

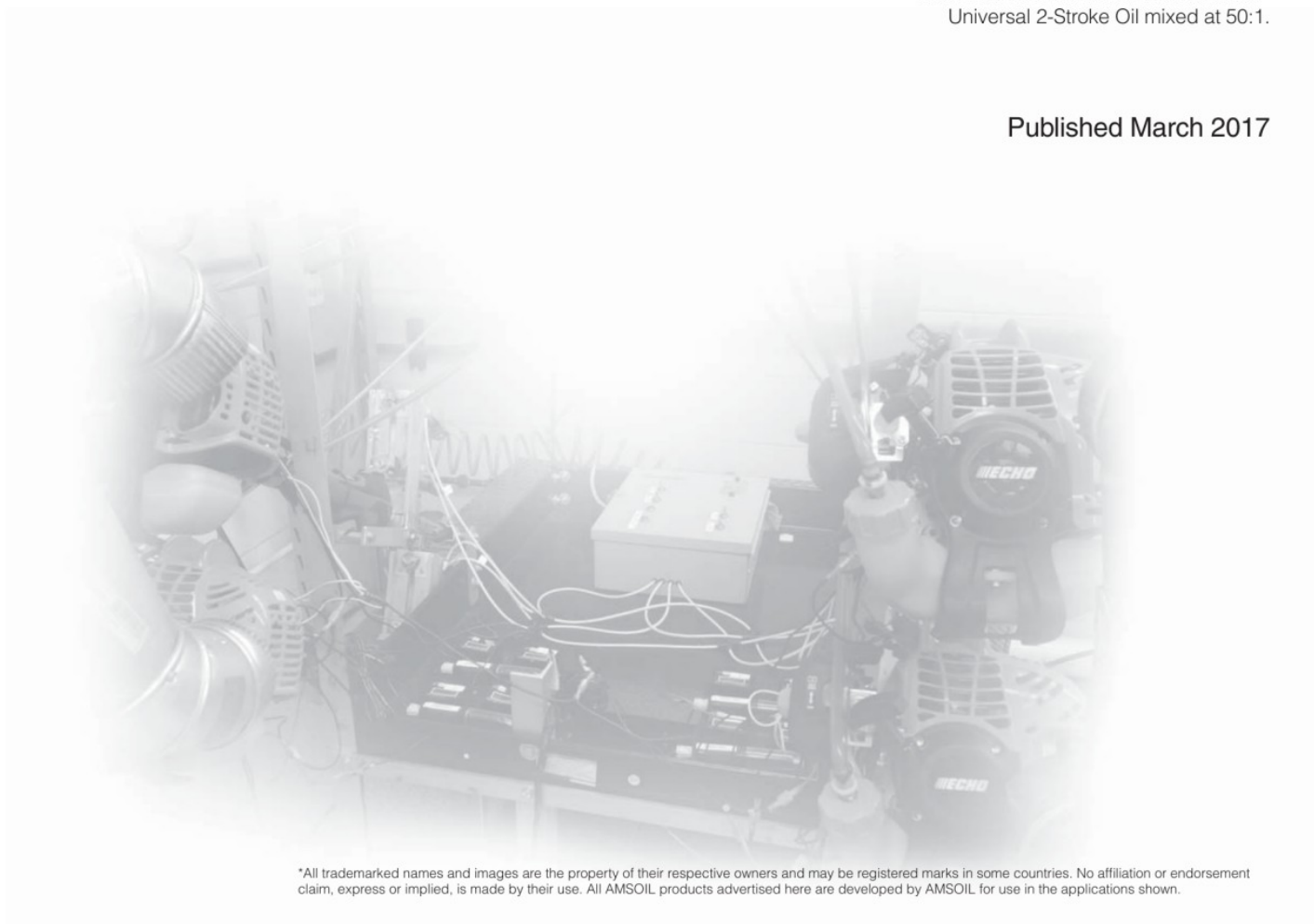
TECHNICAL STUDY



ECHO* 100:1 String Trimmer Technical Study

AMSOIL SABER® Professional Synthetic 2-Stroke Oil mixed at 100:1 resisted deposits and maintained power better than ECHO Power Blend* XTended Life* Universal 2-Stroke Oil mixed at 50:1.

