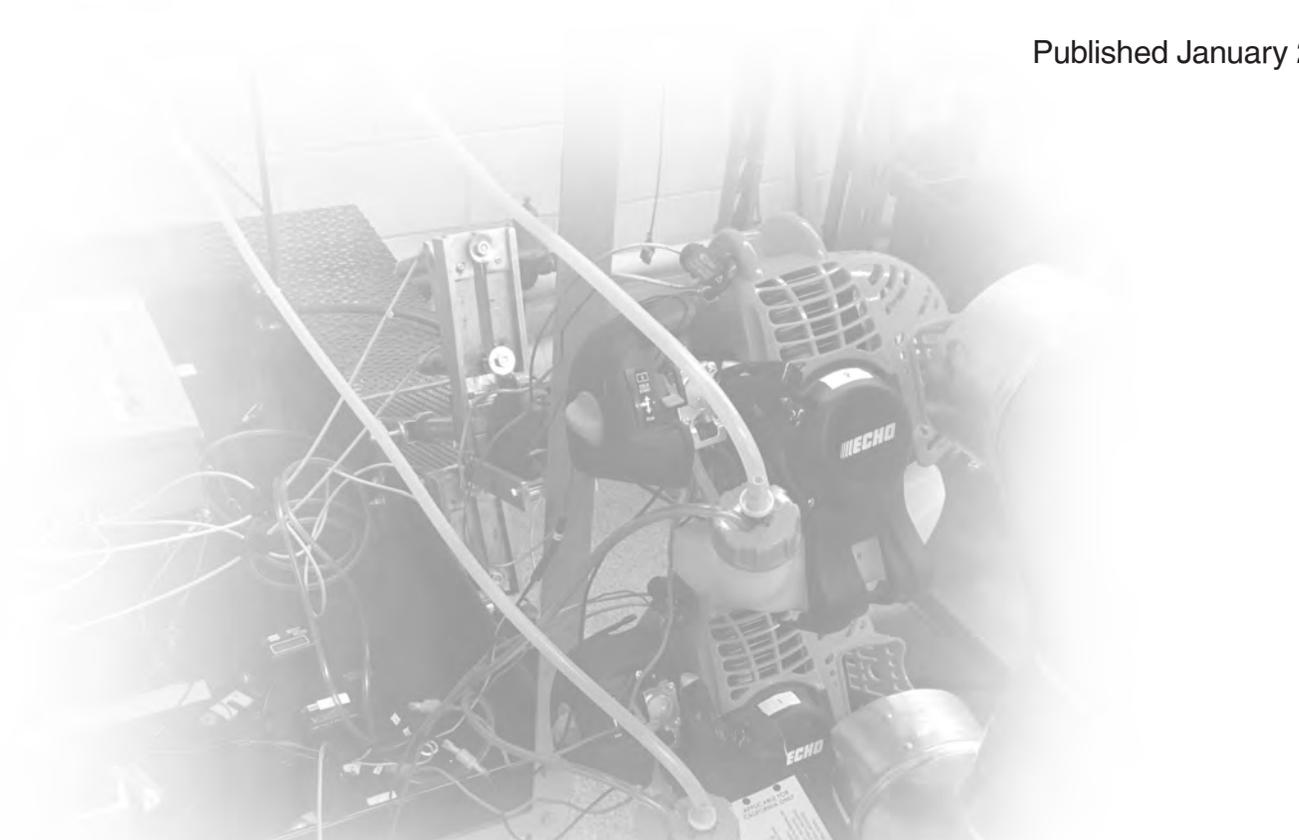




# A Study of LUCAS\* Semi-Synthetic 2-Cycle Oil in ECHO\* String Trimmers

AMSOIL SABER® Professional Synthetic 2-Stroke Oil mixed at 50:1 provided improved resistance to performance-robbing deposits and power loss compared to LUCAS Semi-Synthetic 2-Cycle Oil in ECHO string trimmers.

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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

Compare the performance of AMSOIL SABER® Professional Synthetic 2-Stroke Oil and LUCAS\* Semi-Synthetic 2-Cycle Oil in ECHO\* string trimmers in particular, and modern two-stroke string trimmers in general.

## Methodology

Testing was conducted 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	LUCAS Semi-Synthetic 2-Cycle Oil
Oil Batch Code	85749 072616	47321
Date Oil was Acquired	August 2016	August 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	

The test used four ECHO string trimmers, with SABER Professional used in two and LUCAS Semi-Synthetic 2-Cycle Oil used in the other two. 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.

