



BESTLINE INTERNATIONAL RESEARCH INC.

BestLine Products: Testing Procedures & Results

BestLine has subjected its products to a number of tests (with no modification) performed by third party, world renowned, industry accepted and respected laboratories. Those tests include, but are not limited to the following:

(A) BestLine's Universal Premium Full Synthetic Engine Treatment:

ASTM D testing of the product through the use of the Block-on-Ring Tester and the Seta Shell Four Ball Test machine (ASTM D-2509, D-4172 and D-2782), Pin & Vee Block (ASTM D-2670, D-2625 and D-3233) demonstrates the ability of the product to perform as an extreme pressure additive. Each of these test machines incorporates a rotating steel surface applied against a fixed steel surface while submerged in a bath of the test lubricant. Pressure is noted as kilogram force (KGF) applied to the mating surface while the rotating surface is set for a fixed RPM (revolution per minutes).

The positive results using BestLine's Universal Premium Full Synthetic Engine Treatment are as follows:

Numerous qualified engine tests were completed including small engines, 2-cycle, steam turbines, jet turbines, gasoline and the CRC L-38. These tests have demonstrated the ability of BestLine's lubricants to perform universally. Further, these tests demonstrate that Bestline's lubricants provide a protective coating that remains on the treated metal. Four cylinder engines, after treatment with BestLine, have been stripped of valve covers, oil pans, oil-pumps and filters, with only the molecular thin film of BestLine's lubricant, have successfully run without either oil

or coolant, both on an engine stand and while completely submerged in water. These tests have been run repeatedly and recorded before professional engineers. The engines have been recorded to run in excess of 25 minutes while completely submerged under water. The motors were later stripped and the components reviewed and re-weighed with little sign of wear.

Additional tests:

Test: 1

SWISS FEDERAL INSTITUTE OF TECHNOLOGY LAUSANNE:

The goal of this test was to verify to what extent BestLine's affects the wear mechanisms of steel, and in particular its mechanical response to friction. The end conclusion was, when comparing Mobil 1 without BestLine to Mobile 1 with BestLine, wear was reduced by 94%. Note that portions of this test, because the unique manner in which BestLine works is so revolutionary, have been published in **Wear Magazine**, an International Journal on the Science and Technology of Friction, Lubrication and Wear (December 2016 issue).

Test: 2

CRC L-38

Testing has been completed on a CRC L-38 Engine Stand ASTM D-5119-90 (American Society for Testing and Materials). This rigorous test was conducted at the prestigious PerkinElmer Fluid Science Automotive Research Center/ Intertek Caleb Brett (formerly EG&G Automotive Research) located at 5404 Bandera Road, San Antonio, Texas.

PerkinElmer/Intertek Caleb Brett is one of the largest independent automotive testing organizations in the world. PerkinElmer/Intertek Caleb Brett has been providing testing to the automotive manufacturers and petrochemical industry since 1953. Their customers are worldwide, and include Shell Oil, Exxon-Mobil Oil, Chevron, Castrol, Pennzoil, Petro-Canada

etc., along with automotive OEM's, heavy-duty engine OEM, OEM suppliers and fuel and lubricant companies. This firm was designated by the United States Petroleum Task force to regulate and control of the quality and acceptance of regulated additives.

PerkinElmer/Intertek Caleb Brett was contracted to test the BestLine's Universal Premium Full Synthetic Engine Treatment when combined with an off the shelf motor oil. The reference oil used in the test was rated as a licensed API (American Petroleum Institute) spec motor oil. The test is a grueling 40 hours of severe running conditions plus 13 hours of run up and run down time. The engine is run under full load at an RPM (revolutions per minute) of 3150 using an external oil heater to reach extreme oil temperatures of 290 degrees Fahrenheit (143.3 degrees Celsius) with fuel to run abnormally rich at 4.5 pounds per hour.

