 Exhaust Temp Ave/Max/Min: 492/852/256 °F
 Cat Inlet temp Ave/Max/Min: 80/92/75 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 457.2 lb
 Average Humidity Factor: 1.005
 Average Relative Humidity: 51.60%
 Intake Absolute Humidity: 76.9 grain/lb
 Barometric Pressure: 28.72 in. Hg
 Total Flow Through Filter: 35.36 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 1:58 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.87	0 -- 100	pass
Slope of Reg.	0.9998	0.97 -- 1.03	pass
Y Intercept	5.28	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.28	0 -- 177.76	pass
Slope of Reg.	0.9624	0.83 -- 1.03	pass
Y Intercept	0.03	±15	pass
Coeff. of Reg.	0.9688	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.23	0 -- 30.15	pass
Slope of Reg.	0.9754	0.89 -- 1.03	pass
Y Intercept	-1.58	±5	pass
Coeff. of Reg.	0.9611	0.91 -- 1	pass
Integrated BHP	24.499	21.511 -- 26.573	pass

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E01523-07 Taken on 11/14/06 at 2:38 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.126	0.085	6.125	0.090	7.220	0.1191
CO	1.111	0.061	61.828	3.505	62.645	3.373
CO2	414.551	35.687	6533.369	556.473	6656.288	529.569
NOx	0.220	0.020	52.925	5.012	53.364	4.874
NOx2	0.097	0.009	52.719	5.003	53.121	4.859
SecHC	-0.004	0.000	-0.006	0.000	-0.023	-0.0005
PM						0.2476

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,239.8 SCF
 Dilution factor: 19.92
 Work actual/reference: 24.72/25.31 BhpHr
 Brake specific fuel con.: 0.3797 lb/BhpHr
 Fuel consumption: 9.385 lb
 Fuel recovered: 9.137 lb
 MT temp Ave/Max/Min: 192/372/89 °F
 Fltr face temp Ave/Max/Min: 103/119/85 °F
 Fuel temp Ave/Max/Min: 92/97/73 °F
 MA temp Ave/Max/Min: 87/122/80 °F
 Intake Air Temp Ave/Max/Min: 76/78/73 °F
 Exhaust Temp Ave/Max/Min: 491/851/244 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/79/75 °F
 Average Intake Air Mass: 457.2 lb
 Average Humidity Factor: 1.003
 Average Relative Humidity: 52.24%
 Intake Absolute Humidity: 76.3 grain/lb
 Barometric Pressure: 28.71 in. Hg
 Total Flow Through Filter: 35.39 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/14/06 at 2:38 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	13.05	0 -- 100	pass
Slope of Reg.	0.9974	0.97 -- 1.03	pass
Y Intercept	9.10	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.08	0 -- 177.76	pass
Slope of Reg.	0.9597	0.83 -- 1.03	pass
Y Intercept	0.75	±15	pass
Coeff. of Reg.	0.9688	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.26	0 -- 30.15	pass
Slope of Reg.	0.9730	0.89 -- 1.03	pass
Y Intercept	-1.39	±5	pass
Coeff. of Reg.	0.9607	0.91 -- 1	pass
Integrated BHP	24.470	21.511 -- 26.573	pass

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E01525-01 Taken on 11/15/06 at 8:48 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.438	0.093	5.923	0.076	6.751	0.0980
CO	1.708	0.094	47.567	2.656	48.038	2.545
CO2	436.540	37.649	6628.325	564.562	6743.527	535.839
NOx	0.141	0.013	53.224	5.077	53.401	4.912
NOx2	0.073	0.007	52.875	5.050	52.957	4.874
SecHC	-0.005	0.000	-0.010	0.000	-0.023	-0.0005
PM						0.1795

Warm Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Cold Start
 Volume of total mixture: 43,254.5 SCF
 Dilution factor: 19.71
 Work actual/reference: 24.67/25.31 BhpHr
 Brake specific fuel con.: 0.3892 lb/BhpHr
 Fuel consumption: 9.600 lb
 Fuel recovered: 9.397 lb
 MT temp Ave/Max/Min: 194/373/93 °F
 Fltr face temp Ave/Max/Min: 104/122/86 °F
 Fuel temp Ave/Max/Min: 92/96/75 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 76/78/69 °F
 Exhaust Temp Ave/Max/Min: 492/854/235 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 456.7 lb
 Average Humidity Factor: 1.007
 Average Relative Humidity: 53.86%
 Intake Absolute Humidity: 77.6 grain/lb
 Barometric Pressure: 28.76 in. Hg
 Total Flow Through Filter: 35.40 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Cold start diesel cycle FTP test taken on 11/15/06 at 8:48 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.73	0 -- 100	pass
Slope of Reg.	1.0006	0.97 -- 1.03	pass
Y Intercept	3.95	±50	pass
Coeff. of Reg.	0.9993	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.98	0 -- 177.76	pass
Slope of Reg.	0.9599	0.77 -- 1.03	pass
Y Intercept	1.63	±15	pass
Coeff. of Reg.	0.9685	0.85 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.26	0 -- 30.15	pass
Slope of Reg.	0.9725	0.87 -- 1.03	pass
Y Intercept	-1.13	±5	pass
Coeff. of Reg.	0.9611	0.91 -- 1	pass
Integrated BHP	24.407	21.511 -- 26.573	pass

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E01525-02 Taken on 11/15/06 at 9:28 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.370	0.091	5.698	0.071	6.380	0.0891
CO	1.559	0.085	46.939	2.624	47.484	2.517
CO2	438.767	37.787	6598.412	560.835	6744.046	534.655
NOx	0.177	0.016	52.327	5.015	52.651	4.867
NOx2	0.092	0.008	52.017	4.993	52.544	4.862
SecHC	-0.006	0.000	-0.006	0.000	-0.024	-0.0005
PM						0.1786