Published March 2017



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Overview

Rising costs continue to force landscape contractors and other professionals to find ways to save money without sacrificing their ability to produce professional-looking lawns and grounds. Spending less money on oil by safely using a leaner mix ratio is one way to cut costs. For this strategy to work, however, the oil must be capable of protecting modern, hot-running two-stroke equipment from the negative effects of heat, including wear and power-robbing exhaust-port and spark-arrestor-screen deposits. Otherwise, equipment operability suffers and replacement costs increase.

Objective

Determine through lab testing if AMSOIL SABER® Professional Synthetic 2-Stroke Oil mixed at 100:1 is capable of meeting the increased performance needs of ECHO® string trimmers in particular, and modern two-stroke string trimmers in general.

Methodology

Testing was conducted on eight ECHO trimmers in the AMSOIL mechanical lab and followed a test plan designed to compare two-stroke oils in simulated real-world conditions. Test duration is designed to simulate an extended length of service.

Table 1

String Trimmers Tested	ECHO SRM-225	
Oils Tested	AMSOIL SABER Professional Synthetic 2-Stroke Oil	ECHO Power Blend* XTended Life* Universal 2-Stroke Oil
Oil Batch Codes	85749 072616	365151502 205215176 218815801 208315331 214116699
Date Oil was Acquired	November 2016	November 2016
Mix Ratio	100:1	50:1
Gasoline	Non-oxygenated 91-octane	
Test Duration	300 hours (150 @ mid-throttle; 75 @ idle; 75 @ wide-open throttle)	
Room Temperature	70°F-85°F	

The test used four ECHO string trimmers, with two running SABER Professional and two running ECHO Power Blend. Computer-controlled actuators simultaneously operated the trimmer throttle triggers according to an identical protocol for each unit.

Test administrators monitored engine rpm, spark-plug temperature, exhaust emissions and other parameters to ensure consistent, repeatable operation and gauge overall performance of each trimmer. After 300 hours of operation, the trimmers were disassembled and inspected.

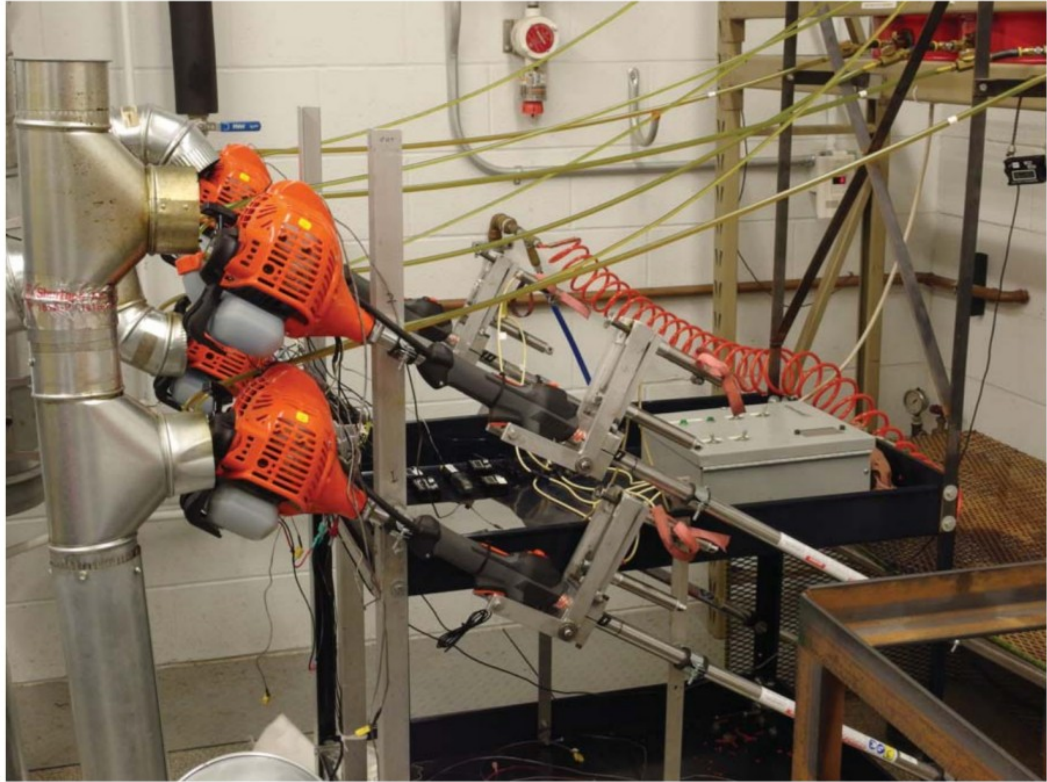
The study was then replicated using the same n=2 design, meaning eight trimmers in total were tested.

