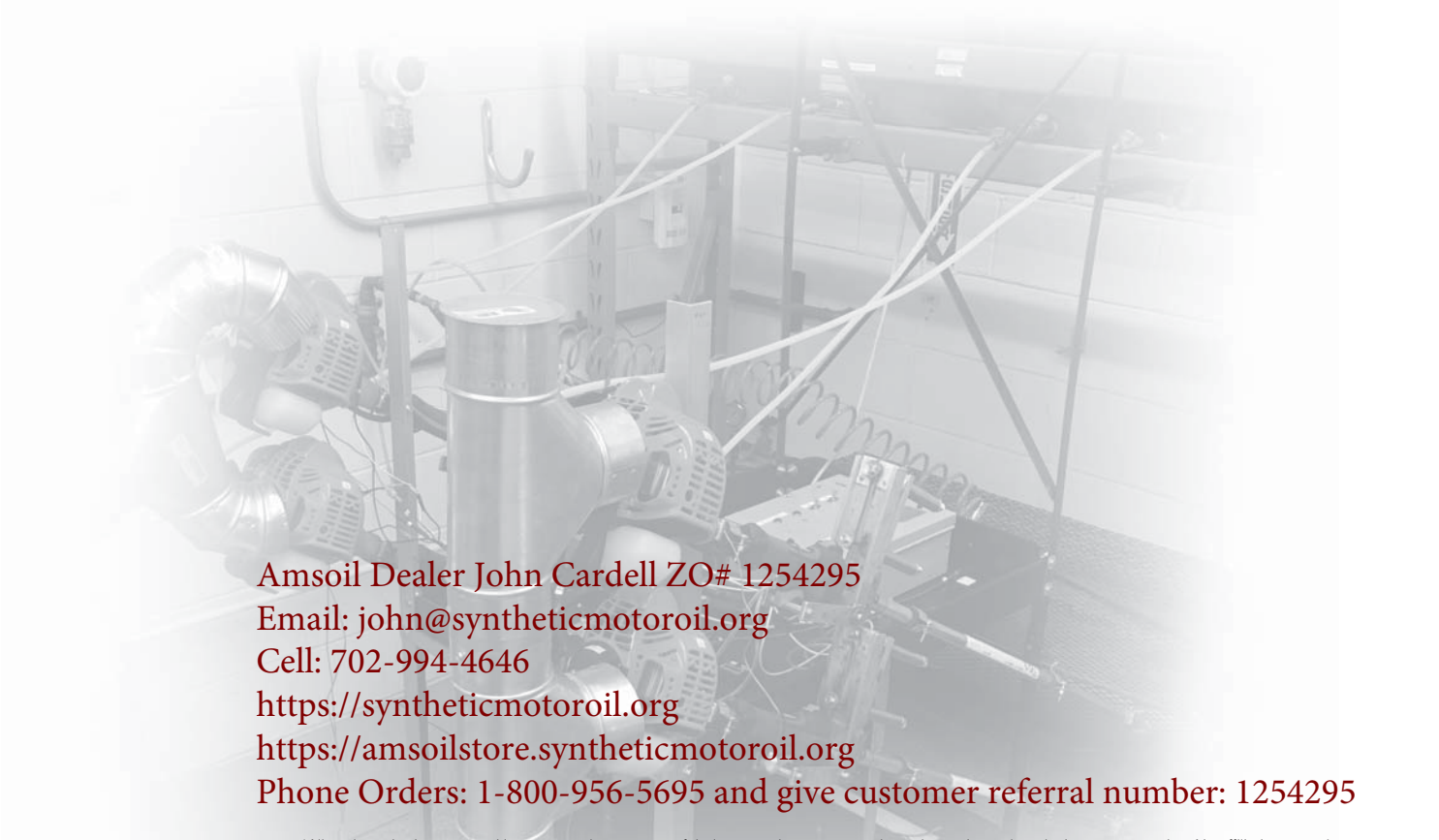




ECHO* String Trimmer Technical Study

AMSOIL SABER® Professional Synthetic 2-Stroke Oil resisted performance-robbing deposits and maintained power and performance in ECHO string trimmers.