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,188.2 SCF
 Dilution factor: 19.71
 Work actual/reference: 24.66/25.31 BhpHr
 Brake specific fuel con.: 0.3913 lb/BhpHr
 Fuel consumption: 9.652 lb
 Fuel recovered: 9.374 lb
 MT temp Ave/Max/Min: 194/373/94 °F
 Fltr face temp Ave/Max/Min: 104/119/86 °F
 Fuel temp Ave/Max/Min: 92/97/72 °F
 MA temp Ave/Max/Min: 87/120/80 °F
 Intake Air Temp Ave/Max/Min: 77/80/76 °F
 Exhaust Temp Ave/Max/Min: 492/855/243 °F
 Cat Inlet temp Ave/Max/Min: 80/91/76 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 456.4 lb
 Average Humidity Factor: 1.014
 Average Relative Humidity: 52.39%
 Intake Absolute Humidity: 80.3 grain/lb
 Barometric Pressure: 28.75 in. Hg
 Total Flow Through Filter: 35.32 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 9:28 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	13.13	0 -- 100	pass
Slope of Reg.	0.9986	0.97 -- 1.03	pass
Y Intercept	7.05	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.28	0 -- 177.76	pass
Slope of Reg.	0.9596	0.83 -- 1.03	pass
Y Intercept	1.57	±15	pass
Coeff. of Reg.	0.9691	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.09	0 -- 30.15	pass
Slope of Reg.	0.9725	0.89 -- 1.03	pass
Y Intercept	-1.24	±5	pass
Coeff. of Reg.	0.9615	0.91 -- 1	pass
Integrated BHP	24.385	21.511 -- 26.573	pass

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E01525-03 Taken on 11/15/06 at 10:08 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.373	0.091	5.880	0.076	6.612	0.0959
CO	1.409	0.077	46.434	2.607	47.176	2.514
CO2	441.897	38.104	6610.690	562.410	6749.577	536.297
NOx	0.197	0.018	52.941	5.064	53.047	4.895
NOx2	0.072	0.006	52.235	5.008	52.883	4.888
SecHC	-0.006	0.000	-0.002	0.000	-0.023	-0.0005
PM						0.1749

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,197.1 SCF
 Dilution factor: 19.70
 Work actual/reference: 24.64/25.31 BhpHr
 Brake specific fuel con.: 0.3913 lb/BhpHr
 Fuel consumption: 9.641 lb
 Fuel recovered: 9.393 lb
 MT temp Ave/Max/Min: 194/371/98 °F
 Fltr face temp Ave/Max/Min: 103/118/85 °F
 Fuel temp Ave/Max/Min: 92/98/77 °F
 MA temp Ave/Max/Min: 87/120/79 °F
 Intake Air Temp Ave/Max/Min: 78/79/76 °F
 Exhaust Temp Ave/Max/Min: 492/852/245 °F
 Cat Inlet temp Ave/Max/Min: 80/90/75 °F
 Cat Outlet temp Ave/Max/Min: 78/81/74 °F
 Average Intake Air Mass: 456.1 lb
 Average Humidity Factor: 1.011
 Average Relative Humidity: 51.43%
 Intake Absolute Humidity: 79.2 grain/lb
 Barometric Pressure: 28.74 in. Hg
 Total Flow Through Filter: 35.32 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 10:08 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.68	0 -- 100	pass
Slope of Reg.	1.0004	0.97 -- 1.03	pass
Y Intercept	4.30	±50	pass
Coeff. of Reg.	0.9993	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.25	0 -- 177.76	pass
Slope of Reg.	0.9590	0.83 -- 1.03	pass
Y Intercept	0.83	±15	pass
Coeff. of Reg.	0.9692	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.16	0 -- 30.15	pass
Slope of Reg.	0.9734	0.89 -- 1.03	pass
Y Intercept	-1.62	±5	pass
Coeff. of Reg.	0.9613	0.91 -- 1	pass
Integrated BHP	24.372	21.511 -- 26.573	pass

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E01525-04 Taken on 11/15/06 at 10:48 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.499	0.095	6.106	0.079	6.894	0.1002
CO	1.397	0.077	45.926	2.574	46.388	2.470
CO2	442.997	38.142	6594.793	560.015	6743.805	535.115
NOx	0.180	0.016	53.401	5.063	53.722	4.910
NOx2	0.115	0.010	53.186	5.048	53.400	4.883
SecHC	-0.006	0.000	-0.007	0.000	-0.023	-0.0005
PM						0.1771

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,191.6 SCF
 Dilution factor: 19.71
 Work actual/reference: 24.67/25.31 BhpHr
 Brake specific fuel con.: 0.3902 lb/BhpHr
 Fuel consumption: 9.628 lb
 Fuel recovered: 9.384 lb
 MT temp Ave/Max/Min: 193/371/89 °F
 Fltr face temp Ave/Max/Min: 103/119/85 °F
 Fuel temp Ave/Max/Min: 92/97/75 °F
 MA temp Ave/Max/Min: 87/119/79 °F
 Intake Air Temp Ave/Max/Min: 77/79/73 °F
 Exhaust Temp Ave/Max/Min: 491/851/245 °F
 Cat Inlet temp Ave/Max/Min: 80/91/76 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 456.1 lb
 Average Humidity Factor: 1.003
 Average Relative Humidity: 49.62%
 Intake Absolute Humidity: 76.2 grain/lb
 Barometric Pressure: 28.73 in. Hg
 Total Flow Through Filter: 35.35 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 10:48 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.82	0 -- 100	pass
Slope of Reg.	0.9983	0.97 -- 1.03	pass
Y Intercept	7.65	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.60	0 -- 177.76	pass
Slope of Reg.	0.9585	0.83 -- 1.03	pass
Y Intercept	2.55	±15	pass
Coeff. of Reg.	0.9680	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.37	0 -- 30.15	pass
Slope of Reg.	0.9727	0.89 -- 1.03	pass
Y Intercept	-1.07	±5	pass
Coeff. of Reg.	0.9605	0.91 -- 1	pass
Integrated BHP	24.448	21.511 -- 26.573	pass

