

Testing and Technical Data Summary

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Table of Contents || Test Results and Technical Data Summary

Independent Fuel Consumption and Emissions Tests

pg2...	Executive Summary: Southwest Research Institute (SwRI) - San Antonio, Texas, USA SAE J1321 Fuel Consumption Test
pg3...	Executive Summary: Forest Engineering Research Institute of Canada (FERIC) - Quebec, Canada SAE J1321 Fuel Consumption Test
pg4...	Executive Summary: Gerotek Test Facilities - Pretoria, South Africa Fuel Consumption and Emissions Test
pg5...	Executive Summary: M I Technology w/ Interfleet Technology - Preston, United Kingdom Rail Application: Fuel Consumption and Emissions Test
pg6...	Executive Summary: Prodrive - Milton Keynes, United Kingdom Fuel Consumption and Emissions Test
pg7...	Executive Summary: Department of Auto Engineering at Tsinghua University - Beijing, China Fuel Consumption and Emissions Test
pg8...	Executive Summary: Atlantic Express - St. Louis, Missouri, USA Field Trial - Fuel Consumption

Independent Injector Nozzle Fouling Tests

pg9...	Executive Summary: Prodrive - Milton Keynes, United Kingdom Injector Nozzle Fouling Test
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Other Tests and Technical Documents

pg10...	Executive Summary: BfB Laboratory - Gembloux, Belgium Biodegradability Test
pg11-12...	Executive Summary: BfB Laboratory - Gembloux, Belgium EN590 Fuel Specification Test

For Material Safety Data Sheets or any other information, contact Paul Lee at 314.863.3000 or at plee@internationalfuel.com.

Test Description

On-road fuel economy industry standard test method simulating long-haul operation.

Testing Facility

Southwest Research Institute, San Antonio, Texas, USA

Test Objective

Evaluate the benefits derived from using IFT's DiesoLiFT(TM) to improve fuel economy under controlled conditions.

Test Procedure

SAE J1321 "Joint TMC/SAE Fuel Consumption Test procedure– Type II."

This procedure was developed by SAE to specifically meet the needs of the trucking industry.

Test Program

The SAE J1321 procedure was conducted utilizing fully serviced trucks. One control truck and two test trucks operated simultaneously.

A single complete SAE J1321 type II fuel economy test consists of a baseline segment and a test segment. A valid segment consists of three test laps having a spread in test/control fuel consumption ratios not greater than two percent of the highest test/control fuel consumption ratio (T/C ratio).

The test route or lap was 46 miles (40 miles minimum according to SAE J1321) and was representative of long-haul operations.

DiesoLiFT(TM) was added to #2 diesel fuel at a 1:600 ratio in volume.

Vehicles

The control and test vehicles were Class-8 diesel trucks.

- Control Vehicle: 1999 Freightliner Model C120 truck tractor equipped with Detroit Diesel 60 series engine rated at 365 hp at 1,700 rpm.
- Test Vehicles: 1994 Freightliner FLD truck tractors equipped with Caterpillar 3176 engine rated at 325 hp at 1,800 rpm.

48-foot flat beds trailers were attached to the tractors. They were ballasted with concrete blocks to a gross vehicle weight (GVW) of approximately 76,000 lbs.

Fuel Type & Fuel Measurement System

The fuel used during the test was a standard #2 diesel fuel.

Weigh tanks were installed on the tractors for the specific purpose of the test and were used for fuel consumption measurement.

TEST RESULTS

DiesoLiFT(TM) DELIVERED AN AVERAGE FUEL ECONOMY IMPROVEMENT OF 3% AT A 1:600 DOSAGE IN #2 DIESEL FUEL.

Test Description

Long haul fuel consumption test on 2004 Kenworth T800 truck powered by a CAT C-15 Engine.

Testing Facility

FERIC - Quebec, Canada

Test Objective

Evaluate the benefits derived from using DiesoLIFT(TM) to improve fuel economy under controlled conditions.

Test Procedure

Standard SAE J1321 long haul fuel consumption testing protocol.

Test Program

The SAE J1321 procedure was conducted utilizing fully serviced, one control truck and two test trucks operated simultaneously.

A single complete SAE J1321 Type II fuel economy test consists of a baseline segment and a test segment. A valid segment consists of three test laps having a spread in test/control fuel consumption ratios not greater than two percent of the highest test/control fuel consumption ration (T/C ratio).

The test route or lap was 65Km (40 miles minimum according to SAE J1321) and was representative of long-haul operations.

DiesoLIFT(TM) was added to #2 diesel fuel at a 1:600 ratio in volume.

