# A Look Inside the AMSOIL Motorcycle Oil Study:

# Four-Ball Wear Test

Motorcycles are very popular vehicles that inspire tremendous brand loyalty. Many motorcyclists invest a great deal of time and energy into their machines and spare no expense when it comes to the protection and performance of their investments. With nearly five million registered motorcycles in the United States and sales topping 750,000 units annually, the potential market for AMSOIL Dealers is almost limitless.

The new AMSOIL Motorcycle Oil Study (G-2156) is an excellent sales tool for Dealers seeking to either break into the motorcycle market or increase their sales. The study compares the test results of 26 different motorcycle oils in the most critical areas of motorcycle oil performance, including wear protection, shear stability and rust protection, helping consumers make educated decisions regarding which oil to use in their motorcycles.

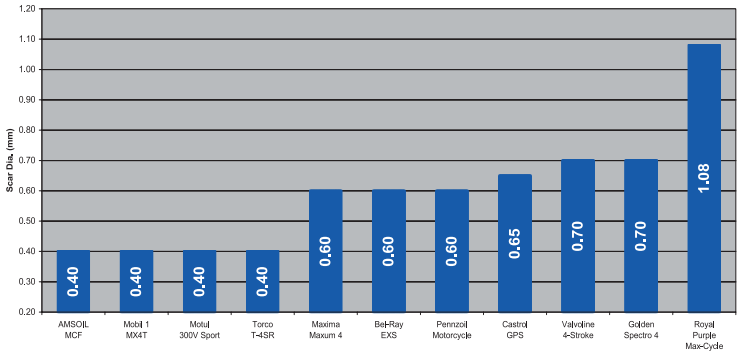
One of the most important functions of any motor oil is wear protection. Because motorcycle engines operate under more severe operating conditions than automobiles, the ability of a motorcycle oil to deliver adequate wear protection is especially important.

The ASTM D-4172 Four-Ball Wear Test is the standard test used to determine a lubricant's ability to minimize wear in metal-to-metal contact situations. Three steel balls are secured and placed in a triangular pattern within a bath of the test lubricant. With load, speed and temperature kept constant, a fourth ball sits atop the other balls and is rotated and forced into them for one hour. Following the test, the lower three balls are inspected for wear scars at the point of contact. The diameters of the wear scars are measured and the results are reported as an average of the three scars. The lower the average wear scar diameter, the better the wear protection properties of the oil.

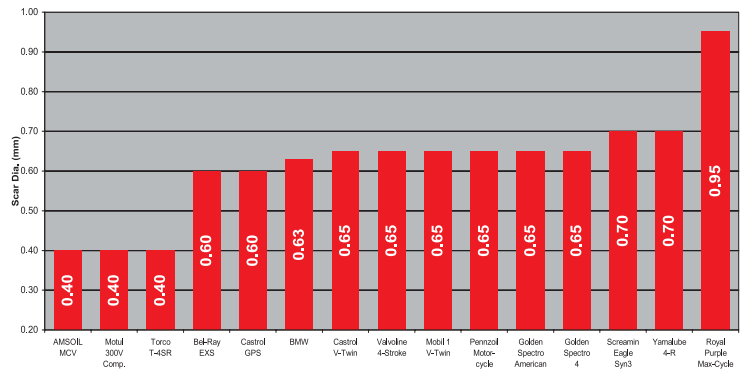
For the Four-Ball Wear Test portion of the AMSOIL Motorcycle Oil Study, the loads, speeds and temperatures were maintained at 40 kg, 1800 RPM and 150 degrees C respectively for each oil tested. Two separate tests were performed for SAE 40 and SAE 50 oils.

As seen in the graphs, both AMSOIL 10W-40 Synthetic Motorcycle Oil (MCF) and 20W-50 Synthetic Motorcycle Oil (MCV) exhibited minimal wear scars of 0.40 mm, placing them at the top of their respective test groups. Competing motorcycle oils showed wear scars up to twice as large. The wear protection provided by AMSOIL Synthetic Motorcycle Oils is second-to-none, allowing motorcycles to perform better, last longer and require less maintenance.

**Results, 4-Ball Wear Test, SAE 40 Group**




**Results, 4-Ball Wear Test, SAE 50 Group**




Although zinc has long been considered an excellent anti-wear additive, it is interesting to note that the oils with the highest levels of zinc, Maxima Maxum 4 in the SAE 40 group and Golden Spectro 4 in the SAE 50 group, did not test in the top of their groups. These results indicate that simply formulating an oil with a high zinc level is not sufficient in minimizing wear.