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E01525-05 Taken on 11/15/06 at 11:28 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.692	0.100	6.139	0.075	6.891	0.0949
CO	1.267	0.069	45.603	2.563	46.021	2.458
CO2	442.574	38.113	6623.653	562.706	6731.397	534.236
NOx	0.187	0.017	52.806	5.003	53.454	4.881
NOx2	0.097	0.009	52.701	5.001	53.117	4.855
SecHC	-0.007	0.000	-0.006	0.000	-0.023	-0.0005
PM						0.1717

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,257.1 SCF
 Dilution factor: 19.75
 Work actual/reference: 24.71/25.31 BhpHr
 Brake specific fuel con.: 0.3910 lb/BhpHr
 Fuel consumption: 9.661 lb
 Fuel recovered: 9.382 lb
 MT temp Ave/Max/Min: 191/371/92 °F
 Fltr face temp Ave/Max/Min: 103/119/85 °F
 Fuel temp Ave/Max/Min: 92/97/78 °F
 MA temp Ave/Max/Min: 87/120/79 °F
 Intake Air Temp Ave/Max/Min: 76/77/71 °F
 Exhaust Temp Ave/Max/Min: 491/849/245 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/80/74 °F
 Average Intake Air Mass: 457.2 lb
 Average Humidity Factor: 1.003
 Average Relative Humidity: 52.67%
 Intake Absolute Humidity: 76.0 grain/lb
 Barometric Pressure: 28.72 in. Hg
 Total Flow Through Filter: 35.44 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 11:28 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.90	0 -- 100	pass
Slope of Reg.	0.9981	0.97 -- 1.03	pass
Y Intercept	8.07	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.90	0 -- 177.76	pass
Slope of Reg.	0.9615	0.83 -- 1.03	pass
Y Intercept	1.87	±15	pass
Coeff. of Reg.	0.9688	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.27	0 -- 30.15	pass
Slope of Reg.	0.9748	0.89 -- 1.03	pass
Y Intercept	-0.98	±5	pass
Coeff. of Reg.	0.9611	0.91 -- 1	pass
Integrated BHP	24.502	21.511 -- 26.573	pass

D:\Detroit1992 S60\ORYXE\TCEQ Nov 2006\Data\E01525\05\

E01525-06 Taken on 11/15/06 at 12:08 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	3.904	0.106	6.412	0.077	7.152	0.0966
CO	1.295	0.071	45.531	2.562	45.846	2.451
CO2	436.216	37.634	6602.958	562.334	6714.977	534.537
NOx	0.144	0.013	53.065	5.048	53.392	4.897
NOx2	0.061	0.006	52.417	4.994	53.112	4.876
SecHC	-0.004	0.000	-0.009	0.000	-0.023	-0.0006
PM						0.1755

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,238.3 SCF
 Dilution factor: 19.80
 Work actual/reference: 24.65/25.31 BhpHr
 Brake specific fuel con.: 0.3905 lb/BhpHr
 Fuel consumption: 9.628 lb
 Fuel recovered: 9.367 lb
 MT temp Ave/Max/Min: 191/370/89 °F
 Fltr face temp Ave/Max/Min: 103/122/85 °F
 Fuel temp Ave/Max/Min: 92/97/73 °F
 MA temp Ave/Max/Min: 87/119/80 °F
 Intake Air Temp Ave/Max/Min: 76/78/74 °F
 Exhaust Temp Ave/Max/Min: 490/848/246 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/80/74 °F
 Average Intake Air Mass: 456.6 lb
 Average Humidity Factor: 1.004
 Average Relative Humidity: 52.78%
 Intake Absolute Humidity: 76.6 grain/lb
 Barometric Pressure: 28.70 in. Hg
 Total Flow Through Filter: 35.41 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 12:08 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	13.17	0 -- 100	pass
Slope of Reg.	0.9983	0.97 -- 1.03	pass
Y Intercept	7.70	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.64	0 -- 177.76	pass
Slope of Reg.	0.9579	0.83 -- 1.03	pass
Y Intercept	1.63	±15	pass
Coeff. of Reg.	0.9688	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.17	0 -- 30.15	pass
Slope of Reg.	0.9710	0.89 -- 1.03	pass
Y Intercept	-1.09	±5	pass
Coeff. of Reg.	0.9610	0.91 -- 1	pass
Integrated BHP	24.405	21.511 -- 26.573	pass

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E01525-07 Taken on 11/15/06 at 12:49 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	4.025	0.109	6.669	0.081	7.452	0.1017
CO	1.274	0.070	46.361	2.610	46.619	2.491
CO2	449.483	38.749	6640.208	564.316	6751.644	536.005
NOx	0.191	0.017	52.653	5.030	53.065	4.887
NOx2	0.075	0.007	52.458	5.022	52.763	4.866
SecHC	-0.004	0.000	-0.002	0.000	-0.024	-0.0006
PM						0.1772