Exhaust-port blockage and spark-arrestor-screen plugging were compared using a paired t-test. Equipment was run at factory-set conditions. If equipment problems developed, testing protocol prohibited intervention outside of recommended maintenance in the owner's manual.

The test data is statistically valid at the 95% confidence interval for exhaust-port blockage and spark-arrestor-screen plugging. The carbon buildup on pistons was not numerically quantified as part of the study.

Note: Test results published in this Technical Study describe and represent properties of oils that were acquired on the dates listed in Table 1. Results do not apply to any subsequent reformulations of such oils or to new oils introduced after completion of testing. All oils were available to consumers at the time of purchase. Testing was completed in January 2017.

String Trimmers Arranged on Test Stand



Oil Cost Comparison

Using a 100:1 mix ratio reduces total oil cost compared to a 50:1 mix ratio. The following table shows the difference in total oil cost.

	AMSOIL SABER® Professional	ECHO* Power Blend*
Number of trimmers	4	4
Total oil used	117.76 ounces	224 ounces
Oil cost	\$0.28 per ounce	\$0.29 per ounce
Mix ratio	100:1	50:1
Total oil cost	\$32.97	\$64.96

The trimmers running SABER Professional at 100:1 should consume exactly half the oil as the trimmers running ECHO Power Blend at 50:1. However, due to heavier deposits, the trimmers lubricated with ECHO Power Blend lost power as the test progressed (see the rpm graph on page 11). Operating at reduced rpm means they consumed fuel/oil at a lower rate compared to trimmers lubricated with SABER Professional.

SABER Professional reduced oil costs by \$31.99, a savings of 49 percent.

Note: Cost of SABER Professional is based on the wholesale gallon price effective at the time of printing. Cost of ECHO Power Blend is based on the average gallon price of a cross-section of retail outlets surveyed at the time of printing.

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Piston Rings/Piston Skirts

Deposits in the ring grooves can cause the rings to stick and lose effectiveness. Engine rpm can decrease and the engine can lose compression. Significant compression loss leads to engine failure. Heavy deposits on the piston skirt increase friction and reduce performance.

AMSOIL SABER® Professional @ 100:1
Exhaust Side

ECHO® Power Blend® @ 50:1
Exhaust Side



Engine 1



Engine 5



Engine 2



Engine 6



Engine 3



Engine 7



Engine 4



Engine 8

Deposits appear heavier on the pistons lubricated with ECHO Power Blend. The pistons lubricated with SABER Professional mixed at 100:1 appear cleaner. SABER Professional provided improved detergency and extreme-heat resistance.

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Piston Crowns/Undercrowns

Heavy piston crown deposits can cause preignition and poor performance. While undercrown deposits are unlikely to impede performance, they are an indicator of the oil's detergency properties. With modern two-stroke equipment running hotter, oils must demonstrate strong detergency and heat resistance to maintain piston cleanliness and peak performance.



Pistons lubricated with ECHO Power Blend appear to contain heavier crown and undercrown deposits. In contrast, the piston crowns lubricated with SABER Professional look clean, with low levels of deposits. At 100:1, SABER Professional provided improved detergency and extreme-heat resistance.