The test is designed to break the down the oil, causing premature wear to the piston rod bearings, while have an adverse effect on the viscosity of the engine oil. The reduced viscosity of the oil can create excessive wear and increase the amount of sludge and varnish buildup.

The scoring is based on a reference oil test on a particular machine. The reference oil must have passed the test on one of the many test machines. The maximum allowable bearing loss is 40 mg of copper for the piston rod bearing. Sludge and varnish deposits are scored best out of 10 points, with 10 being perfect.

The engine assigned for the BestLine test was rated as the most difficult on which to obtain a passing score. The reference oil recorded a bearing weight loss of 27.7-mg. of copper. The oil with the BestLine's Universal Premium Full Synthetic Engine Treatment recorded a bearing weight loss of only **9.0 mg**. The engineer overseeing the test commented that it was one of, if not the best, test he has seen in over 12 years of service with PerkinElmer. Further the results of viscosity, sludge and varnish tests were nearly perfect. Out of a total of 60 possible points, the test with BestLine's Universal Premium Full Synthetic Engine Treatment scored 58.30 and 58.80 respectively in varnish and sludge. (The results exceeded all expectations.)

Test: 3

Sequence VIB (VIB):

This test, also known as the ASTM D 6837, measures the effects of automotive engine oils on the fuel economy of passenger cars and light-duty trucks. *BestLine's product scored significantly better than required to pass the industry-standard Sequence VIB test.* Further, there are several factors that should be noted:

- For the BestLine test, an off-the-shelf GF-3 (one that could **not** pass the VIB test brand-name oil (10W30) was used. BestLine's additive was blended with the oil to equal approximately ten percent (10 percent) of the total volume.
- To pass the Sequence VIB, a minimum score of 1.1 is needed after 16 hours of continuous running. The oil with BestLine's additive had a score of 1.49, the higher the score, the better and this amount is significantly better than "passing".
- After 96 hours, a score of .8 is required to pass the test (it is recognized that the oil is starting to fail by 96 hours, and, a lower score is acceptable). The oil with the BestLine additive achieved a score of 1.51, almost double of that required to pass the test.

This test proves that an oil with the BestLine additive reduces friction, improves performance, increases fuel economy, and continues to treat the metal of the internal engine surfaces long after most other oils have started to fail.

Test: 4

Sequence VIII (VIII):

The purpose of the VIII is to: a) evaluate a lubricant's performance in combating bearing wear, and b) to measure viscous shear stability (ability of the oil to maintain viscosity). Again, BestLine's lubricant easily passed this test, and there are several factors that need to be noted:

- The engine is run for 40 hours at 3150 rpm with the oil temperature raised to 290 Deg. F (143 Deg. C) through the use of an external heater (approximately 100 Deg. F hotter than experienced in the average engine).
- Upon completion of the test, the connecting rod bearings are measured for weight loss and the viscosity of the oil is measured.

- To pass the test, the bearing weight loss cannot exceed 26.4 mg.
- The oil used for the BestLine test was an off-the-shelf GF-3 (no claim by the manufacturer that it could pass the VIII) brand-name oil. BestLine's additive equaled eight percent (8 percent) of the test oil.
- The weight loss on the bearings was only 23.7 mg (easily passing the test).
- The viscosity of the oil with the BestLine additive started at 9.76 Centistokes at 100 Deg. C. At the end of the test, the viscosity was 9.76 Centistokes at 100 Deg. C. There was no change to the viscosity of the oil tested when the Bestline product was added.

Usually, as engine oil starts to break down, the oil either thins out (lower viscosity – and loss of protection) or thickens (higher viscosity with a buildup of sludge in the engine). With BestLine added, at the end of the test, there was absolutely no change in viscosity. This demonstrates superior performance and stability.

The low bearing weight loss is also of significance.

The picture at the right, as published by the lab conducting the test, shows a set of bearings, with significant scoring. Even with that extensive scoring, they still passed the test.



This second picture shows one of the bearings after the test with BestLine. As can easily be seen, the bearing looks pristine with essentially no scoring.