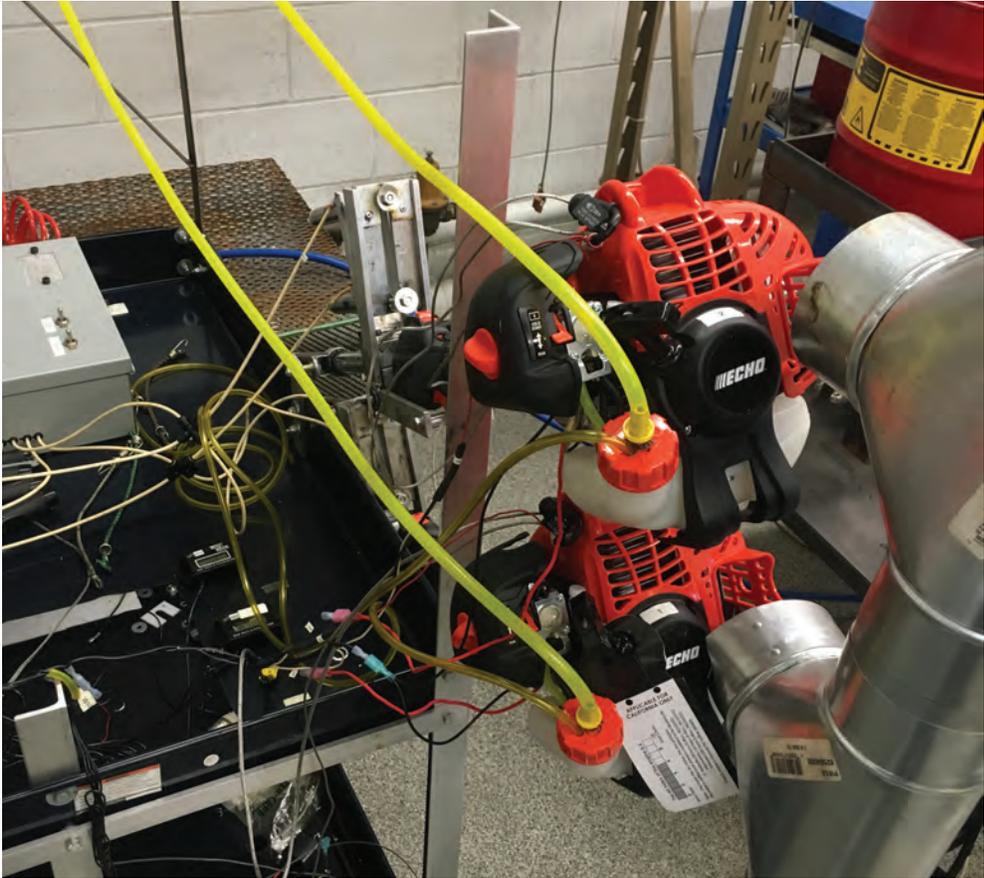
Exhaust-port blockage and spark-arrestor-screen plugging were compared using a paired t-test. Equipment was run at factory-set conditions and there was no effort to intervene on any problems developed by the equipment outside of recommended maintenance in the owner's manual.

The differences in effects between AMSOIL SABER Professional and LUCAS Semi-Synthetic 2-Cycle Oil 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.

**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 October 2016.

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**String Trimmers Arranged on Test Stand**



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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*

**LUCAS® Semi-Synthetic 2-Cycle Oil**  
Exhaust Side



*Engine 5*



*Engine 6*



*Engine 7*



*Engine 8*

Deposits appear heavier on the pistons lubricated with LUCAS Semi-Synthetic 2-Cycle Oil. The pistons lubricated with SABER Professional 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 LUCAS Semi-Synthetic 2-Cycle Oil appear to contain heavier crown and undercrown deposits than pistons lubricated with SABER Professional. AMSOIL 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**



*Engine 1*



*Engine 2*



*Engine 3*



*Engine 4*

### **LUCAS\* Semi-Synthetic 2-Cycle Oil**



*Engine 5*



*Engine 6*



*Engine 7*



*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.