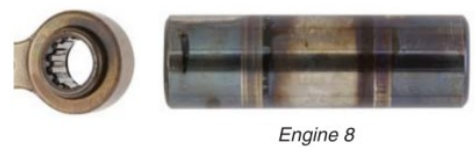
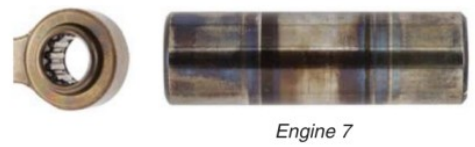
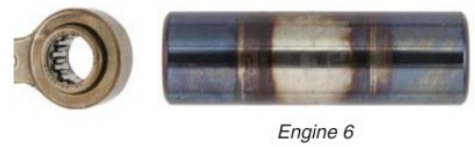
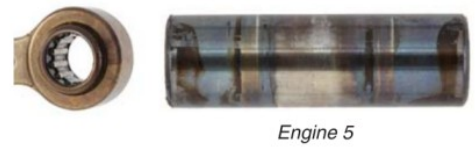
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Wrist Pins & Bearings

The wrist pin and bearing are exposed to extreme heat due to their proximity to the combustion event. Ineffective lubrication can result in deposits, polishing and flat spots on the wrist pin, restricting rotation. As the engine works to overcome this restriction, the piston can bear increased pressure, leading to scuffing and, eventually, failure.

AMSOIL SABER® Professional @ 100:1

ECHO® Power Blend* @ 50:1



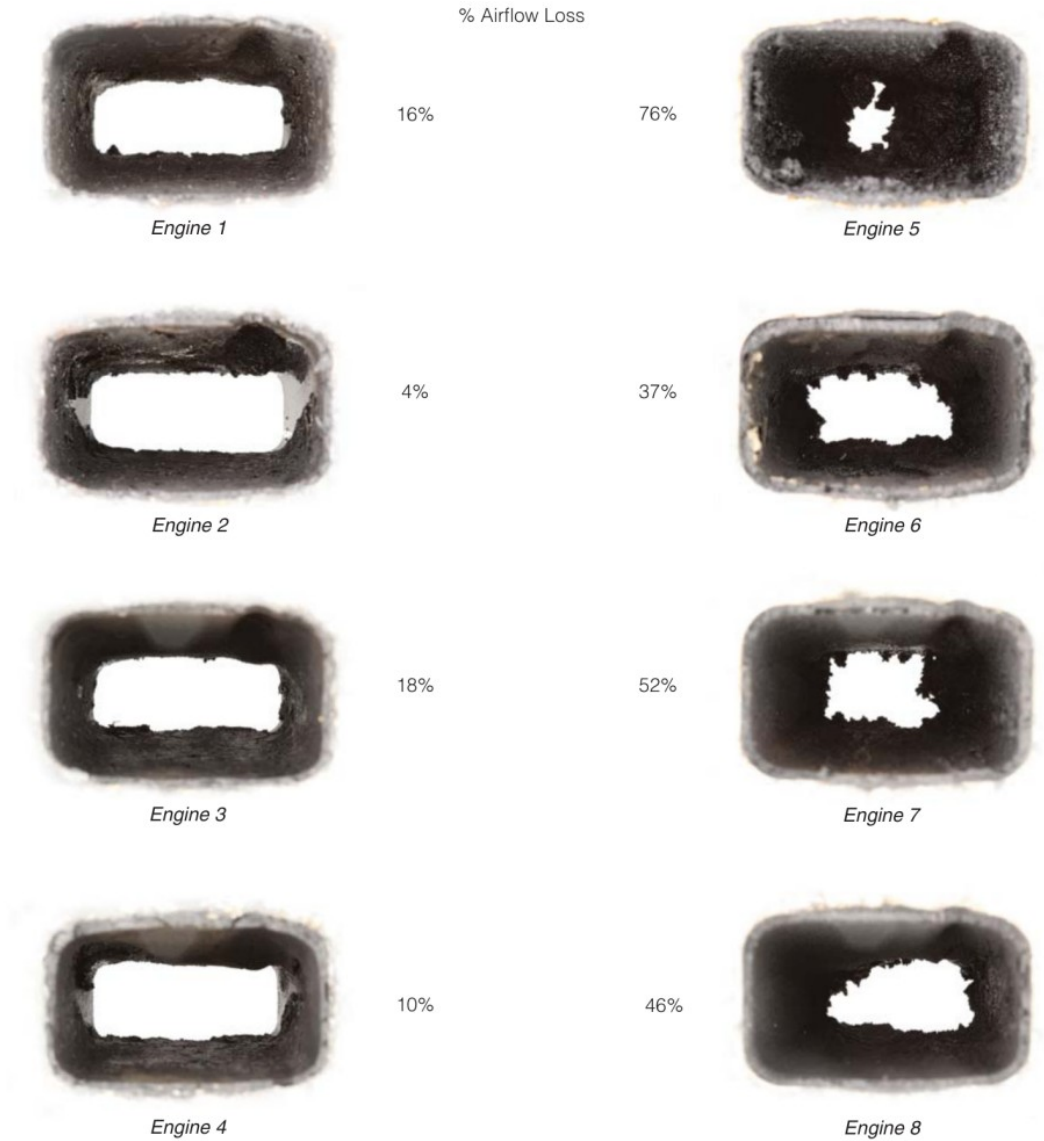
All eight wrist pin bearings demonstrated no issues throughout the test, indicating the oils provided good protection. None of the wrist pins contain flat spots. Both oils performed well in this area.