A coupon offer for one free Motorcycle Oil Study is included in each case of AMSOIL 10W-40 (MCF) and 20W-50 (MCV) Motorcycle Oil. It is also available for purchase.

| Stock # | U.S. | Can. |
|---|---|---|
| G-2156 | 2.00 | 2.60 |

# A Look Inside the AMSOIL Motorcycle Oil Study:

# Rust Protection

**Motorcycle Oil Study**

| Stock # | U.S. | Can. |
|---|---|---|
| G-2156 | 2.00 | 2.60 |

By comparing the test results of 26 different motorcycle oils in the most critical areas of motorcycle oil performance, the AMSOIL Motorcycle Oil Study (G-2156) is an excellent sales tool for Dealers seeking to either break into the motorcycle market or increase their sales. The March issue of the *Action News* took a closer look at the specifics of the Four-Ball Wear Test and how each of the oils fared. This issue examines rust protection.

Rust protection is particularly important in motorcycle applications. Often used seasonally, then stored and unused during the offseason, condensation and moisture within the engine promote rust formation. In addition, the combustion process and short trip driving create condensation and acids that further promote corrosion and rust.

Rust is as abrasive as dirt, causing problems such as scratching and pitting on cylinders, pistons and bearing surfaces, leading to blow-by, lower compression and reduced power and performance. When rust forms on needle bearings, bearing failure results. Rust also causes excessive wear on bearings, camshafts, lifters and gear surfaces.

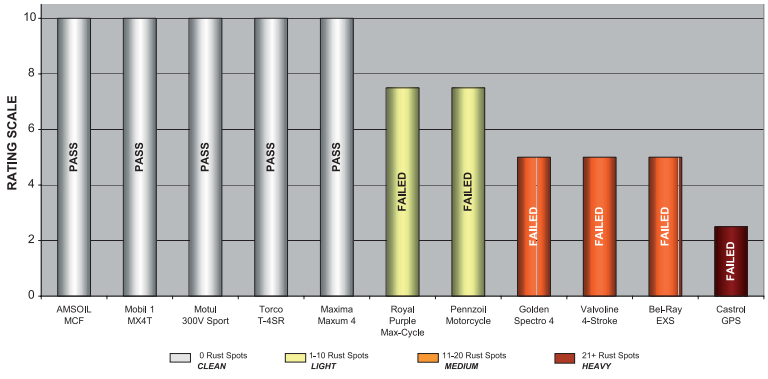
Motor oil has little or no natural ability to prevent rust. It must be formulated with special rust inhibitors. However, because rust inhibitors typically sacrifice wear protection by competing with antiwear additives for the metal surface, many motorcycle oils are formulated without rust inhibitors. AMSOIL Synthetic Motorcycle Oils are formulated with breakthrough technology that provides outstanding protection against rust without sacrificing wear protection (see Four-Ball Wear Test article in the March *Action News*).

The ASTM D-1748 humidity cabinet test measures a lubricant's ability to protect against rust and corrosion. A standard metal reference coupon is immersed in the test oil before being placed in a humidity cabinet for 24 hours at 120 degrees F. Following the test period, the coupons are removed and inspected for rust. In order to pass the test, an oil may allow no more than three rust spots less than or equal to 1 mm in diameter. Oils allowing more than three rust spots, or one rust spot larger than 1 mm in diameter, fail the test.

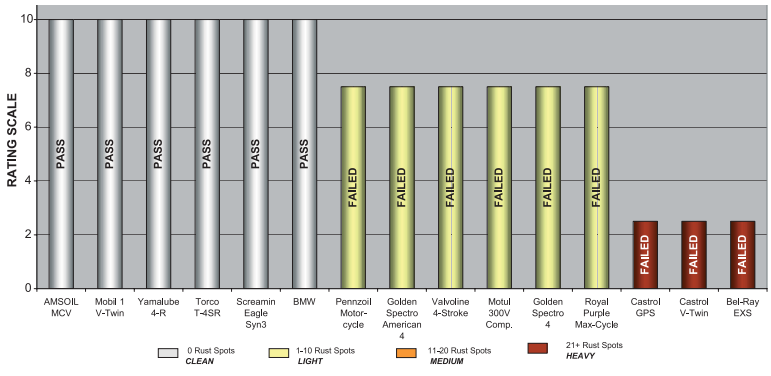
Two separate tests were performed for SAE 40 and SAE 50 oils. As seen in the graphs, failing oils were divided into three categories: oils showing 1-10 spots, oils showing 11-20 spots and oils showing over 20 spots.

