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TECHNICAL STUDY

# RedMax* 100:1 String Trimmer Technical Study

AMSOIL SABER® Professional Synthetic 2-Stroke Oil mixed at 100:1 resisted deposits better than RedMax* 2-Stroke Engine Oil mixed at 50:1.

Published June 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 RedMax* string trimmers in particular, and modern two-stroke string trimmers in general.

## Methodology

Testing was conducted on eight RedMax 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** | RedMax BCZ260TS | |
|---|---|---|
| **Oils Tested** | AMSOIL SABER Professional Synthetic 2-Stroke Oil | RedMax 2-Stroke Engine Oil |
| **Oil Batch Codes** | 85749 072616 | 16716084 |
| **Date Oil was Acquired** | November 2016 | January 2017 |
| **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 RedMax string trimmers, with two running SABER Professional and two running RedMax 2-Stroke Engine Oil. 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 March 2017.



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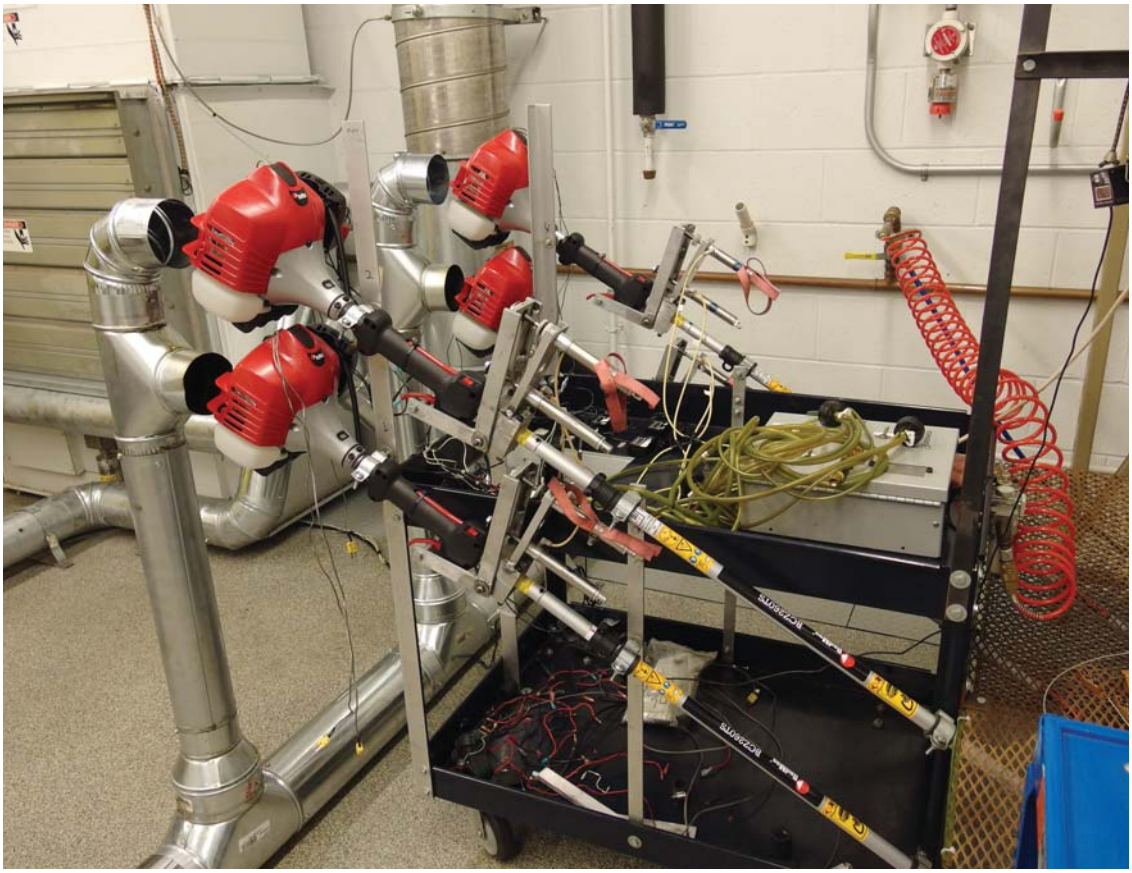
## String Trimmers Arranged on Test Stand



## 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 | RedMax* 2-Stroke Engine Oil |
|---|---|---|
| Number of trimmers | 4 | 4 |
| Total oil used | 145.66 ounces | 294.26 ounces |
| Oil cost | $0.29 per ounce | $0.40 per ounce |
| Mix ratio | 100:1 | 50:1 |
| **Total oil cost** | **$42.24** | **$117.70** |

SABER Professional reduced oil costs by $75.46, a savings of 64 percent.