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 43,183.2 SCF
 Dilution factor: 19.69
 Work actual/reference: 24.63/25.31 BhpHr
 Brake specific fuel con.: 0.3912 lb/BhpHr
 Fuel consumption: 9.638 lb
 Fuel recovered: 9.386 lb
 MT temp Ave/Max/Min: 191/370/92 °F
 Fltr face temp Ave/Max/Min: 102/123/85 °F
 Fuel temp Ave/Max/Min: 92/98/73 °F
 MA temp Ave/Max/Min: 87/120/80 °F
 Intake Air Temp Ave/Max/Min: 77/78/75 °F
 Exhaust Temp Ave/Max/Min: 491/849/244 °F
 Cat Inlet temp Ave/Max/Min: 80/90/75 °F
 Cat Outlet temp Ave/Max/Min: 78/81/74 °F
 Average Intake Air Mass: 456.0 lb
 Average Humidity Factor: 1.010
 Average Relative Humidity: 52.35%
 Intake Absolute Humidity: 78.7 grain/lb
 Barometric Pressure: 28.69 in. Hg
 Total Flow Through Filter: 35.41 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/15/06 at 12:49 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.94	0 -- 100	pass
Slope of Reg.	0.9992	0.97 -- 1.03	pass
Y Intercept	6.21	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.04	0 -- 177.76	pass
Slope of Reg.	0.9585	0.83 -- 1.03	pass
Y Intercept	0.75	±15	pass
Coeff. of Reg.	0.9685	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.31	0 -- 30.15	pass
Slope of Reg.	0.9717	0.89 -- 1.03	pass
Y Intercept	-1.29	±5	pass
Coeff. of Reg.	0.9607	0.91 -- 1	pass
Integrated BHP	24.374	21.511 -- 26.573	pass

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E01527-01 Taken on 11/16/06 at 8:55 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.662	0.071	5.195	0.075	5.835	0.0921
CO	1.699	0.092	48.979	2.711	49.473	2.599
CO2	442.447	37.757	6704.960	565.300	6807.106	535.538
NOx	0.143	0.013	53.834	5.021	54.397	4.887
NOx2	0.095	0.008	54.220	5.061	54.411	4.890
SecHC	-0.006	0.000	-0.005	0.000	-0.023	-0.0005
PM						0.1753

Warm Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Cold Start
 Volume of total mixture: 42,692.4 SCF
 Dilution factor: 19.53
 Work actual/reference: 24.59/25.31 BhpHr
 Brake specific fuel con.: 0.3921 lb/BhpHr
 Fuel consumption: 9.643 lb
 Fuel recovered: 9.364 lb
 MT temp Ave/Max/Min: 196/375/94 °F
 Fltr face temp Ave/Max/Min: 97/106/90 °F
 Fuel temp Ave/Max/Min: 92/99/79 °F
 MA temp Ave/Max/Min: 87/121/81 °F
 Intake Air Temp Ave/Max/Min: 74/77/73 °F
 Exhaust Temp Ave/Max/Min: 500/857/278 °F
 Cat Inlet temp Ave/Max/Min: 80/90/76 °F
 Cat Outlet temp Ave/Max/Min: 77/80/75 °F
 Average Intake Air Mass: 451.4 lb
 Average Humidity Factor: 0.994
 Average Relative Humidity: 51.72%
 Intake Absolute Humidity: 72.9 grain/lb
 Barometric Pressure: 28.35 in. Hg
 Total Flow Through Filter: 34.96 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Cold start diesel cycle FTP test taken on 11/16/06 at 8:55 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.71	0 -- 100	pass
Slope of Reg.	0.9976	0.97 -- 1.03	pass
Y Intercept	8.84	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.86	0 -- 177.76	pass
Slope of Reg.	0.9582	0.77 -- 1.03	pass
Y Intercept	0.62	±15	pass
Coeff. of Reg.	0.9676	0.85 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.57	0 -- 30.15	pass
Slope of Reg.	0.9707	0.87 -- 1.03	pass
Y Intercept	-1.01	±5	pass
Coeff. of Reg.	0.9597	0.91 -- 1	pass
Integrated BHP	24.353	21.511 -- 26.573	pass

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E01527-02 Taken on 11/16/06 at 9:36 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	0.007	0.000	5.464	0.154	6.164	0.1716
CO	-0.279	-0.015	48.421	2.778	49.077	2.677
CO2	-17.431	-1.483	6627.458	595.794	6821.767	574.487
NOx	0.022	0.002	53.807	5.020	54.646	4.914
NOx2	0.082	0.007	54.083	5.040	54.729	4.913
SecHC	0.043	0.001	-0.008	-0.001	-0.023	-0.0018
PM						0.1792

Hot Start, TCEQ Cand Fuel, Test Not Valid --> No Background Bag (Did not plug bag in

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,652.3 SCF
 Dilution factor: 19.49
 Work actual/reference: 24.64/25.31 BhpHr
 Brake specific fuel con.: 0.3917 lb/BhpHr
 Fuel consumption: 9.652 lb
 Fuel recovered: 10.068 lb
 MT temp Ave/Max/Min: 191/373/90 °F
 Fltr face temp Ave/Max/Min: 95/104/87 °F
 Fuel temp Ave/Max/Min: 92/98/75 °F
 MA temp Ave/Max/Min: 87/122/79 °F
 Intake Air Temp Ave/Max/Min: 77/82/73 °F
 Exhaust Temp Ave/Max/Min: 495/856/248 °F
 Cat Inlet temp Ave/Max/Min: 80/90/75 °F
 Cat Outlet temp Ave/Max/Min: 78/81/75 °F
 Average Intake Air Mass: 450.6 lb
 Average Humidity Factor: 0.996
 Average Relative Humidity: 48.09%
 Intake Absolute Humidity: 73.3 grain/lb
 Barometric Pressure: 28.28 in. Hg
 Total Flow Through Filter: 34.99 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 9:36 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.74	0 -- 100	pass
Slope of Reg.	0.9984	0.97 -- 1.03	pass
Y Intercept	7.48	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	68.87	0 -- 177.76	pass
Slope of Reg.	0.9575	0.83 -- 1.03	pass
Y Intercept	0.66	±15	pass
Coeff. of Reg.	0.9667	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.64	0 -- 30.15	pass
Slope of Reg.	0.9709	0.89 -- 1.03	pass
Y Intercept	-1.13	±5	pass
Coeff. of Reg.	0.9596	0.91 -- 1	pass
Integrated BHP	24.365	21.511 -- 26.573	pass