A Cold Start test was run based on SAE J1635 testing protocol.

Vehicles

Two Caterpillar C-15 475 engines in identical 2004 Kenworth T800 trucks.

Fuel Type & Fuel Measurement System

Standard #2 diesel was used for the test.

The trucks were fitted with temporary fuel tanks and fuel was measured by weight.

TEST RESULTS

DiesoLIFT(TM) PROVIDED A MINIMUM FUEL ECONOMY IMPROVEMENT OF 5.2% AT A 1:600 DOSAGE IN DIESEL FUEL.

FLEET DATA CALCULATIONS INDICATE THAT DiesoLIFT(TM) DELIVERED A FUEL ECONOMY IMPROVEMENT OF 5.6%.

COLD START TESTING PRODUCED AN S-I-D SCORE OF 9-8-9, REFLECTING A POSITIVE BEHAVIOR IN THE TRUCK USING FUEL TREATED WITH DiesoLIFT(TM).

Test Description

Test and compare the fuel economy of a Samil 100 truck at constant speeds of 60km/h, 80km/h, and maximum speed in top gear with and without IFT's DiesoLIFT(TM) in the fuel system.

Testing Facility

Gerotek Test Facility (Pretoria, South Africa)

Test Objective

To conduct fuel consumption tests on a heavy vehicle with and without IFT's DiesoLIFT(TM) fuel additive.

Test Procedure

A standard Samil 100 truck was loaded with 8 tons of material and run around a high-speed oval track to bring it to operating temperatures. The average fuel consumption was then determined without DiesoLIFT(TM). DiesoLIFT(TM) was then added with the diesel fuel, and the truck continued to travel various set distances to see if DiesoLIFT(TM) affected fuel consumption levels.

Test Program

Once the Samil 100 truck's average fuel consumption without any DiesoLIFT(TM) was determined, DiesoLIFT(TM) was added to the fuel tank at a ratio of 1:600 in volume and the truck was run at constant speeds of 60km/h, 80km/h, and at its maximum speed in top gear. The truck's fuel-consumption data was collected after the truck had traveled 120km, 620km, 877km, 1,545km, and 3,072km.

Engines

The Samil 100 truck had its standard V10 engine with 16,593cc displacement.

Fuel Type & Fuel Measurement System

Standard #2 diesel was used for testing.

Fuel consumption was measured with Daton speed and fuel measuring equipment.

TEST RESULTS

AFTER TRUCK HAD RUN 877km WITH DiesoLIFT(TM), TEST RESULTS SHOWED FUEL ECONOMY IMPROVEMENTS OF 3.9% AND 4.1% AT SPEEDS OF 60km/h and 80km/h RESPECTIVELY. AFTER THE TRUCK HAD TRAVELED 1,545km, FUEL ECONOMY IMPROVED TO 5% FOR BOTH SPEEDS. AND AFTER 3,072km, TEST RESULTS SHOWED FUEL ECONOMY IMPROVEMENTS OF 5.5% and 8.0% AT SPEEDS OF 60km/h AND 80km/h RESPECTIVELY.

Test Description

Performance and emissions testing on a Cummins NTA855R3 engine on a test bed.

Testing Facility

MI Technology, Preston, United Kingdom

Test Objective

Evaluate the benefits derived from using IFT's DiesoLIFT(TM) to improve fuel economy and reduce harmful emissions under controlled conditions.

Test Procedure

Power and Consumption Test Method BS ISO 15550:2002 and ISO 3046 – 1:2002.
Emissions testing performed according to ISO8178 Test Cycle F for rail traction.

Test Program

Fuel consumption and emissions testing was conducted utilizing one Cummins NTA855R3 engine on a test bed at MI Technology. Data was collected from an initial performance and emissions test was run with standard gas oil. Next, a 40-hour conditioning run was executed at 100% engine load and speed using fuel treated with DiesoLIFT(TM). To conclude, data was collected from a final performance and emissions test using fuel treated with DiesoLIFT(TM).

Engines

The control and test engine was a 14-liter Cummins NTA855R3 engine on a test bed.

Fuel Type & Fuel Measurement System

Standard BS 2869 Class A2 gas oil was used for the test.
The fuel was dosed with DiesoLIFT(TM) in a 1:600 ratio by volume.

TEST RESULTS

DiesoLIFT(TM) PROVIDED AN MINIMUM FUEL ECONOMY IMPROVEMENT OF 6.9% AT FULL LOAD IMPROVING TO 10.4% IMPROVEMENT AT LOWER LOAD AT A 1:600 DOSAGE IN DIESEL FUEL.