Test: 5

Primary Parameter of Engine Deviations:

Tests were conducted on the various engine components at the completion of the test to evaluate any changes the test oil with the added BestLine's Universal Premium Full Synthetic Engine Treatment may have had on the engine. ASTM and the ACC (American Chemical Council) for the API (American Petroleum Industry) allow permitted deviation before a failure is recorded.

	Percentage:	Permitted Deviation	Calculated Deviation
Engine Oil Gallery Temperature		2.5 %	0.0
Engine Coolant Outlet Temperature		2.5%	0.0
Engine Coolant Delta Temperature		2.5%	0.0
Fuel Flow		2.5%	0.0
Crankcase Off-Gas Std FT (3) h		2.5%	0.0
Oil Pressure, PSI		2.5%	0.0
Engine Speed, RPM		5.0%	0.0
AFR		5.0%	0.0
Exhaust, in Hg.		5.0 %	0.0

Note: These results of zero deviation exceeded all expectations.

Test: 6

Seta-Shell Four Ball Extreme Pressure Test (ASTM D-2783-82):

In this test, three steel test balls are locked in a holding cup while a fourth ball is fixed in a rotating chuck. Lubricant is applied to the container holding the fixed and rotating bearings. Pressure is loaded on the force arm and the electric motor is started (to rotate the fourth bearing). The electric DC motor is set to run at a 1725 RPM for a specified time (such as 10.0 seconds) in this test.

Wear Scar in Millimeters (4-ball method Scar Wear = mm)

Test Sample:	Load K.G.F:	Time/Seconds:	A/Temp:	Scar Length:	Width:
BestLine (BL)	500	10.0	76° F	0.803	1.064
BestLine (BL)	780	10.0	76° F	1.043	1.337
Texaco™ 10W30	500	10.0	76° F	2.940	2.440
Plus 10% BL	780	10.0	76° F	2.160	2.020
Esso™ 10W30	500	10.0	76° F	2.910	2.510
Plus 10% BL	780	10.0	76° F	2.210	2.160
Motor Master™ 30	500	10.0	76° F	5.00	3.857
Plus 10% BL	780	10.0	76° F	2.074	1.951
Hydraulic AW46™	500	10.0	76° F	2.900	2.320
Plus 10% BL	780	10.0	76° F	1.240	1.220

Notes:

- K.G.F. = Kilogram Force
- Weld or Failure = Score of 4.00 mm or greater
- BL = BestLine’s Universal Premium Full Synthetic Engine Treatment

Test: 7

Analytical Report:

BestLine’s Universal Premium Full Synthetic Engine Treatment was tested with the analytical results posted below:

			ASTM Test No:
Flash Point 342°F	172.2° C		ASTM D-92
Specific Gravity	1.036		ASTM D-1298
Total Base No	Mg KOH/g	7.5	ASTM D-4739
Copper Corrosion	1A	No Corrosion	ASTM D-130
Pour Point	-40° F	-40° C	ASTM D-97
Kinetic Viscosity cSt	42.2	40° C	ASTM D-445
Kinetic Viscosity cSt	8.8	100° C	ASTM D-445
Ash Content	0.277		ASTM D-482

Test: 8

Metal Analysis: ASTM D-5185

A sample of BestLine's Universal Premium Full Synthetic Engine Treatment was subjected to a metal analysis with the results posted below.

Aluminum	None Detected
Barium	None Detected
Copper	None Detected
Chromium	None Detected
Iron	None Detected
Lead	None Detected
Molybdenum	None Detected
Nickel	None Detected
Zinc	None Detected
Silver	None Detected
Tin	None Detected
Vanadium	None Detected

Test: 9

Engine Stand Testing

A brand new NASCAR™ engine was provided for testing on a dynamometer. The engine was run in on Kendall Racing Oil™ and numerous pulls were performed. BestLine Universal Premium Full Synthetic Engine Treatment was then added to the Kendall Racing Oil™ at a 10% ratio (20 parts oil to 2 parts BestLine). The test is posted as below.