Exhaust Ports

For the engine to run properly and produce maximum power, exhaust gases must flow freely out the exhaust port during operation. Restricted exhaust causes rpm and power loss, starting difficulties and, eventually, failure to operate.

AMSOIL SABER® Professional @ 100:1

ECHO® Power Blend* @ 50:1



SABER Professional mixed at 100:1 demonstrated low exhaust-port deposits. In contrast, all four exhaust ports on the engines using the ECHO product, mixed at 50:1, suffered some blockage. The exhaust port on Engine 5 was nearly completely blocked, causing the trimmer to barely idle by the end of the test.

Note: Airflow loss was calculated using a flow bench to measure restriction, which was converted to a percentage of flow compared to an unblocked exhaust port.

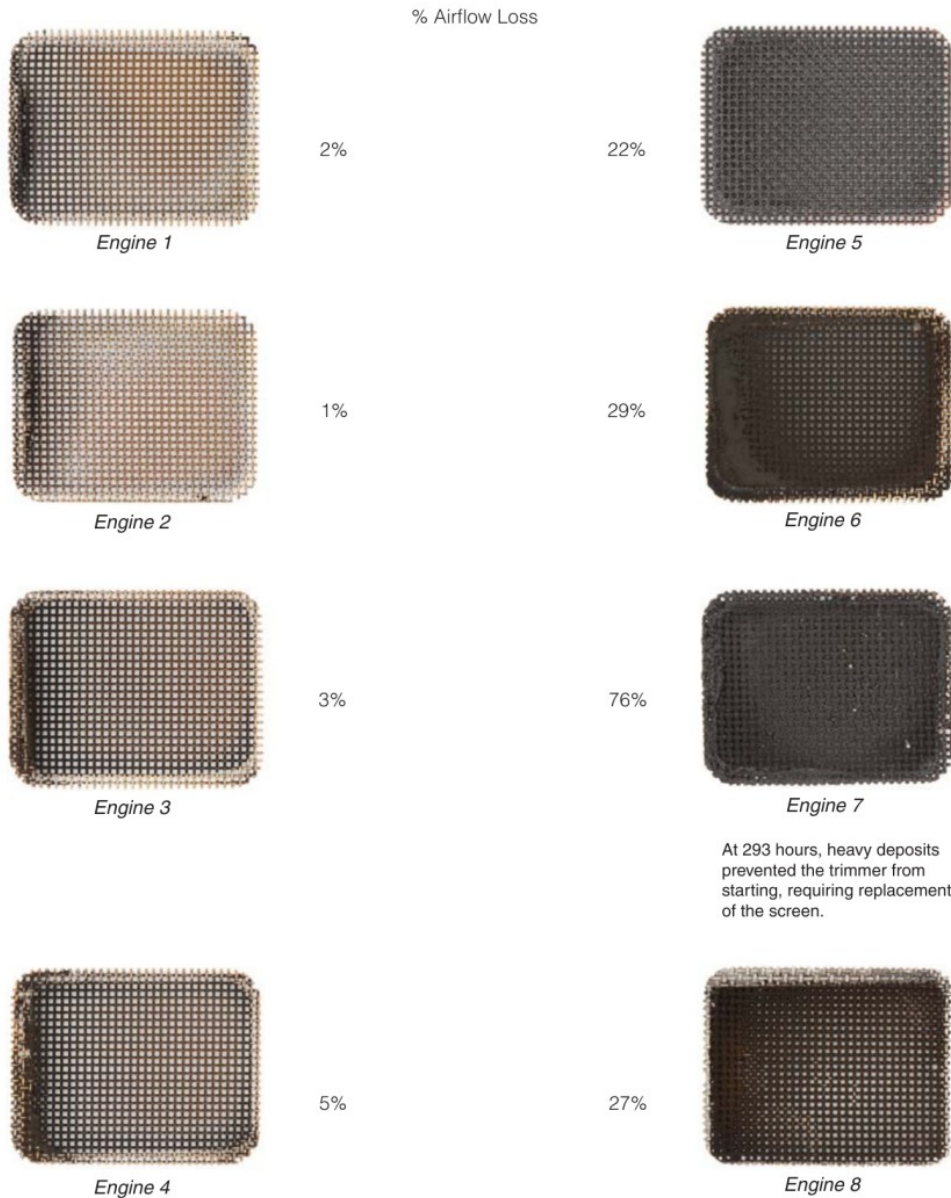
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Spark Arrestor Screens