DiesoLIFT(TM) PROVIDED A REDUCTION OF 4.3% in THC, 12.8% in CO, 8.5% in CO₂, and 24.6% in EXHAUST SMOKE EMISSIONS.

PARTICULATE MATTER AND EXHAUST SMOKE WERE BOTH REDUCED SIGNIFICANTLY, BY 95% and 24.6% RESPECTIVELY.

Test Description

The test was performed under the standard conditions of test procedure CEC F-23-A-01, Issue 11. Fuel consumption was measured by Mass Flow Rate and expressed in Kg/Hr.

Testing Facility

Prodrive Ltd., Milton Keynes, United Kingdom

Test Objective

The test was carried out to investigate the effect that DiesoLIFT(TM) has on the fuel consumption of an indirect injection diesel engine under standard test conditions. The test work was commissioned at Prodrive Ltd., in the United Kingdom.

Test Procedure

Test performed according to the CEC Test Protocol CEC F-23-A-01.

Test Program

The CEC F-23-A-01 test was performed through two test cycles;

Test Cycle 1: Ref. IF-XUD9-001. This test cycle was performed with reference fuel not treated with DiesoLIFT(TM). Test was commenced with clean test injector nozzles as per the standard test procedure. Fuel flow was recorded throughout the test cycle. At completion of test cycle injector nozzle flow rates were measured and recorded.

Test Cycle 2: Ref. IF-XUD9-002. The test cycle was then performed with reference fuel not treated with DiesoLIFT(TM) at a dose rate of 1:600 in volume. The test was commenced with clean injector nozzles as per the standard test procedure. Fuel flow was recorded throughout the test cycle. At completion of the test cycle injector nozzles' flow rates were measured and recorded.

Engines

The engine used for the test was a Peugeot XUD9AL unit supplied by PSA specifically for the Nozzle Coking Test, as originally specified by CEC Working Group PF-23.

Fuel Type & Fuel Measurement System

Reference fuel CEC RF-06-03 fuel was used during testing.

Test Results

Prodrive Ltd.'s test results demonstrate that the use of DiesoLIFT(TM) alone was able to improve fuel economy throughout the test cycle and to reduce smoke particulate emissions.

	% reduction in fuel consumption	% reduction in smoke
Stage 1	11.7	
Stage 2	3.9	
Stage 3	7.6	5.2
Stage 4	5.7	6.8

Test Description

The test compared the performance of ordinary diesel fuel with diesel fuel treated with DiesoLiFT(TM) technology.

Testing Facility

Department of Automotive Engineering (DAE) of Tsinghua University in Beijing, China

Test Objective

The test objective was to determine the effect that DiesoLiFT(TM) had on the power output, fuel consumption and emissions of Diesel engines under Chinese standard test conditions.

Test Procedure

Test protocol was defined by the Chinese National Standard GB/T 18297-2001 "Test Method of the Performance of Automobile Engines"

Test Program

The Cummings-4B diesel engine was first warmed up for two hours on normal diesel with no additives.

After the engine was warmed, a 15 to 20 minute break ensued allowing for the fuel to be switched for diesel fuel with IFT's DiesoLiFT(TM) added in at a ratio of 1 to 600. Once the fuel was switched, the engine ran for another two hours at full load and partial load at two different speeds of 1800r/min and 2200r/min. During this time, engine power, fuel consumption and exhaust emissions were measured.

Engines

The engine used during the test was a naturally aspirated 4-stroke Cummings-4B diesel engine with bore x stroke = 102x120, displacement = 3.92L, rated = 2800 r/min.

Fuel Type & Fuel Measurement System

Standard #2 diesel was used for testing.

The tools used to calculate performance were an exhaust gas analyzer, a dynamometer, an electronic balance and smoke meter, and an exhaust particulate matter analyzer.

TEST RESULTS

TEST RESULTS SHOWED THAT WHEN THE 4-STROKE CUMMINGS-4B DIESEL ENGINE WAS AT PARTIAL LOAD, AND IFT's DiesoLiFT(TM) WAS USED, FUEL CONSUMPTION DECREASED 3%.

CO EMISSIONS WERE LOWER WHEN THE ENGINE WAS BEING RUN AT A FULL LOAD AND DiesoLiFT(TM) WAS MIXED WITH THE DIESEL FUEL. THERE WAS ALSO A SIGNIFICANT DECREASE IN PARTICULATE MATTER WHEN DiesoLiFT(TM) WAS USED.