Dynamometer Test on 358 Cu. In. GM® Engine (5.8 Liter)

- The NASCAR™® Engine was set up and run in to full operating temperature at speeds to 6900 RPM.

- After multiple runs with Kendall Racing 20W50 Racing Oil™, the maximum results were recorded in both horsepower and torque.

- BestLine Universal Premium Full Synthetic Engine Treatment was then added at a 10% ratio and the tests repeated with maximum results recorded.

Results:

- STPPwr-Chp Kendall® Maximum Horsepower = 494
- STPPwr-Chp with 10% BestLine added to Kendall®, Horsepower = **508**
- STPTrq-Clb-ft Kendall® Maximum Torque = 399
- STPTrq-Clb-ft Kendall® plus 10% BestLine added, Torque = **411**

Test: 10

Copper Corrosion Test: ASTM D-130

The tests were carried out on polished copper blanks that were submerged, for 3 hours at 100 degrees C, in oil treated with 15% of BestLine's Universal Premium Full Synthetic Engine Treatment and a number of its blended by-products. The blanks were then withdrawn, washed in Stoddard's solvent and the colors of the blanks were compared with a standard chart. The results of the tests consistently revealed 1-A, meaning "No Corrosion".

Test: 11

Rheological Evaluation:

Rheological evaluation was performed on the BestLine's Universal Premium Full Synthetic Engine Treatment when blended with various conventional motor oils. The test is to examine the effect that BestLine can have when blended with a host oil.

The samples oils tested with 10% and 15% addition of BestLine displayed Newtonian behavior (the desired results) at all temperatures tested. The treated oils displayed a substantial improvement in minimizing thermal degradation with the addition of BestLine. Using standard regression techniques, the variations of oil viscosities with each temperature was found to follow the Arrhenius model, Ae/RT ($n = Ae$) (excellent result).

Further tests conducted on BestLine products include, but are not limited to:

Engine Tests: All Tests Were Passed with Exceptional Results

Sequence VI B Fuel Economy Test with Energy Conserving Oil

Sequence VI B SJ Fuel Economy Test with Energy Conserving Oil

Sequence VIII Bearing Corrosion and Shear Stability with Energy Conserving Oil

BestLine received an API License to produce an Energy Conserving Multi-Vis Engine Oil under the Engine Oil Licensing Certification System

Test: 12

ASTM D-3233-B - Pin on Vee Block:

This test is used for evaluating wear, friction and extreme pressure properties of both materials and lubricants. Performed in September 2016, this test, in comparison with Chevron Delo 400 (a well-respected brand name Diesel Engine Oil) yielded the following results:

- a. Because of the inherent efficiencies in the BestLine Full Synthetic Oil, it withstood 167.5% more torque to achieve the required direct load for the test before failure, 149.8 inch pounds of torque compared to 89.6 inch pounds of torque.
- b. Because of the inherent efficiencies in the BestLine Full Synthetic Oil, the oil took 240% more time to reach the point of failure at the higher torque level than the Chevron Oil. Twelve (12) seconds for BestLine as compared to five (5) seconds for the Chevron Delo 400 LE
- c. Because of the efficiencies in BestLine Full Synthetic Oil, the oil showed substantially lower oil temperatures at the various test points and an 11% lower temperature at the point of failure

Test: 13

(B) MLT-101 Penetrant Tests, Information and Results:

ASTM D 2782-83 the Standard Test Method for Extreme Pressure Properties

ASTM D 4172 the Standard Test Method for Wear Test Properties

Note: The 4-ball wear or weld tester consists of 4 balls arranged in the form of an equilateral tetrahedron. The three lower balls are held immovable in a clamp (chuck) to form a cradle in which the fourth ball is caused to rotate around a vertical axis under prescribed conditions of load, speed and temperature. Ten milliliters of the lubricant are placed with the ball pot and, after the test is completed, the wear scar is measured, length and width, on each of the three balls. The spinning ball is not measured. Pressure exerted upon the balls is measured in KgF. (Kilogram Force)