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Amsoil Dealer John Cardell ZO# 1254295
Email: john@syntheticmotoroil.org
Cell: 702-994-4646
<https://syntheticmotoroil.org>
<https://amsoilstore.syntheticmotoroil.org>
Phone Orders: 1-800-956-5695 and give customer referral number: 1254295

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Overview

Government mandates require modern handheld trimmers and other two-stroke equipment to produce less exhaust emissions. To comply, some original equipment manufacturers (OEMs) design their equipment to run on leaner fuel/oil mixtures. Burning more air and less fuel/oil, however, also increases heat. To withstand this intense environment and ensure equipment lasts as designed, modern two-stroke oils must demonstrate improved wear protection and detergency.

Objective

Demonstrate through lab testing that the latest generation** of AMSOIL SABER® Professional Synthetic 2-Stroke Oil exceeds the increased performance needs of ECHO® string trimmers in particular, and modern two-stroke string trimmers in general.

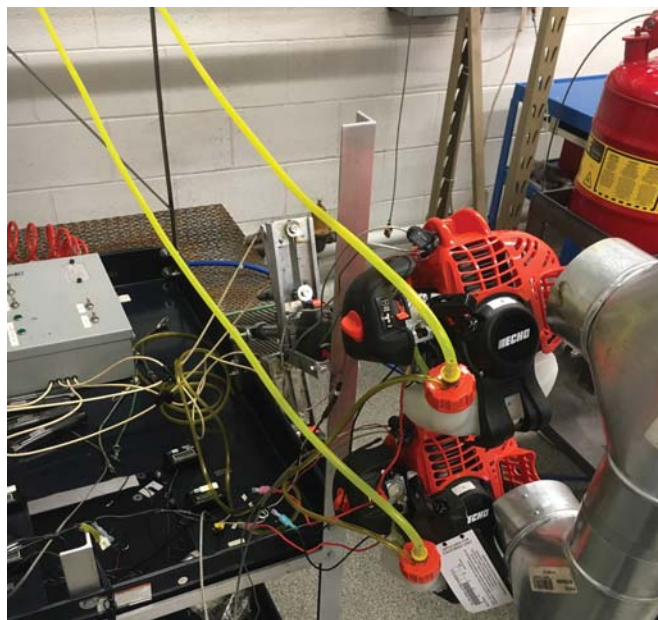
Methodology

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. The OEM's recommended 50:1 mix ratio was followed.

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	82318 032116	365151502 205215176 218815801 208315331
Date Oil was Acquired	March 2016	May 2016
Mix Ratio	50:1	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	

SABER Professional was installed in four trimmers and ECHO Power Blend was installed in another four. Computer-controlled actuators operated the trimmer throttle triggers according to an identical protocol for each unit. Images of trimmers arranged on the test stand are included for reference.



String trimmers arranged on test stand.

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**Indicated by batch code 82318 and higher.



String trimmers arranged on test stand.

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.

Note: Test results published in this Technical Study describe and represent properties of oils that were acquired on the dates listed in Table 1 on the facing page. 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 July 2016.

The differences in effects between AMSOIL SABER Professional and ECHO* Power Blend* are 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.

The test was run using two engines for each treatment. The study was then replicated using the same n=2 design. Exhaust- port blockage and spark-arrestor screen plugging were compared using a paired t-test. Equipment was run at factory-set conditions and there was no effort to intervene on any problems developed by the equipment outside of recommended maintenance in the owner's manual.

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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
Exhaust Side