EXECUTIVE SUMMARY || FUEL CONSUMPTION FIELD TRIAL
Atlantic Express Bus Lines || St. Louis, Missouri, USA

Test Description

Fuel economy testing on forty (40) Atlantic Express buses and four (4) Atlantic Express vans for a period of three months.

Testing Facility

Atlantic Express Chouteau Bus Depot in St. Louis, Missouri.

Test Objective

Evaluate the fuel economy benefits of DiesoLIFT(TM) when added to active buses and vans.

Test Procedure

Standard refueling of forty buses and four vans as they completed normal functions.

Test Program

For three months prior to testing, Atlantic Express calculated the average daily fuel economy for their forty buses and four vans.

Beginning March 8, 2002, the forty buses and four vans were then refueled with their normal diesel fuel and IFT's DiesoLIFT(TM) for three additional months. IFT's DiesoLIFT(TM) was added first to the fuel tank with the diesel fuel added in next to cause the two to splash blend together.

Atlantic Express additized at a ratio of 1 gallon of DiesoLIFT(TM) per 575 gallons of diesel fuel. For buses refueling an average of 21 gallons to 30 gallons, 500mL of DiesoLIFT(TM) was mixed. Buses refueling between 31 gallons and 40 gallons received 600mL of DiesoLIFT(TM). And buses that refueled with 20 gallons or less received 400mL of DiesoLIFT(TM).

Engines

Of the forty buses used during testing, seven had International Engines, including two 1994 engines, four 1995 engines, and one 1996 engine. The other thirty-three engines used were Caterpillar engines, including twenty-eight 1995 engines and five 1996 engines. The four Atlantic Express vans all had 1995 Chevy engines.

Fuel Type & Fuel Measurement System

Standard #2 diesel was used for testing.

Fuel economy was measured by the number of miles driven divided by the number of gallons burned. This number was then compared to the average fuel economy prior to testing.

TEST RESULTS

DiesoLIFT(TM) DELIVERED AN AVERAGE INCREASE OF 10.13% IN FUEL ECONOMY.

Test Description

The test was performed to the test procedure CEC F-23-A-01, Issue 11. Results are expressed in terms of the percentage airflow loss at various injector needle lift points. Airflow measurements were accomplished with an airflow rig complying with ISO 4010.

Testing Facility

Prodrive Ltd., in the United Kingdom

Test Objective

The test was carried out to investigate the effect that DiesoLIFT(TM) had on the formation of deposits of injector nozzles of an indirect injection diesel engine. The test work was performed at Prodrive Ltd., in the United Kingdom.

Test Procedure

Test performed according to the CEC Test Protocol CEC F-23-A-01.

Test Program

The CEC F-23-A-01 test was performed through three test cycles;

Test Cycle 1: Ref. IF-XUD9-003. This test cycle was performed with reference fuel not treated with DiesoLIFT(TM). Test commenced with clean test injector nozzle. Upon completion of test cycle injector nozzles' flow rates were measured and recorded.

Test Cycle 2: Ref. IF-XUD9-004. Engine prepared according to protocol, but dirty injector nozzles from Cycle 1 were returned to the engine unclean. The test cycle was then performed with reference fuel treated with DiesoLIFT(TM) at a dose rate of 1:600 ratio of DiesoLIFT(TM):Fuel by volume. Upon completion of the test cycle injector nozzles' flow rates were measured and recorded.

Test Cycle 3: Ref. IF-XUD9-005. Repeat of the test Cycle 2 procedure, with the dirty injector nozzles returned to the engine unclean after flow rate measurement at the end of Cycle 2. Upon completion of the third test cycle the test results were analyzed for observed effects on injector nozzle fouling by the addition of DiesoLIFT(TM) to the reference fuel.

Engines

The engine used for the test was a Peugeot XUD9AL unit supplied by PSA specifically for the Nozzle Coking Test, as originally specified by CEC Working Group PF-23.

Fuel Type & Fuel Measurement System

Reference fuel CEC RF-93-T-095 was used throughout the study. Note that this reference fuel is specifically blended to encourage deposit formation.

TEST RESULTS

TESTING DEMONSTRATES THAT AFTER ONE XUD9 ENGINE 10-HOUR CYCLE, USE OF DiesoLIFT(TM) WAS ABLE TO REDUCE NOZZLE FOULING BY 5%.

% NOZZLE FOULING AFTER FIRST XUD9 CYCLE USING UNADDITIZED FUEL	90%
% NOZZLE FOULING AFTER SECOND XUD9 CYCLE USING ADDITIZED FUEL	85%
% IMPROVEMENT IN NOZZLE FOULING AFTER ONE CYCLE WITH DiesoLIFT(TM)	5%

CONFORMS TO INDUSTRY STANDARD "NO HARM" TESTING.