ASTM D 2782-83 Extreme Pressure Test

Speed: 800 RPM

Product	Test No.:	Load:	Time-sec:	Temp:	Scar mm Width:	Scar mm Length:
BestLine	1	150 KgF	10.0	76° F	0.549	1.28
MLT-101	2	150 KgF	10.4	76° F	0.583	1.36
	3	150 KgF	10.2	76° F	0.557	1.30

Results: Average **0.563** Average **0.763**
Average **0.663**

WD-40	1	150 KgF	-10	76° F	5.0 Weld	5.0 Weld
	2	150 KgF	-10	76° F	5.0 Weld	5.0 Weld
	3	150 KgF	-10	76° F	5.0 Weld	5.0 Weld

Results: Average **5.0** Average **5.0**
Average **5.0 (Weld)**

Note: With WD-40, there was a large amount of metal deformation taken off the spinning ball in the chuck and deposited on the three stationary or locked balls. According to the ASTM D-2782 test, with stationary balls, a scar size of 4 mm or greater is considered a weld, or total failure.

Four Ball Wear Test ASTM D 4172

Speed: 1200 RPM

Product	Ball No.	Load	Time-Min	Temp	Scar mm Length	Width
BestLine	1	28 KgF	1.0 hours	76° F	0.429	0.429
MLT-101	2	28 KgF	1.0 hours	76° F	0.429	0.429
	3	28 KgF	1.0 hours	76° F	0.429	0.429

Results: Average **0.429** Average **0.429**
Average **0.429**

WD-40	1	28 KgF	1.0 hours	76° F	1.286	0.857
	2	28 KgF	1.0 hours	76° F	1.286	0.857
	3	28 KgF	1.0 hours	76° F	1.286	0.857

Results: Average **1.286** Average **0.857**
Average **1.072**

Note: We saw slight variances between Seta Shell Balls and SKF balls.

Test: 14

Physical Properties

BestLine Penetrant MLT-101 Test:

ASTM D-4739 Base No.mg KOH/gram7.5

ASTM D-1298 Specific Gravity0.96 @ 25° C.

ASTM D-93 Pensky-Marten Closed Cup Flash Point ...83°C

ASTM D-130 Copper Strip Corrosion1A

Appearance: Amber liquid with appearance of light weight oil

Odor: Sweet smelling

ASTM D-97 Pour Point -40°C -40°F Physical state: Liquid

ASTM D-1194 Vapor pressure for component: 33.00MM Hg @ 20° C.

ASTM D-4052 Vapor density: Air = 1. Heavier than Air @ 15°C.

ASTM D-92 Boiling Point: Greater than 153°C. @ 760.00 mm Hg. Stable under normal conditions.

Melting point: Not Applicable

Solubility in water: Negligible.

Evaporation rate: Negligible. Slower than ether.

ASTM D-5200 Percent volatile: Less than 60%

Note: Closed Cup Flash Testing will give substantially lower values for flash point compared to the Cleveland Open Cup Test.

Test: 15

HFRR: High Frequency Reciprocating Rig Lubricity Test:

All Diesel fuel sold after 2006 must be Ultra Low Sulfur Diesel (ULSD). To put this in perspective, Diesel fuel sold prior to 2006 could contain sulfur in a concentration of up to 500 parts per million (ppm). Sulfur's primary purpose was to provide lubrication to the fuel pump, injectors and valves. After 2006, the ULSD could only contain up to 15 ppm. BestLine's Diesel Fuel Treatment, as one of its benefits, more than replaces the lubrication lost when the sulfur was removed.

The issues surrounding ULSD became so great that the ASTM D 6079 test (also known as the High Frequency Reciprocating Rig Lubricity Test) was developed to measure the suitability of fuel for use in 2006 or older diesel engines.