**Note**: Cost of SABER Professional is based on the gallon price available to AMSOIL Dealers, Preferred Customers and commercial businesses effective at the time of printing. Cost of RedMax 2-Stroke Engine Oil 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***



*Engine 1*



*Engine 2*



*Engine 3*



*Engine 4*

***RedMax* 2-Stroke Engine Oil @ 50:1***
***Exhaust Side***



*Engine 5*



*Engine 6*



*Engine 7*



*Engine 8*

Deposits appear heavier on the pistons lubricated with RedMax 2-Stroke Engine Oil mixed at 50:1. 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.

| ***AMSOIL SABER® Professional @ 100:1*** | | ***RedMax* 2-Stroke Engine Oil @ 50:1*** | |
|---|---|---|---|
| ***Crown*** | ***Undercrown*** | ***Crown*** | ***Undercrown*** |
|  *Engine 1* |  |  *Engine 5* |  |
|  *Engine 2* |  |  *Engine 6* |  |
|  *Engine 3* |  |  *Engine 7* |  |
|  *Engine 4* |  |  *Engine 8* |  |

Pistons lubricated with RedMax 2-Stroke Engine Oil appear to contain heavier crown deposits. In contrast, the piston crowns lubricated with SABER Professional look cleaner, with low levels of deposits. At 100:1, SABER Professional provided improved detergency and extreme-heat resistance.

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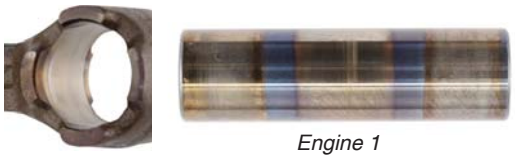
## Wrist Pins & Bearings

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.

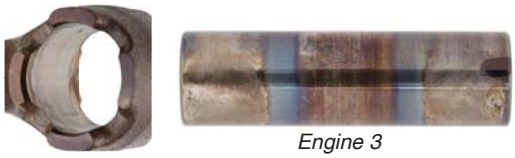
***AMSOIL SABER® Professional @ 100:1***



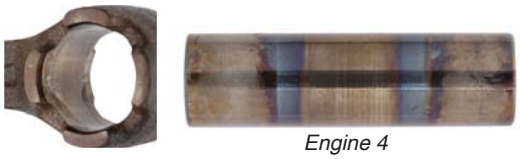
*Engine 1*



*Engine 2*



*Engine 3*

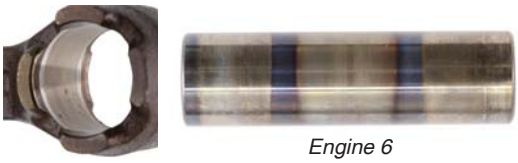


*Engine 4*

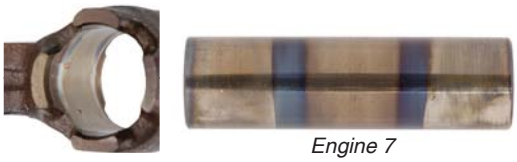
***RedMax* 2-Stroke Engine Oil @ 50:1***



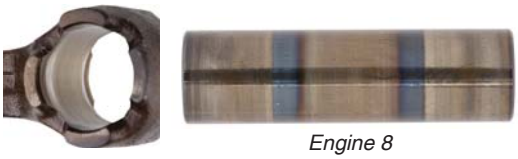
*Engine 5*



*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 @ 100:1*** | % Airflow Loss | ***RedMax* 2-Stroke Engine Oil @ 50:1*** |
|---|---|---|
|  *Engine 1* | 8% | 28%  *Engine 5* |
|  *Engine 2* | 11% | 19%  *Engine 6* |
|  *Engine 3* | 10% | 26%  *Engine 7* |
|  *Engine 4* | 5% | 16%  *Engine 8* |

SABER Professional mixed at 100:1 demonstrated low exhaust-port deposits. The exhaust ports from engines using RedMax 2-Stroke Engine Oil contain higher levels of deposits in comparison, resulting in an average of 2.6X more airflow loss.