Test Description

Determination of biodegradability characteristics on a selected range of IFT additives.

Testing Facility

BfB Oil Research SA, Belgium

Test Objective

Verify that IFT additive technology is fully biodegradable.

Test Procedure

Test followed OECD 301B protocol.

Test Program

The tests were performed according to the standard OECD 301B method required by the 'REACH' and Eco-Label procedures for biodegradability determination.

Additive candidates:

- DiesoLiFT(TM)
- GasoLiFT(TM)
- EM1 (TM)

TEST RESULTS

RESULTS SHOW THAT DiesoLiFT(TM), GasoLiFT(TM), and EM1(TM) ARE READILY BIODEGRADABLE ACCORDING TO THE OECD 301B PROTOCOL.

DiesoLiFT(TM) BIODEGRADABILITY RATING:	63.3%
GasoLiFT(TM) BIODEGRADABILITY RATING:	72.0%
EM1(TM) BIODEGRADABILITY RATING:	80.6%

Test Description

Determination of diesel fuel characteristics prior and after treatment with IFT's DiesoLiFT(TM) at a 1:600 ratio in volume.

Testing Facility

BfB Oil Research SA, Gembloux, Belgium

Test Objective

Verify that diesel fuel characteristics remain within standard specifications after treatment with IFT's DiesoLiFT(TM) at a 1:600 ratio in volume.

Test Procedure

EN 590 protocol for diesel fuel characteristics.

Test Program

Determination of EN 590 characteristics on a commercial diesel fuel meeting EN 590 standard before and after additization with DiesoLiFT(TM) at a 1:600 ratio in volume.

Fuel Type & Fuel Measurement System

The fuel used during the test was a standard EN 590 commercial diesel fuel.
It was then additized using DiesoLiFT(TM) at a 1:600 ratio in volume.

TEST RESULTS

ALL CHARACTERISTICS REMAIN WITHIN SPECIFICATIONS AFTER TREATMENT WITH DiesoLiFT(TM) AT THE RECOMMENDED DOSAGE OF 1:600 IN VOLUME.

RESULTS SHOW THAT THE USE OF DiesoLiFT(TM) AT THE RECOMMENDED DOSAGE OF 1:600 IN VOLUME DRAMATICALLY IMPROVES THE LUBRICITY CHARACTERISTIC OF DIESEL FUEL, THUS SIGNIFICANTLY REDUCING FRICTION IN THE ENGINES.

(see next page for technical data chart)

RESULTS

CHARACTERISTIC	METHOD	UNIT	EN 590 REQ.	EN 590 DIESEL	EN 590 DIESEL + DiesoLiFT(TM) (1:600 v/v)
Aspect	Visual	-	Clear & Bright	Clear & Bright	Clear & Bright
Density	ISO 3675	kg/l	820-845	833.3	833.1
Distillation	ISO3405	-	-	-	-
Initial Boiling Point		°C	-	166.2	167.6
% v/v distillate at 250°C		% (v/v)	65 max.	40.4	40.4
% v/v distillate at 350°C		% (v/v)	85 min.	97.0	97.4
95% distillate at		°C	360 max.	341.4	340.3
Sulfur content	ISO 14596	mg/kg	50 max.	26	27
HFRR Lubricating Capacity	ISO 12156-1	µm	460 max.	303	228
Cold Filter Plugging Point	EN 116	°C	-15 max.	-18	-16
Flash Point	ISO 2719	°C	55 min.	61.0	64.0
Copper Corrosion	ISO 2160-	-	class 1 max.	1a	1a
Water content (Karl Fisher)	ISO 1733	mg/kg	200 max.	26	31
Sediment content	EN 12662	mg/kg	24 max.	2	4
Ash content	ISO 6245	% (m/m)	0.01 max.	< 0.01	< 0.01
Kinematic viscosity @ 40°C	ISO 3104	mm ² /s	2.00-4.50	2.44	2.48
Cetane Rating calculated	ISO 4264-	-	46 min.	51.3	51.1
Aromatic Hydrocarbon	EN 12916	% (m/m)	11 max.	2.8	2.6
Carbon Residue	ISO 8615	% (m/m)	0.30 max.	< 0.01	< 0.01
Oxidation Stability	ISO 12205	g/m ³	25 max.	3	2
Euromarker	NF XP M-07-113	-	Negative	Negative	Negative