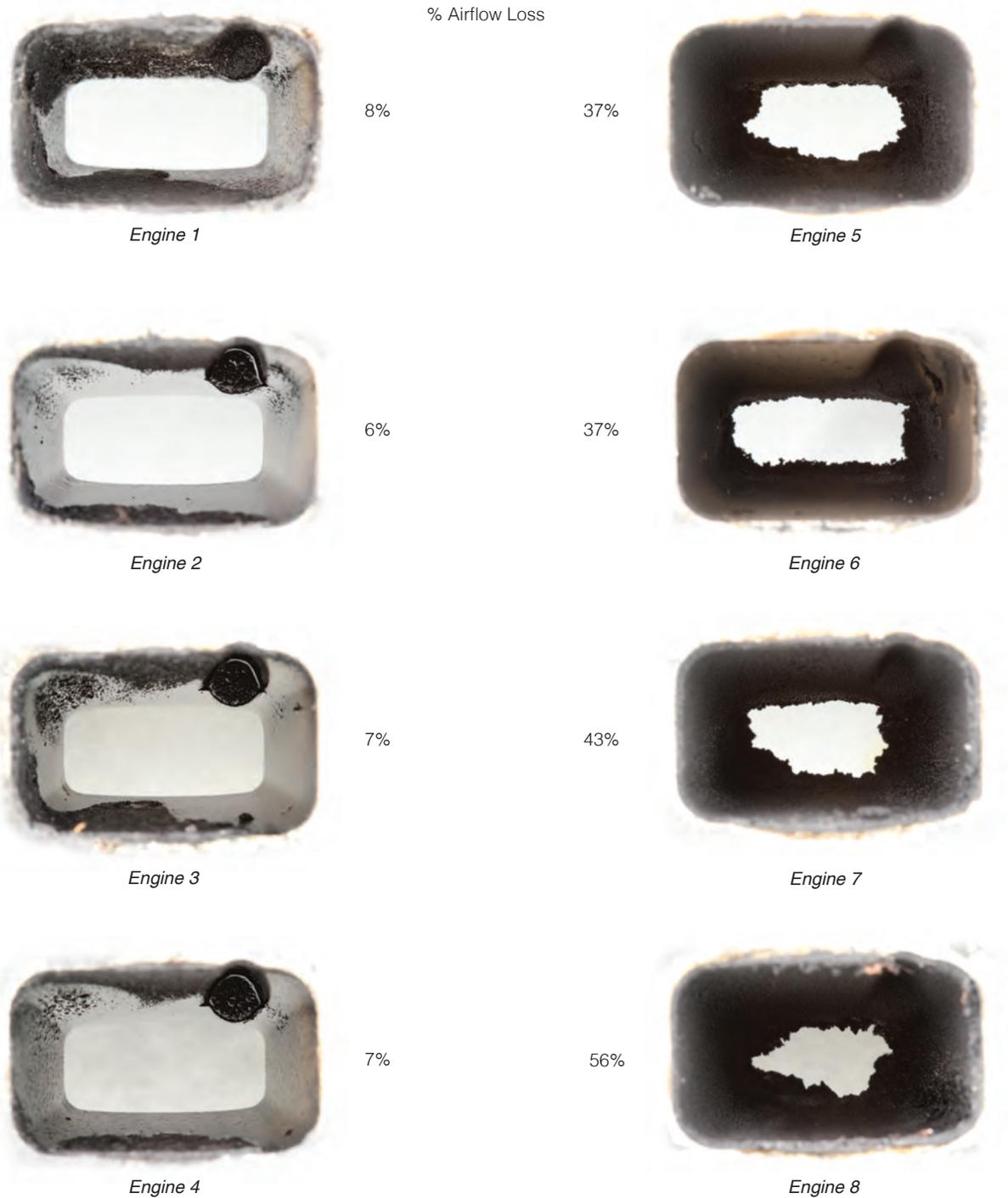
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## Exhaust Ports

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

### LUCAS® Semi-Synthetic 2-Cycle Oil



SABER Professional demonstrated low exhaust-port deposits. In contrast, all four exhaust ports on the engines using the LUCAS product suffered at least 37 percent airflow loss due to heavy 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