Exhaust gases continually flow through the spark arrestor screen (located on the muffler), which is prone to plugging. Like the exhaust ports, excessive deposits on the spark arrestor screen restrict airflow and reduce power.

AMSOIL SABER® Professional @ 100:1

ECHO® Power Blend® @ 50:1



SABER Professional demonstrated low spark-arrestor-screen deposits. In contrast, screens on the trimmers lubricated with the ECHO product contained higher levels of deposits. The screen from engine 7 was nearly completely blocked with deposits after 293 hours of the 300-hour test and required replacement. On average, screens from engines using ECHO Power Blend suffered 14X more airflow loss than screens from engines using SABER Professional.

Note: Airflow loss was calculated using a flow bench to measure restriction, which was converted to a percentage of flow compared to an unblocked spark arrestor screen.

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Main Bearings

The main bearings receive little lubrication given their location in the lower end of the engine. Deposits are an indicator of poor oil detergency. Heavy deposits can restrict bearing rotation and eventually lead to failure.



The bearings lubricated with SABER Professional appear to contain fewer deposits.

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Crankcases

Oils with ineffective detergency properties can allow deposits to accumulate in the crankcase. During operation, deposits can circulate throughout the engine and reduce performance.

AMSOIL SABER® Professional @ 100:1

ECHO* Power Blend* @ 50:1



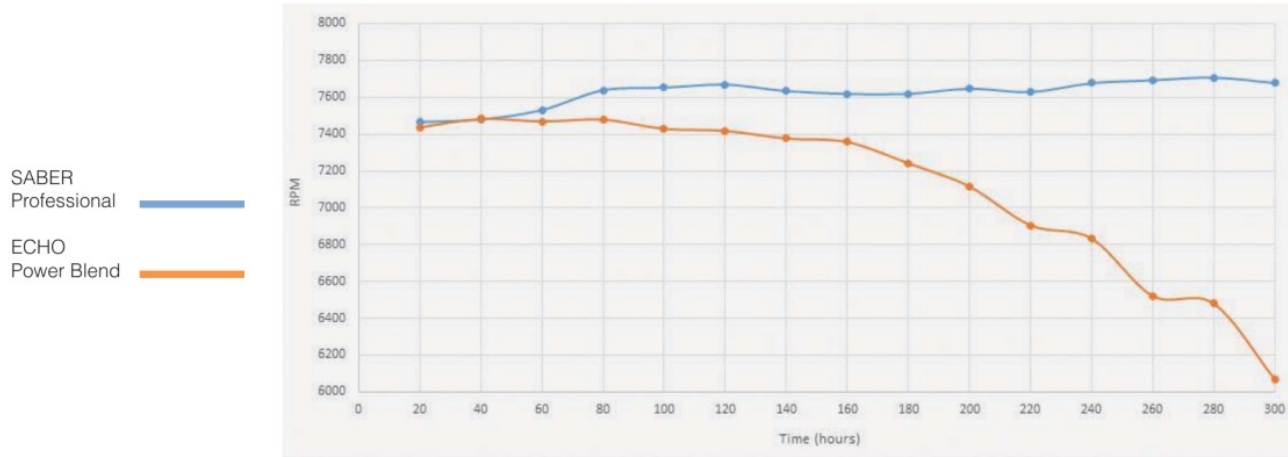
Crankcase deposits look heavier in the engines using ECHO Power Blend. The engines using SABER Professional appear clean and free of harmful deposits.