**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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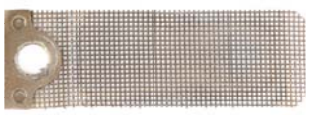
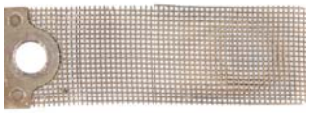
## Spark Arrestor Screens

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*** | % Airflow Loss | ***RedMax* 2-Stroke Engine Oil @ 50:1*** |
|---|---|---|
|  *Engine 1* | 1.4% | 6.0%  *Engine 5* |
|  *Engine 2* | 1.4% | 7.4%  *Engine 6* |
|  *Engine 3* | 0.8% | 6.2%  *Engine 7* |
|  *Engine 4* | 1.8% | 6.4%  *Engine 8* |

SABER Professional demonstrated low spark-arrestor-screen deposits. The screens from engines using RedMax 2-Stroke Engine Oil contain higher levels of deposits in comparison, resulting in an average of 4.8X more airflow loss.

**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 @ 100:1***



*Engine 1*



*Engine 2*



*Engine 3*

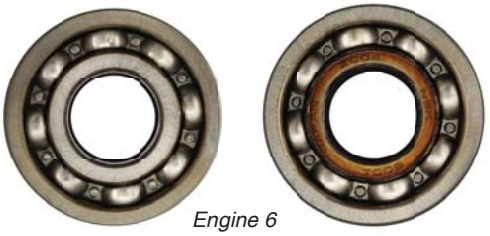


*Engine 4*

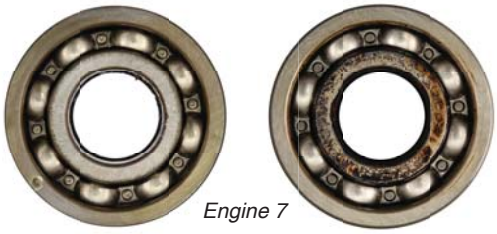
***RedMax* 2-Stroke Engine Oil @ 50:1***



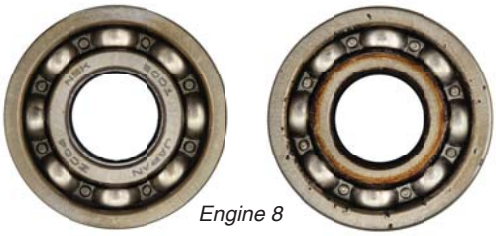
*Engine 5*



*Engine 6*



*Engine 7*



*Engine 8*

Both oils protected against bearing deposits well.

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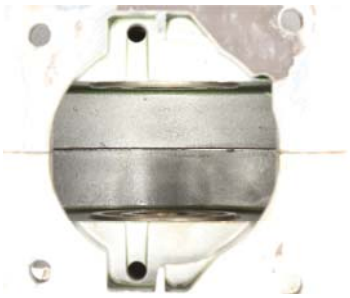
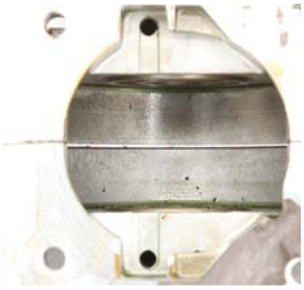
## Crankcases

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*** | ***RedMax* 2-Stroke Engine Oil @ 50:1*** |
|---|---|
|  |  |
| *Engine 1* | *Engine 5* |
|  |  |
| *Engine 2* | *Engine 6* |
|  |  |
| *Engine 3* | *Engine 7* |
|  |  |
| *Engine 4* | *Engine 8* |

Both oils resisted crankcase deposits well.