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E01527-03 Taken on 11/16/06 at 10:16 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.588	0.069	5.377	0.082	5.969	0.0975
CO	1.423	0.077	47.701	2.646	48.260	2.540
CO2	419.357	35.698	6628.031	558.876	6788.396	534.234
NOx	0.161	0.014	53.092	4.990	54.090	4.895
NOx2	0.067	0.006	53.342	5.022	54.106	4.903
SecHC	-0.007	0.000	-0.007	0.000	-0.022	-0.0005
PM						0.1723

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,625.7 SCF
 Dilution factor: 19.58
 Work actual/reference: 24.62/25.31 BhpHr
 Brake specific fuel con.: 0.3916 lb/BhpHr
 Fuel consumption: 9.641 lb
 Fuel recovered: 9.350 lb
 MT temp Ave/Max/Min: 191/371/90 °F
 Fltr face temp Ave/Max/Min: 95/105/87 °F
 Fuel temp Ave/Max/Min: 93/98/81 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 76/78/73 °F
 Exhaust Temp Ave/Max/Min: 494/854/249 °F
 Cat Inlet temp Ave/Max/Min: 80/90/76 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 450.4 lb
 Average Humidity Factor: 1.005
 Average Relative Humidity: 51.69%
 Intake Absolute Humidity: 77.0 grain/lb
 Barometric Pressure: 28.27 in. Hg
 Total Flow Through Filter: 34.92 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 10:16 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.88	0 -- 100	pass
Slope of Reg.	0.9980	0.97 -- 1.03	pass
Y Intercept	8.21	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.35	0 -- 177.76	pass
Slope of Reg.	0.9579	0.83 -- 1.03	pass
Y Intercept	2.26	±15	pass
Coeff. of Reg.	0.9680	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.43	0 -- 30.15	pass
Slope of Reg.	0.9706	0.89 -- 1.03	pass
Y Intercept	-0.75	±5	pass
Coeff. of Reg.	0.9602	0.91 -- 1	pass
Integrated BHP	24.418	21.511 -- 26.573	pass

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E01527-04 Taken on 11/16/06 at 10:56 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.623	0.070	5.373	0.081	6.010	0.0976
CO	1.644	0.089	48.150	2.662	48.680	2.553
CO2	513.251	43.667	6808.505	567.626	6965.602	541.833
NOx	0.137	0.012	53.460	5.044	54.024	4.911
NOx2	0.045	0.004	53.127	5.021	53.827	4.898
SecHC	-0.008	0.000	-0.004	0.000	-0.022	-0.0004
PM						0.1729

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,610.9 SCF
 Dilution factor: 19.09
 Work actual/reference: 24.59/25.31 BhpHr
 Brake specific fuel con.: 0.3919 lb/BhpHr
 Fuel consumption: 9.637 lb
 Fuel recovered: 9.471 lb
 MT temp Ave/Max/Min: 191/372/90 °F
 Fltr face temp Ave/Max/Min: 95/104/87 °F
 Fuel temp Ave/Max/Min: 93/98/80 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 76/79/75 °F
 Exhaust Temp Ave/Max/Min: 494/855/248 °F
 Cat Inlet temp Ave/Max/Min: 80/90/75 °F
 Cat Outlet temp Ave/Max/Min: 78/80/74 °F
 Average Intake Air Mass: 450.1 lb
 Average Humidity Factor: 1.008
 Average Relative Humidity: 51.66%
 Intake Absolute Humidity: 78.0 grain/lb
 Barometric Pressure: 28.27 in. Hg
 Total Flow Through Filter: 34.96 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 10:56 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.05	0 -- 100	pass
Slope of Reg.	0.9991	0.97 -- 1.03	pass
Y Intercept	6.53	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.46	0 -- 177.76	pass
Slope of Reg.	0.9594	0.83 -- 1.03	pass
Y Intercept	0.16	±15	pass
Coeff. of Reg.	0.9680	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.46	0 -- 30.15	pass
Slope of Reg.	0.9714	0.89 -- 1.03	pass
Y Intercept	-1.12	±5	pass
Coeff. of Reg.	0.9602	0.91 -- 1	pass
Integrated BHP	24.352	21.511 -- 26.573	pass

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E01527-05 Taken on 11/16/06 at 11:36 AM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.609	0.070	5.190	0.077	5.847	0.0937
CO	2.465	0.134	49.030	2.670	49.300	2.546
CO2	426.531	36.369	6688.190	564.612	6791.148	535.286
NOx	0.124	0.011	53.715	5.080	54.111	4.927
NOx2	0.076	0.007	53.670	5.080	54.048	4.923
SecHC	-0.005	0.000	-0.007	0.000	-0.022	-0.0005
PM						0.1697