### LUCAS\* Semi-Synthetic 2-Cycle Oil

% Airflow Loss



9%

Engine 1



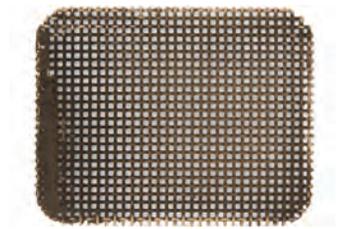
11%

Engine 5



8%

Engine 2



12%

Engine 6



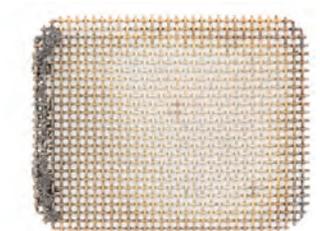
6%

Engine 3



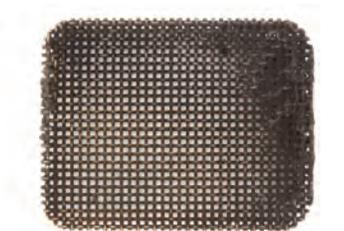
13%

Engine 7



6%

Engine 4



17%

Engine 8

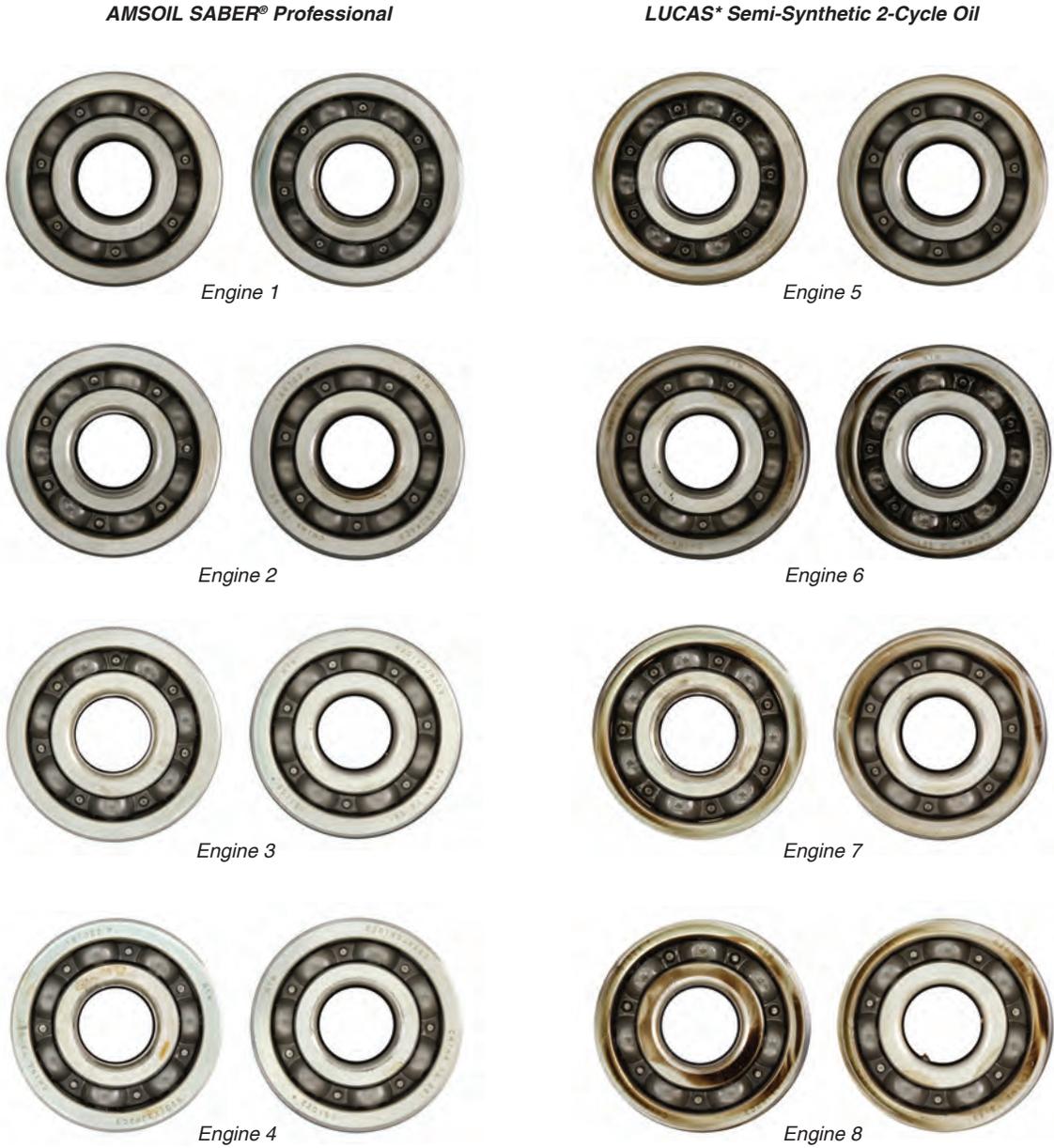
Screens from engines lubricated with the LUCAS product blocked an average of 7.8 percent more airflow than SABER Professional.

**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 engines using SABER Professional look clean and free of harmful 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.