Engine 1



Engine 2



Engine 3



Engine 4

ECHO* Power Blend*
Exhaust Side



Engine 5



Engine 6



Engine 7

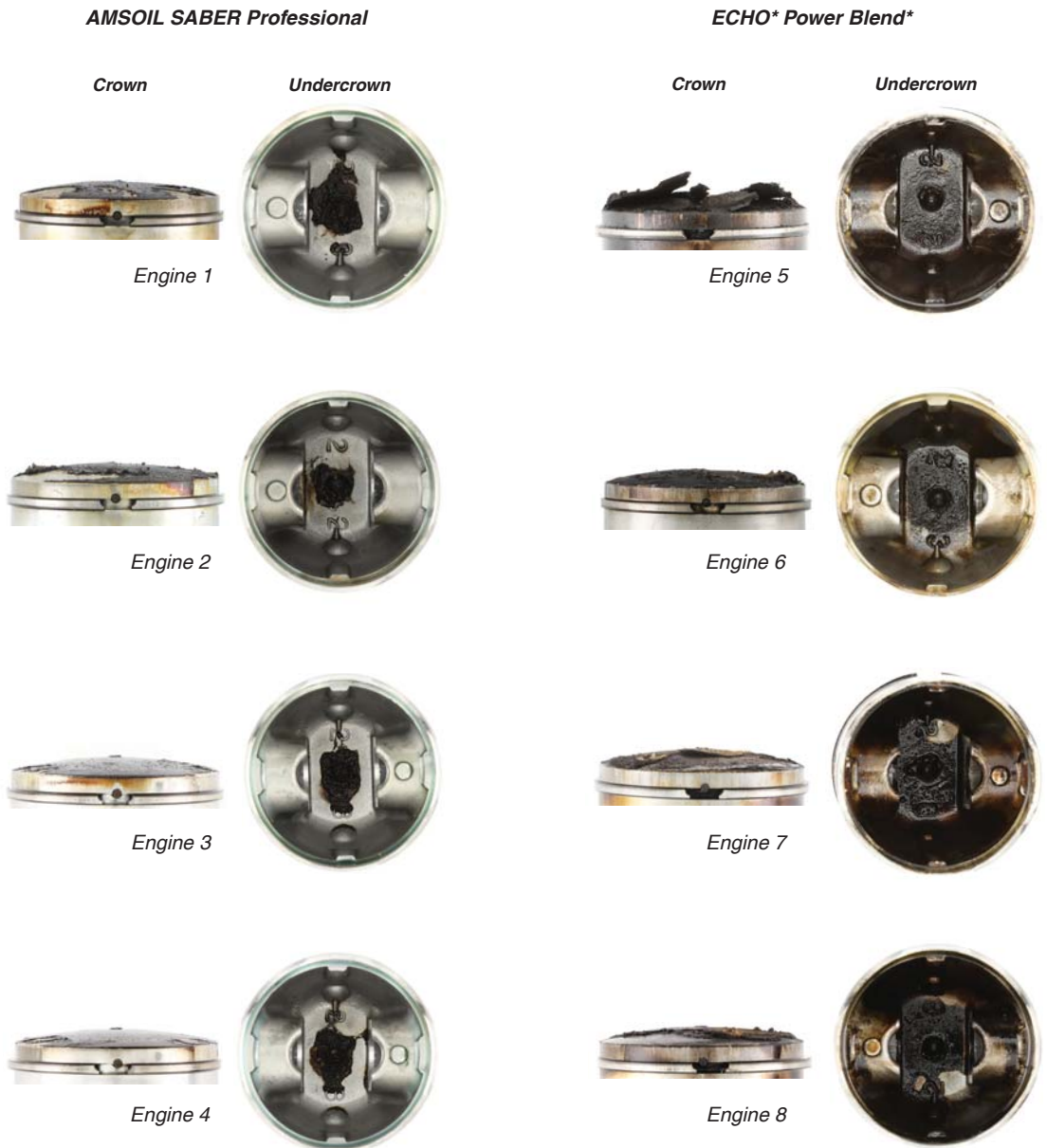


Engine 8

Deposits appear heavier on the pistons lubricated with ECHO Power Blend. The pistons lubricated with SABER Professional appear cleaner. SABER Professional provided improved detergency and extreme-heat resistance. Both oils guarded against piston ring sticking well.

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. SABER Professional provided improved detergency and extreme-heat resistance.

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

ECHO* Power Blend*



Engine 1



Engine 5



Engine 2



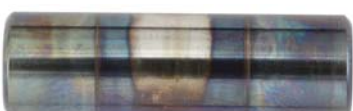
Engine 6



Engine 3



Engine 7



Engine 4



Engine 8

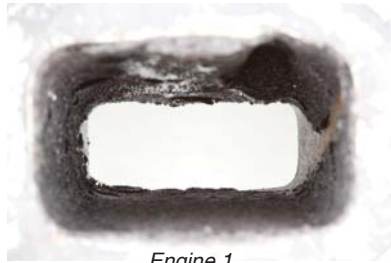
All eight wrist pin bearings demonstrated no issues throughout the test, indicating the oils provided good protection. None of the wrist pins contain flat spots. Both oils performed well in this area.