As seen in the photos and graphs, both AMSOIL 10W-40 Synthetic Motorcycle Oil (MCF) and 20W-50 Synthetic Motorcycle Oil (MCV) showed no rust spots, placing them at the top of their respective test groups. Many competing motorcycle oils failed the test. AMSOIL Synthetic Motorcycle Oils provide unsurpassed rust protection, allowing motorcycles to perform better, last longer and require less maintenance. Order the G-2156 Motorcycle Oil Study to see all the results

## Results, Rust Protection, SAE 40 GROUP




## Results, Rust Protection, SAE 50 GROUP



# A Look Inside the AMSOIL Motorcycle Oil Study:

# GEAR PERFORMANCE

UPDATED

**Motorcycle Oil Study**

| Stock # | U.S. | Can. |
|---|---|---|
| G-2156 | 2.00 | 2.60 |

The AMSOIL Motorcycle Oil Study (G-2156) compares the test results of 28 different motorcycle oils in the most critical areas of motorcycle oil performance, making it an excellent sales tool for Dealers seeking to either break into the motorcycle market or increase their sales. The March issue of the *Action News* took a closer look at the specifics of the Four-Ball Wear Test, while the April issue covered rust protection. This issue examines gear wear testing.

Many motorcycle engines share a common lubricant sump with the transmission, requiring the same oil to lubricate both assemblies. Because engines and transmissions place different demands on lubricants, an oil that provides good engine protection may fail to provide adequate transmission protection. High sliding pressures, shock loading and shearing forces applied by motorcycle transmission gears place a great deal of stress on a lubricant, and it is up to the oil's viscosity and chemical additives to protect the gears against wear.

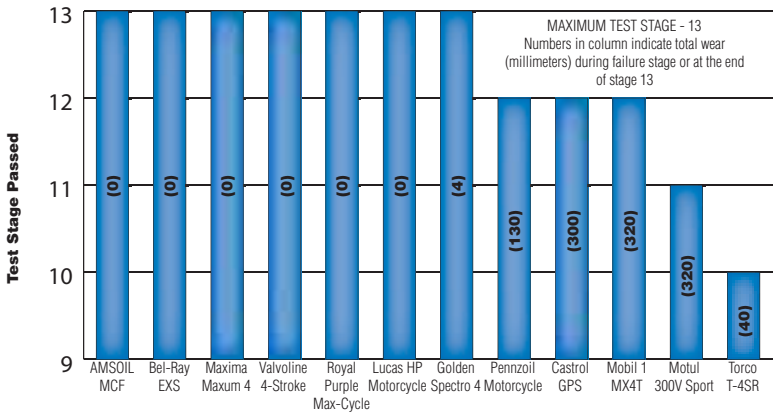
The ASTM D-5182 FZG Gear Wear Test is used to determine a lubricant's gear oil performance. Two hardened steel spur gears are partially immersed in the test lubricant, while temperature is maintained at a constant 194 degrees F and a predetermined load is placed on the pinion gear. The gears are rotated at 1,450 RPM for 21,700 revolutions before being inspected for scuffing. If the total width of wear on the pinion gear teeth exceeds 20 mm, the test is terminated. If the total width of wear is below 20 mm, additional load is placed on the pinion gear and the test continues for another 21,700 revolutions. Each time an oil passes, it advances to a higher test stage. The highest stage is 13, and results are reported as the highest stage passed by the oil. Wear is indicated for the stage at which the oil failed.

Two separate tests were performed for SAE 40 and SAE 50 oils, and results indicate that 58.3 percent of the SAE 40 oils and 75 percent of the SAE 50 oils passed stage 13. Although Mobil 1 MX4T, Motul 300V Sport and Torco T-4SR tested among the top SAE 40 oils in the Four Ball Wear Test, they tested among the lowest in the FZG Gear Wear Test. In addition, Motul 300V Competition and Torco T-4SR tested among the top SAE 50 oils in the Four Ball Wear Test, but also tested among the lowest in the FZG Gear Wear Test.

As seen in the photos and graphs, both AMSOIL 10W-40 Synthetic Motorcycle Oil (MCF) and 20W-50 Synthetic Motorcycle Oil (MCV) placed at the top of their respective test groups in the FZG Gear Wear Test. *Only AMSOIL MCF and MCV placed at the top of their respective test groups in both the Four Ball Wear Test and the FZG Gear Wear Test, indicating that AMSOIL Synthetic Motorcycle Oils are the best choice for superior protection of motorcycle engines and transmissions.*

Order the G-2156 Motorcycle Oil Study to see all of the test results.