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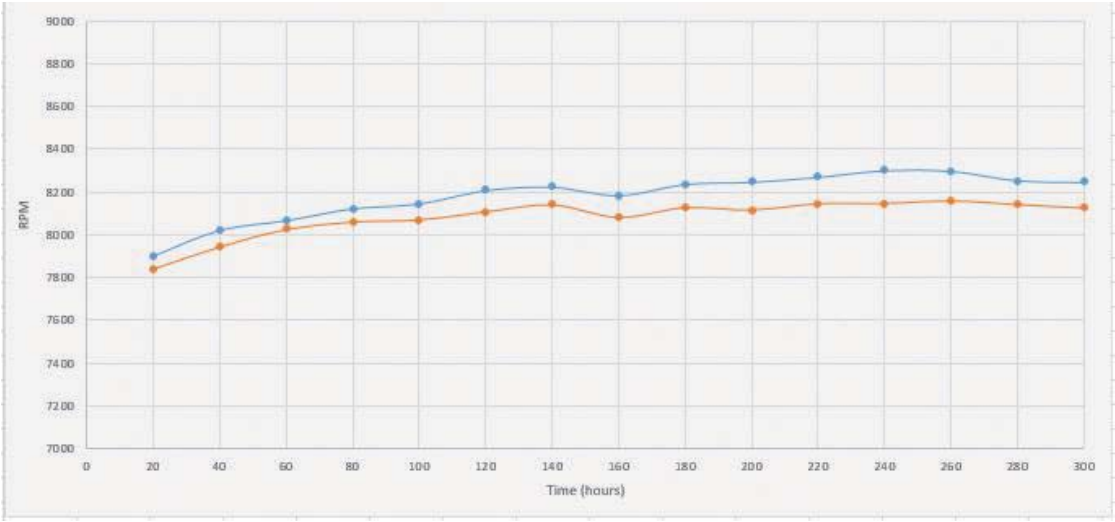
## RPM & Spark-Plug Temperature

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 RedMax* 2-Stroke Engine Oil.

**AVERAGE RPM @ WIDE-OPEN THROTTLE**

SABER Professional

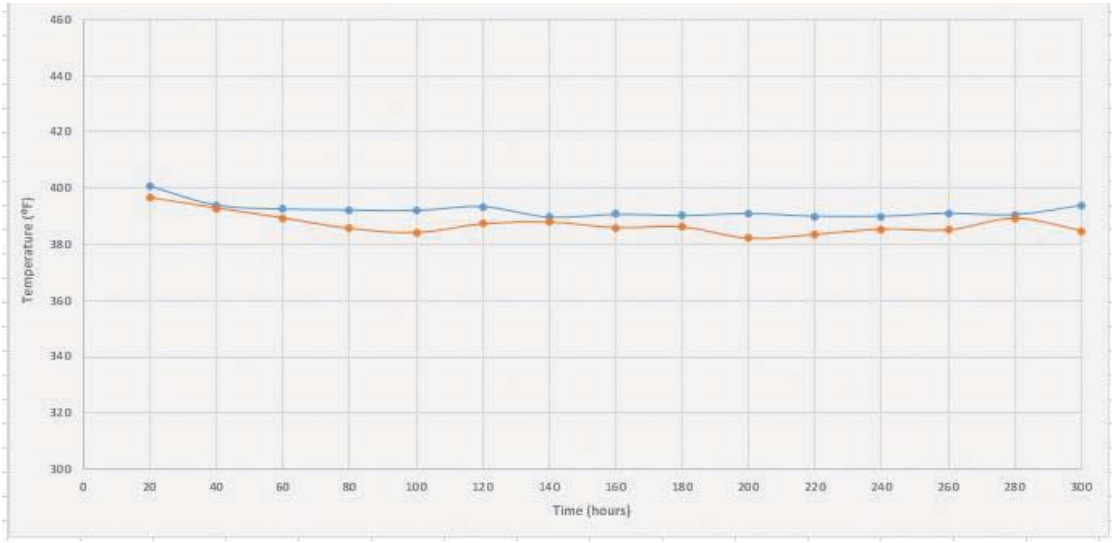
RedMax 2-Stroke Oil




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

SABER Professional

RedMax 2-Stroke Oil




All eight engines maintained consistent rpm and spark-plug temperature throughout the 300-hour test.

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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 64 percent compared to RedMax* 2-Stroke Engine Oil mixed at 50:1. SABER Professional also provided improved resistance to piston deposits and exhaust port deposits, resulting in reliable operation. SABER Professional meets or exceeds the increased performance requirements of RedMax BCZ260TS trimmers.

**AMSOIL fully supports the use of SABER Professional as a replacement for RedMax 2-Stroke Engine Oil, and warrants its use according to the AMSOIL Limited Liability Warranty (G1363).**

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**Referral #**_____

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