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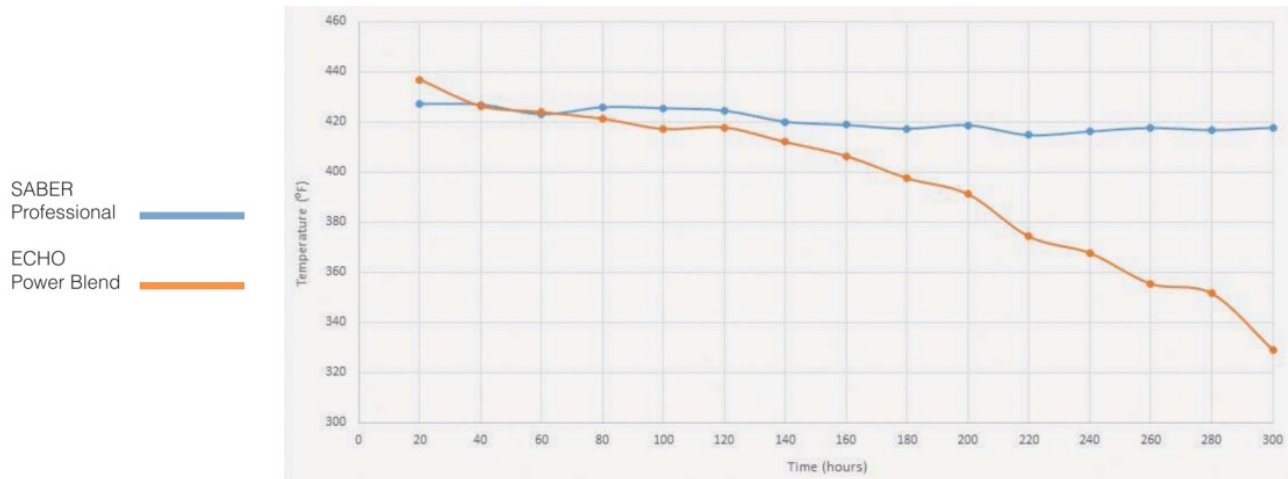
RPM & Spark-Plug Temperature

Reduced rpm and spark-plug temperatures are indicators the engine is producing sub-optimal power. This can be caused by heavy exhaust-port and spark-arrestor-screen deposits, which restrict airflow through the engine and result in reduced power. The following graphs depict the average rpm and spark-plug temperature of engines at wide-open throttle using SABER® Professional and ECHO* Power Blend*.

AVERAGE RPM @ WIDE-OPEN THROTTLE



AVERAGE SPARK-PLUG TEMPERATURE @ WIDE-OPEN THROTTLE



Engines using SABER Professional maintained consistent power throughout the study, while the average spark-plug temperature declined slightly. In contrast, the engines using ECHO Power Blend slowly lost power as the study progressed. Similarly, the average spark-plug temperature suffered a drop.

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Conclusion

As demonstrated in lab testing designed to simulate an extended length of service, AMSOIL SABER® Professional Synthetic 2-Stroke Oil mixed at 100:1 reduced oil costs 49 percent compared to ECHO Power Blend* XTended Life* Universal 2-Stroke Oil mixed at 50:1. SABER Professional also provided improved resistance to piston deposits, crankcase deposits and exhaust port blocking. Due to its ability to limit exhaust-port and spark-arrestor-screen deposits, SABER Professional protected against rpm loss 27 percent better, resulting in reliable operation. SABER Professional meets or exceeds the increased performance requirements of ECHO SRM 225 trimmers.

AMSOIL fully supports the use of SABER Professional as a replacement for ECHO Power Blend XTended Life Universal 2-Stroke Oil, and warrants its use according to the AMSOIL Limited Liability Warranty (G1363).

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