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Exhaust Ports

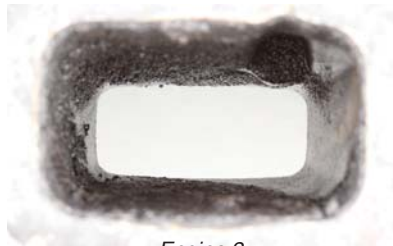
For the engine to run properly and produce maximum power, exhaust gases must flow freely out the exhaust port during operation. Restricted exhaust causes rpm and power loss, starting difficulties and, eventually, failure to operate.

AMSOIL SABER Professional



Engine 1

% Airflow Loss
1%



Engine 2

4%



Engine 3

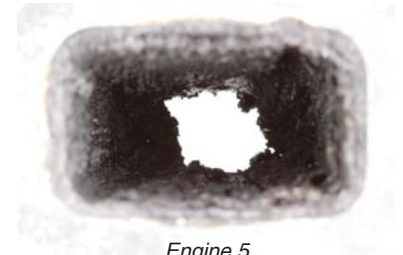
5%



Engine 4

5%

ECHO* Power Blend*



Engine 5

60%



Engine 6

29%



Engine 7

52%



Engine 8

26.5%

SABER Professional demonstrated low exhaust-port deposits. In contrast, all four exhaust ports on the engines using the ECHO product suffered blockage, with two more than half blocked with deposits.

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.

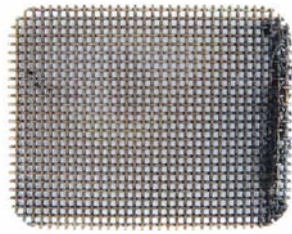
Spark Arrestor Screens

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

ECHO* Power Blend*

% Airflow Loss



Engine 1

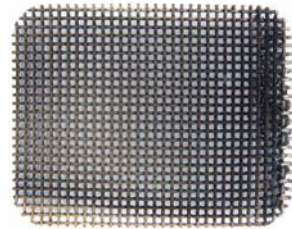
6.9%



Engine 5†

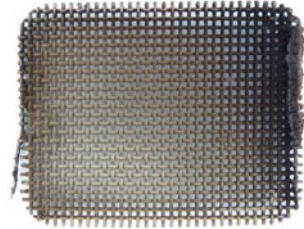
67%

†Engine #5 stopped running at 239 hours due to heavy spark arrestor screen deposits. The screen was replaced and the test continued to 300 hours.



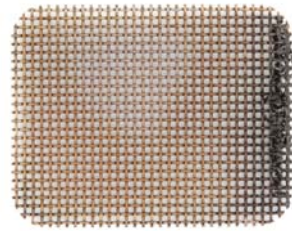
Engine 2

8%



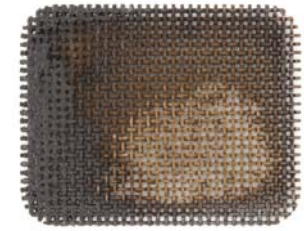
Engine 6

14.7%



Engine 3

6.8%



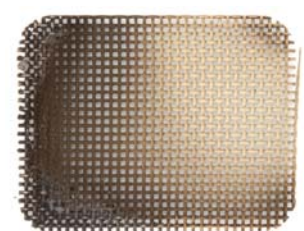
Engine 7

22%



Engine 4

7%



Engine 8

13%

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 5 was nearly completely blocked with deposits after 239 hours of the 300-hour test and required replacement. On average, screens from engines using ECHO Power Blend suffered 4X 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.