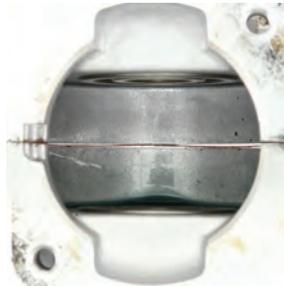
### *AMSOIL SABER® Professional*



*Engine 1*



*Engine 2*



*Engine 3*



*Engine 4*

### *LUCAS\* Semi-Synthetic 2-Cycle Oil*



*Engine 5*



*Engine 6*



*Engine 7*



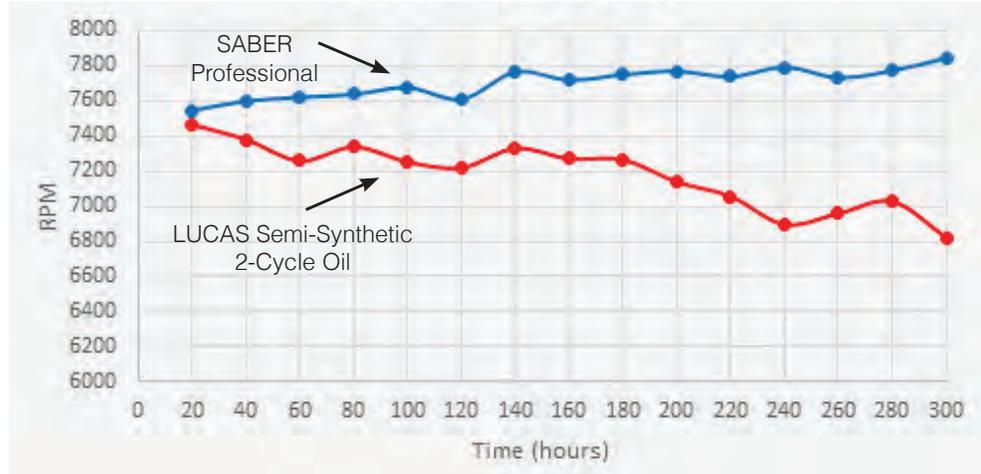
*Engine 8*

The engines using SABER Professional look clean and free of harmful deposits.

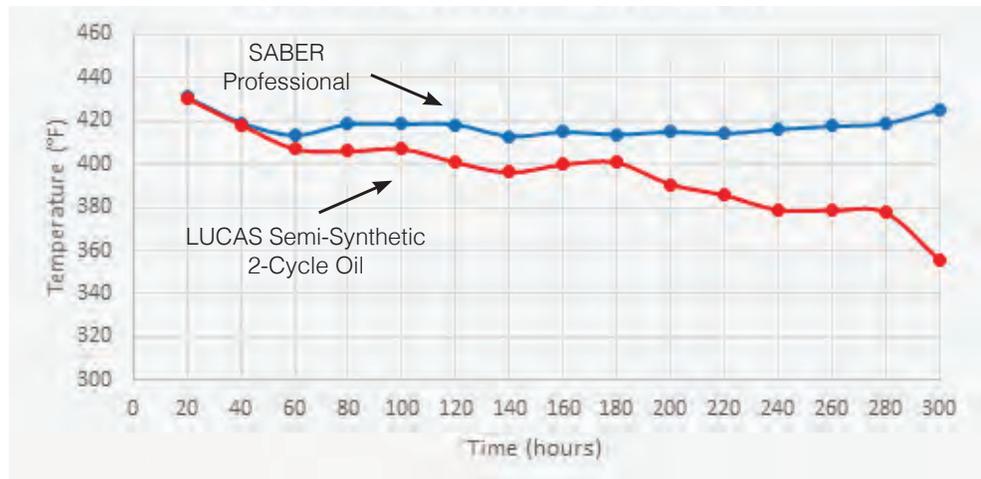
## RPM & Spark-Plug Temperature

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 the eight engines at wide-open throttle using SABER® Professional and LUCAS® Semi-Synthetic 2-Cycle Oil.

**AVERAGE RPM @ WIDE-OPEN THROTTLE**



**AVERAGE SPARK-PLUG TEMPERATURE @ WIDE-OPEN THROTTLE**



Engines using SABER Professional maintained consistent power and spark-plug temperature throughout the study. In contrast, the engines using LUCAS Semi-Synthetic 2-Cycle Oil slowly lost power as the study progressed. Similarly, the average spark-plug temperature dropped.

## 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 LUCAS\* Semi-Synthetic 2-Cycle Oil by providing improved resistance to piston deposits and exhaust port blocking. Due to its ability to limit exhaust-port and spark-arrestor-screen deposits, SABER Professional protected against rpm loss 13 percent better, resulting in reliable operation.

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