Hot Start, TCEQ Cand Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,617.9 SCF
 Dilution factor: 19.57
 Work actual/reference: 24.57/25.31 BhpHr
 Brake specific fuel con.: 0.3928 lb/BhpHr
 Fuel consumption: 9.652 lb
 Fuel recovered: 9.351 lb
 MT temp Ave/Max/Min: 191/372/89 °F
 Fltr face temp Ave/Max/Min: 96/105/88 °F
 Fuel temp Ave/Max/Min: 92/98/81 °F
 MA temp Ave/Max/Min: 87/121/79 °F
 Intake Air Temp Ave/Max/Min: 77/79/73 °F
 Exhaust Temp Ave/Max/Min: 494/855/247 °F
 Cat Inlet temp Ave/Max/Min: 80/92/76 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 449.7 lb
 Average Humidity Factor: 1.009
 Average Relative Humidity: 51.38%
 Intake Absolute Humidity: 78.4 grain/lb
 Barometric Pressure: 28.27 in. Hg
 Total Flow Through Filter: 34.95 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 11:36 AM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.93	0 -- 100	pass
Slope of Reg.	0.9984	0.97 -- 1.03	pass
Y Intercept	7.49	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.96	0 -- 177.76	pass
Slope of Reg.	0.9585	0.83 -- 1.03	pass
Y Intercept	-1.01	±15	pass
Coeff. of Reg.	0.9675	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.65	0 -- 30.15	pass
Slope of Reg.	0.9705	0.89 -- 1.03	pass
Y Intercept	-1.51	±5	pass
Coeff. of Reg.	0.9594	0.91 -- 1	pass
Integrated BHP	24.273	21.511 -- 26.573	pass

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E01529-01 Taken on 11/16/06 at 1:39 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.734	0.073	5.879	0.092	7.030	0.1222
CO	1.977	0.106	67.174	3.699	67.884	3.541
CO2	391.231	33.053	6642.792	558.289	6753.583	528.822
NOx	0.120	0.011	53.244	4.980	53.507	4.824
NOx2	0.042	0.004	53.128	4.976	53.485	4.827
SecHC	-0.004	0.000	-0.008	0.000	-0.023	-0.0005
PM						0.2574

Warm Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Cold Start
 Volume of total mixture: 42,338.5 SCF
 Dilution factor: 19.62
 Work actual/reference: 24.64/25.31 BhpHr
 Brake specific fuel con.: 0.3840 lb/BhpHr
 Fuel consumption: 9.462 lb
 Fuel recovered: 9.101 lb
 MT temp Ave/Max/Min: 203/385/103 °F
 Fltr face temp Ave/Max/Min: 99/108/91 °F
 Fuel temp Ave/Max/Min: 93/98/87 °F
 MA temp Ave/Max/Min: 88/120/82 °F
 Intake Air Temp Ave/Max/Min: 77/82/74 °F
 Exhaust Temp Ave/Max/Min: 509/866/291 °F
 Cat Inlet temp Ave/Max/Min: 80/92/74 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 449.3 lb
 Average Humidity Factor: 1.007
 Average Relative Humidity: 50.53%
 Intake Absolute Humidity: 77.8 grain/lb
 Barometric Pressure: 28.22 in. Hg
 Total Flow Through Filter: 34.74 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Cold start diesel cycle FTP test taken on 11/16/06 at 1:39 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.83	0 -- 100	pass
Slope of Reg.	0.9987	0.97 -- 1.03	pass
Y Intercept	6.95	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.12	0 -- 177.76	pass
Slope of Reg.	0.9641	0.77 -- 1.03	pass
Y Intercept	0.07	±15	pass
Coeff. of Reg.	0.9697	0.85 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.17	0 -- 30.15	pass
Slope of Reg.	0.9754	0.87 -- 1.03	pass
Y Intercept	-1.23	±5	pass
Coeff. of Reg.	0.9614	0.91 -- 1	pass
Integrated BHP	24.468	21.511 -- 26.573	pass

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E01529-02 Taken on 11/16/06 at 2:19 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.795	0.074	5.967	0.093	7.080	0.1220
CO	1.526	0.082	65.182	3.612	66.087	3.474
CO2	388.978	32.883	6565.558	551.860	6735.134	528.318
NOx	0.116	0.010	53.798	5.024	54.409	4.899
NOx2	0.108	0.010	53.591	5.006	54.402	4.898
SecHC	-0.004	0.000	-0.006	0.000	-0.022	-0.0005
PM						0.2446

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,478.9 SCF
 Dilution factor: 19.68
 Work actual/reference: 24.71/25.31 BhpHr
 Brake specific fuel con.: 0.3810 lb/BhpHr
 Fuel consumption: 9.414 lb
 Fuel recovered: 9.117 lb
 MT temp Ave/Max/Min: 192/376/94 °F
 Fltr face temp Ave/Max/Min: 96/105/88 °F
 Fuel temp Ave/Max/Min: 93/98/84 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 77/79/74 °F
 Exhaust Temp Ave/Max/Min: 495/857/248 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/80/74 °F
 Average Intake Air Mass: 450.4 lb
 Average Humidity Factor: 1.005
 Average Relative Humidity: 50.56%
 Intake Absolute Humidity: 77.0 grain/lb
 Barometric Pressure: 28.22 in. Hg
 Total Flow Through Filter: 34.81 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 2:19 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	11.86	0 -- 100	pass
Slope of Reg.	0.9992	0.97 -- 1.03	pass
Y Intercept	6.31	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.43	0 -- 177.76	pass
Slope of Reg.	0.9635	0.83 -- 1.03	pass
Y Intercept	-0.79	±15	pass
Coeff. of Reg.	0.9693	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.15	0 -- 30.15	pass
Slope of Reg.	0.9735	0.89 -- 1.03	pass
Y Intercept	-1.23	±5	pass
Coeff. of Reg.	0.9614	0.91 -- 1	pass
Integrated BHP	24.413	21.511 -- 26.573	pass