AMSOIL SABER Professional

ECHO* Power Blend*



Engine 1



Engine 5



Engine 2



Engine 6



Engine 3



Engine 7



Engine 4



Engine 8

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



Engine 1



Engine 2



Engine 3



Engine 4

ECHO Power Blend**



Engine 5



Engine 6



Engine 7



Engine 8

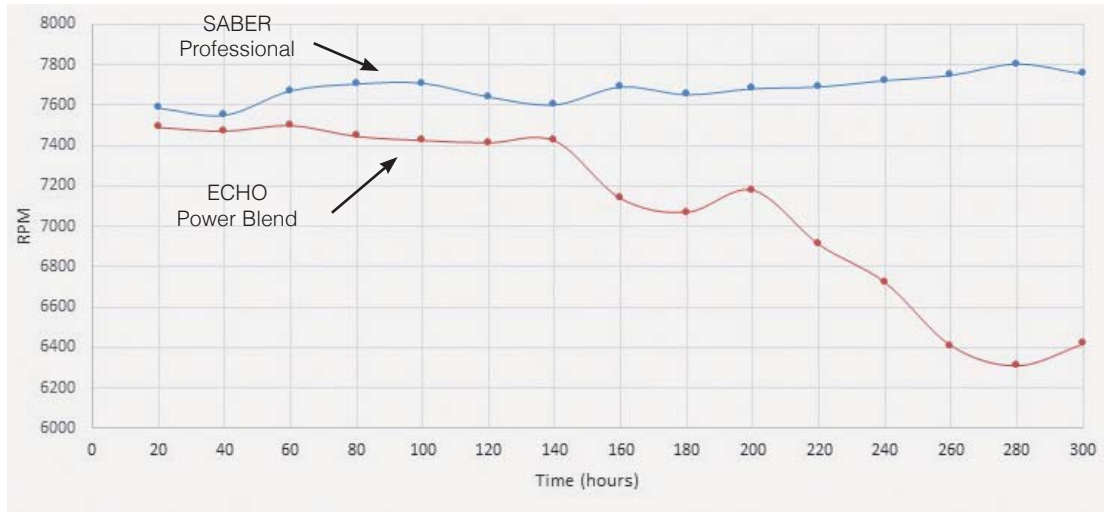
Crankcase deposits look heavier in the engines using ECHO Power Blend. The engines using SABER Professional appear clean and free of harmful deposits.

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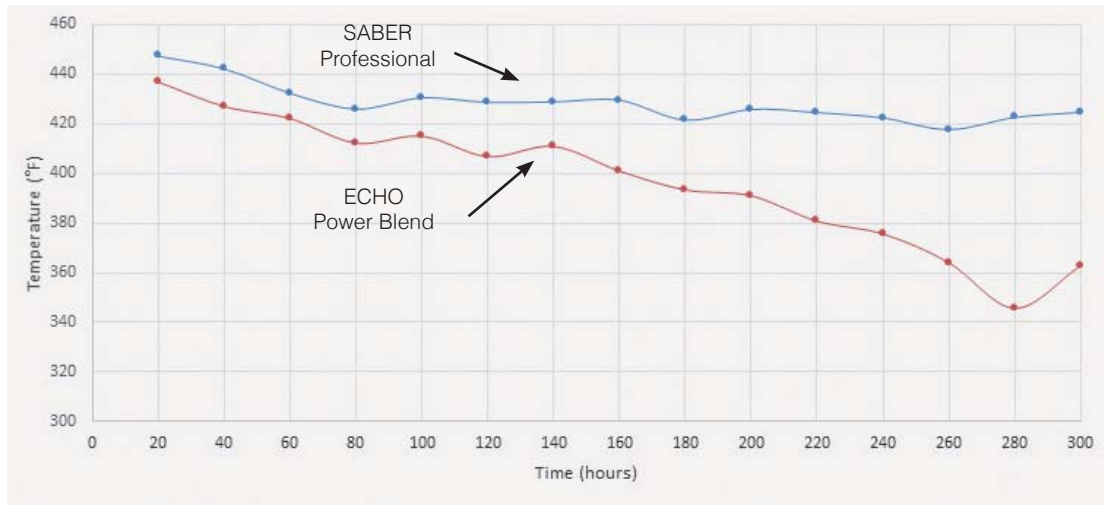
RPM & Spark-Plug Temperature

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.

Conclusion

As demonstrated in lab testing designed to simulate a full season of real-world use, AMSOIL SABER Professional Synthetic 2-Stroke Oil provides excellent protection for ECHO* brand string trimmers. SABER Professional outperformed ECHO Power Blend* XTended Life* Universal 2-Stroke Oil by providing 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 21 percent better, resulting in reliable operation. The latest generation of 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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