When BestLine's Diesel Fuel Treatment is added to ULSD, wear is reduced by over 25% from what is deemed acceptable for the fuel to be deemed suitable. The submitted ULSD fuel tested (taken directly from a retail Diesel fuel pump) resulted in a wear scar of 534 microns (14 microns over the allowable limit of 520 microns), while the same fuel treated with BestLine Synthetic Diesel Fuel Treatment (two ounces per 10 gallons of fuel) resulted in a wear scar of 354 microns.

In addition to the tests that have been performed in world recognized laboratories, there have been a number of real world tests that have been conducted under strict protocols. Those tests are:

Test: 16

HEAVY DUTY DYNAMOMETER TEST:

BestLine has not yet performed any tests specific to emissions. However, several years ago, product was provided to a trucking company in Calgary, Canada for testing on their fleet (unfortunately that company is now out of business). Their testing yielded some very favorable results.

With respect to reduction in fuel consumption, their fleet showed an average savings of 5.7% per ton mile. Their dynamometer testing relative to emissions provided the following results:

DESCRIPTION:

- Detroit Diesel 4-7 IN 2-Cycle
- Test Duration: 20 Hours
- Fuel Consumption
- Horsepower
- Exhaust Emissions: Smoke, CO, HC, NOX

TEST METHOD:

- EPA-13 Mode Heavy Duty Test Cycle
- Additive Conditioning, Using Three Steady State Modes
- Idle @ 1600 RPM, 50% hp
- Run @ 2300 RPM, 90% hp
- Run @ 2300 RPM, 25% hp

TEST SEQUENCE:

- Inspect and Install Used Fuel Injectors
- Conduct EPA-13 Mode Heavy Duty Test Cycle (Initial)
- Add BestLine Synthetic Diesel Fuel Treatment as Directed
- Repeat EPA-13 Mode Heavy Duty Test Cycle (Final)
- Compare Initial to Final Test Results to Determine Effects of BestLine Synthetic Diesel Fuel Treatment.

CHANGE IN EMISSIONS: After operation with fuel treated with BestLine International Research, Inc., Diesel Fuel Treatment at a ratio of 2 ounces per 10 gallons of fuel:

Engine: Detroit Diesel 4-71 N
1113 MODE TEST PROCEDURE:

PERCENT IMPROVEMENT

- 1. Brake Specific Fuel Consumption 3.4%
- 2. Hydrocarbons 4.6%
- 3. Carbon Monoxide 16.9%
- 4. Nitrous Oxide 1.8%
- 5. Particulates (soot) 10.9%

Test: 17

CD & Power:

CD & Power, a supplier of generators and engines in California, conducted a test to determine the effect of BestLine’s Diesel Fuel Treatment (DFT) upon fuel efficiency. Using a One Mega Watt generator, using only BestLine’s DFT at a ratio of three (3) ounces per 10 gallons of fuel, there was an **11.3% decrease in fuel consumption.**

Test: 18

Pacific Challenger:

This was a Test on the Pacific Challenger, a commercial fishing trawler, of both BestLine’s Diesel Engine Treatment and Diesel Fuel Treatment. Using a 12.5% blend of the Diesel Engine treatment in the engine oil and 1.9 ounces of Diesel Fuel Treatment per 10 gallons of fuel, there was an average **10.97% decrease in fuel consumption.**

Test: 19

SS Legacy:

UnCruise Adventures, on their cruise ship, the SS Legacy, conducted a test to determine how BestLine's Diesel Engine Treatment increased the life of the oil used in their engines. Their mechanics regularly test the engine oil to determine if it is in need of being changed.

By past history, they have found that their oil usually needs to be changed after approximately 500 hours of run time. After adding BestLine's Diesel Engine Treatment to make a 10% blend in their regular oil, they found that they were able to run 1,886 hours before the oil needed to be changed. This was an **increase of 370% in oil life.**

For further information, please contact:



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