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E01529-03 Taken on 11/16/06 at 2:59 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.738	0.073	5.960	0.094	6.959	0.1203
CO	1.179	0.063	65.435	3.648	66.435	3.514
CO2	399.107	33.764	6613.676	555.733	6741.324	528.311
NOx	0.115	0.010	53.556	5.008	54.042	4.874
NOx2	0.080	0.007	53.816	5.035	54.053	4.876
SecHC	-0.005	0.000	-0.005	0.000	-0.023	-0.0005
PM						0.2481

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,503.2 SCF
 Dilution factor: 19.66
 Work actual/reference: 24.71/25.31 BhpHr
 Brake specific fuel con.: 0.3805 lb/BhpHr
 Fuel consumption: 9.401 lb
 Fuel recovered: 9.116 lb
 MT temp Ave/Max/Min: 192/376/88 °F
 Fltr face temp Ave/Max/Min: 97/105/88 °F
 Fuel temp Ave/Max/Min: 92/99/76 °F
 MA temp Ave/Max/Min: 87/121/80 °F
 Intake Air Temp Ave/Max/Min: 77/78/75 °F
 Exhaust Temp Ave/Max/Min: 495/856/247 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 78/80/75 °F
 Average Intake Air Mass: 450.7 lb
 Average Humidity Factor: 1.006
 Average Relative Humidity: 50.90%
 Intake Absolute Humidity: 77.1 grain/lb
 Barometric Pressure: 28.22 in. Hg
 Total Flow Through Filter: 34.86 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 2:59 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.66	0 -- 100	pass
Slope of Reg.	0.9980	0.97 -- 1.03	pass
Y Intercept	8.28	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.90	0 -- 177.76	pass
Slope of Reg.	0.9640	0.83 -- 1.03	pass
Y Intercept	-0.78	±15	pass
Coeff. of Reg.	0.9690	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.25	0 -- 30.15	pass
Slope of Reg.	0.9744	0.89 -- 1.03	pass
Y Intercept	-1.24	±5	pass
Coeff. of Reg.	0.9611	0.91 -- 1	pass
Integrated BHP	24.438	21.511 -- 26.573	pass

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E01529-04 Taken on 11/16/06 at 3:39 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.758	0.073	5.947	0.093	6.907	0.1189
CO	1.384	0.075	63.174	3.519	64.195	3.395
CO2	383.920	32.574	6575.019	555.119	6732.073	530.602
NOx	0.034	0.003	53.697	5.019	54.312	4.893
NOx2	0.122	0.011	53.981	5.037	54.472	4.898
SecHC	-0.001	0.000	-0.004	0.000	-0.023	-0.0006
PM						0.2385

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,540.5 SCF
 Dilution factor: 19.70
 Work actual/reference: 24.66/25.31 BhpHr
 Brake specific fuel con.: 0.3805 lb/BhpHr
 Fuel consumption: 9.382 lb
 Fuel recovered: 9.134 lb
 MT temp Ave/Max/Min: 190/374/89 °F
 Fltr face temp Ave/Max/Min: 102/113/92 °F
 Fuel temp Ave/Max/Min: 92/98/76 °F
 MA temp Ave/Max/Min: 87/122/80 °F
 Intake Air Temp Ave/Max/Min: 76/78/74 °F
 Exhaust Temp Ave/Max/Min: 494/855/245 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/80/74 °F
 Average Intake Air Mass: 451.1 lb
 Average Humidity Factor: 1.001
 Average Relative Humidity: 50.90%
 Intake Absolute Humidity: 75.3 grain/lb
 Barometric Pressure: 28.24 in. Hg
 Total Flow Through Filter: 34.96 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 3:39 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.75	0 -- 100	pass
Slope of Reg.	0.9971	0.97 -- 1.03	pass
Y Intercept	9.65	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.83	0 -- 177.76	pass
Slope of Reg.	0.9625	0.83 -- 1.03	pass
Y Intercept	-1.16	±15	pass
Coeff. of Reg.	0.9681	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.45	0 -- 30.15	pass
Slope of Reg.	0.9729	0.89 -- 1.03	pass
Y Intercept	-1.22	±5	pass
Coeff. of Reg.	0.9602	0.91 -- 1	pass
Integrated BHP	24.434	21.511 -- 26.573	pass

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E01529-05 Taken on 11/16/06 at 4:19 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.814	0.075	6.067	0.095	7.045	0.1207
CO	1.229	0.066	63.597	3.545	64.288	3.404
CO2	386.850	32.771	6600.561	556.262	6725.661	529.096
NOx	0.032	0.003	54.060	5.030	54.499	4.889
NOx2	0.114	0.010	53.616	4.982	54.465	4.877
SecHC	-0.004	0.000	-0.005	0.000	-0.023	-0.0005
PM						0.2430

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,562.3 SCF
 Dilution factor: 19.71
 Work actual/reference: 24.71/25.31 BhpHr
 Brake specific fuel con.: 0.3798 lb/BhpHr
 Fuel consumption: 9.385 lb
 Fuel recovered: 9.128 lb
 MT temp Ave/Max/Min: 190/376/88 °F
 Fltr face temp Ave/Max/Min: 100/111/92 °F
 Fuel temp Ave/Max/Min: 92/98/76 °F
 MA temp Ave/Max/Min: 87/123/76 °F
 Intake Air Temp Ave/Max/Min: 75/78/71 °F
 Exhaust Temp Ave/Max/Min: 493/853/244 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 451.8 lb
 Average Humidity Factor: 0.998
 Average Relative Humidity: 50.85%
 Intake Absolute Humidity: 74.2 grain/lb
 Barometric Pressure: 28.26 in. Hg
 Total Flow Through Filter: 34.93 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 4:19 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.24	0 -- 100	pass
Slope of Reg.	0.9981	0.97 -- 1.03	pass
Y Intercept	8.03	±50	pass
Coeff. of Reg.	0.9992	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	67.37	0 -- 177.76	pass
Slope of Reg.	0.9621	0.83 -- 1.03	pass
Y Intercept	-0.21	±15	pass
Coeff. of Reg.	0.9685	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.45	0 -- 30.15	pass
Slope of Reg.	0.9749	0.89 -- 1.03	pass
Y Intercept	-1.53	±5	pass
Coeff. of Reg.	0.9604	0.91 -- 1	pass
Integrated BHP	24.456	21.511 -- 26.573	pass

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E01529-06 Taken on 11/16/06 at 5:00 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.761	0.074	5.983	0.094	6.953	0.1197
CO	1.519	0.082	62.958	3.502	63.769	3.372
CO2	384.019	32.617	6569.175	555.070	6707.360	529.803
NOx	0.083	0.007	53.571	4.980	54.486	4.882
NOx2	0.085	0.008	54.010	5.021	54.578	4.888
SecHC	-0.004	0.000	-0.003	0.000	-0.022	-0.0005
PM						0.2433

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,616.4 SCF
 Dilution factor: 19.77
 Work actual/reference: 24.68/25.31 BhpHr
 Brake specific fuel con.: 0.3802 lb/BhpHr
 Fuel consumption: 9.383 lb
 Fuel recovered: 9.128 lb
 MT temp Ave/Max/Min: 189/374/89 °F
 Fltr face temp Ave/Max/Min: 99/109/91 °F
 Fuel temp Ave/Max/Min: 92/99/76 °F
 MA temp Ave/Max/Min: 87/123/80 °F
 Intake Air Temp Ave/Max/Min: 75/77/71 °F
 Exhaust Temp Ave/Max/Min: 492/852/243 °F
 Cat Inlet temp Ave/Max/Min: 80/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 452.4 lb
 Average Humidity Factor: 0.995
 Average Relative Humidity: 51.06%
 Intake Absolute Humidity: 73.2 grain/lb
 Barometric Pressure: 28.26 in. Hg
 Total Flow Through Filter: 35.01 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 5:00 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.96	0 -- 100	pass
Slope of Reg.	0.9968	0.97 -- 1.03	pass
Y Intercept	10.12	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	66.87	0 -- 177.76	pass
Slope of Reg.	0.9629	0.83 -- 1.03	pass
Y Intercept	-0.42	±15	pass
Coeff. of Reg.	0.9689	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.24	0 -- 30.15	pass
Slope of Reg.	0.9759	0.89 -- 1.03	pass
Y Intercept	-1.71	±5	pass
Coeff. of Reg.	0.9611	0.91 -- 1	pass
Integrated BHP	24.425	21.511 -- 26.573	pass

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E01529-07 Taken on 11/16/06 at 5:40 PM

	Background Bag		Dilute Bag		Continuous Sampling	
	PPM	g/BhpHr	PPM	g/BhpHr	PPM	g/BhpHr
HC	2.884	0.077	6.131	0.095	7.026	0.1183
CO	1.225	0.066	63.591	3.550	64.369	3.413
CO2	379.836	32.221	6592.875	556.844	6707.337	528.898
NOx	0.070	0.006	53.382	4.990	54.005	4.877
NOx2	0.095	0.008	53.428	4.992	54.168	4.887
SecHC	-0.005	0.000	-0.007	0.000	-0.023	-0.0005
PM						0.2454

Hot Start, TCEQ Ref Fuel

Engine Name: DDC S60 1992
 Start Type: Hot Start
 Volume of total mixture: 42,597.6 SCF
 Dilution factor: 19.77
 Work actual/reference: 24.70/25.31 BhpHr
 Brake specific fuel con.: 0.3803 lb/BhpHr
 Fuel consumption: 9.394 lb
 Fuel recovered: 9.121 lb
 MT temp Ave/Max/Min: 191/378/90 °F
 Fltr face temp Ave/Max/Min: 99/109/91 °F
 Fuel temp Ave/Max/Min: 92/99/76 °F
 MA temp Ave/Max/Min: 87/121/79 °F
 Intake Air Temp Ave/Max/Min: 76/79/73 °F
 Exhaust Temp Ave/Max/Min: 493/856/244 °F
 Cat Inlet temp Ave/Max/Min: 79/91/75 °F
 Cat Outlet temp Ave/Max/Min: 77/81/74 °F
 Average Intake Air Mass: 452.0 lb
 Average Humidity Factor: 1.002
 Average Relative Humidity: 50.76%
 Intake Absolute Humidity: 75.7 grain/lb
 Barometric Pressure: 28.32 in. Hg
 Total Flow Through Filter: 34.90 scf
 Split Ratio: 1.000
 Channel 50: 0.00 scf
 Channel 51: 0.00 litres

FTP Test Validity Analysis Table

Hot start diesel cycle FTP test taken on 11/16/06 at 5:40 PM for DDC S60 1992 Engine

SPEED	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	12.60	0 -- 100	pass
Slope of Reg.	0.9971	0.97 -- 1.03	pass
Y Intercept	9.59	±50	pass
Coeff. of Reg.	0.9991	0.97 -- 1	pass

TORQUE	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	65.93	0 -- 177.76	pass
Slope of Reg.	0.9639	0.83 -- 1.03	pass
Y Intercept	-1.43	±15	pass
Coeff. of Reg.	0.9699	0.88 -- 1	pass

BHP	Validation Stat.	EPA Criterion	Result
		Min - Max	
Standard Error	23.06	0 -- 30.15	pass
Slope of Reg.	0.9748	0.89 -- 1.03	pass
Y Intercept	-1.59	±5	pass
Coeff. of Reg.	0.9616	0.91 -- 1	pass
Integrated BHP	24.432	21.511 -- 26.573	pass

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