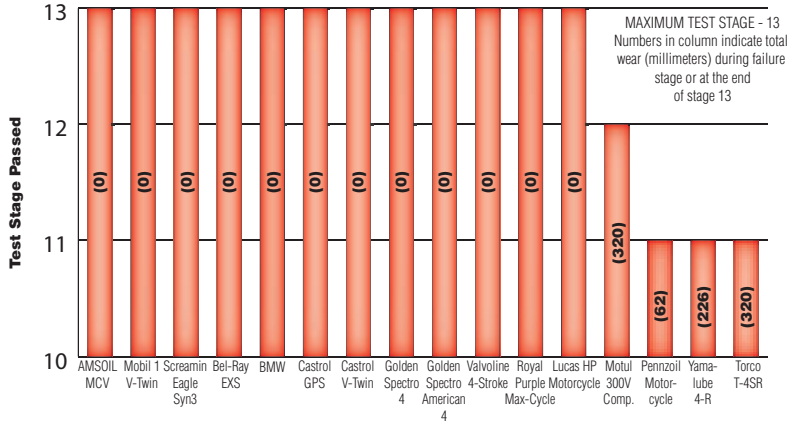
**Results, Gear Wear Test, SAE 40 GROUP**




*Pass Example: AMSOIL MCF Passed Stage 13, Total Wear 0 mm*

*Failure Example: Castrol GPS Passed Stage 12, Failed Stage 13, Total Wear in Stage 13, 300 mm*

**Results, Gear Wear Test, SAE 50 GROUP**




*Pass Example: AMSOIL MCV Passed Stage 13, Total Wear 0 mm*

*Failure Example: Motul 300 Comp. Passed Stage 12, Failed Stage 13, Total Wear in Stage 13, 320 mm*

# A Look Inside the AMSOIL Motorcycle Oil Study:

## Shear Stability

The AMSOIL Motorcycle Oil Study (G-2156) compares the test results of 28 different motorcycle oils in the most critical areas of motorcycle oil performance, making it an excellent sales tool for Dealers seeking to either break into or increase their sales in the motorcycle market. Previous issues of the *Action News* examined engine wear, gear wear and rust protection testing. This issue takes a closer look at shear stability.

Mechanical activity within an engine creates shearing forces that can negatively affect a lubricant's protective viscosity. Even lubricants that provide consistent viscosity through a wide temperature range (high viscosity index) are susceptible to shearing forces that reduce viscosity and load carrying ability. Engines operating at high RPMs and those that share a common oil sump with the transmission are particularly subject to high shear rates. In fact, gear sets found in motorcycle transmissions are the leading cause of shear induced viscosity loss in motorcycle lubricants.

The ASTM D-6278 Viscosity Shear Stability Test is used to determine a lubricant's shear stability. After measuring its initial viscosity, the oil is subjected to shearing forces in 30 cycle intervals. Viscosity is measured and compared to the oil's initial viscosity following 30, 90 and 120 cycles. The lower the degree of change, the better protection the lubricant provides against shearing forces.

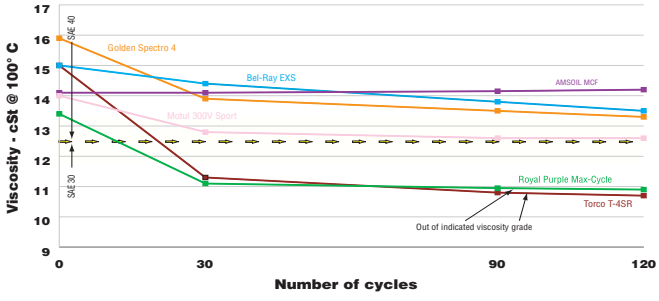
Two separate tests were performed for SAE 40 and SAE 50 oils, with each grade split into two or three groups to make the graphs easier to reference. The flatter the line on the graph, the greater the shear stability of the oil. The results showed significant variances in shear stability protection. Within the SAE 40 group, 41.6 percent of the oils dropped one viscosity grade to an SAE 30, while 43.8 percent of the oils in the SAE 50 group dropped one viscosity grade to an SAE 40. The viscosity loss tended to occur quickly, with most of the affected oils dropping a viscosity grade within the first 30 cycles of shearing. In addition, it is interesting to note that two of the oils with the highest viscosity indices, Torco T-4SR in the SAE 40 group and Yamalube 4R in the SAE 50 group, exhibited the largest drops in viscosity in their respective test groups during shear stability testing.

As seen in the graphs, both AMSOIL 10W-40 Synthetic Motorcycle Oil (MCF) and 20W-50 Synthetic Motorcycle Oil (MCV) placed at the top of their respective test groups in the Viscosity Shear Stability Test, indicating that AMSOIL Synthetic Motorcycle Oils are the best choice for superior protection of motorcycle engines and transmissions.

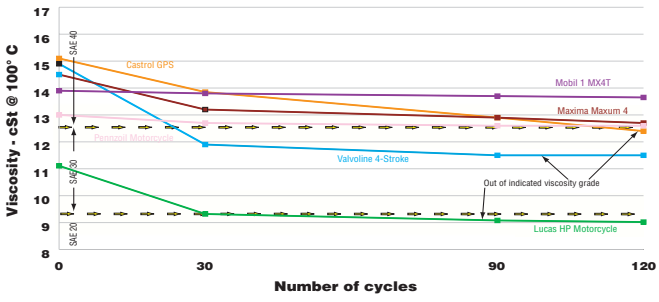
*Order the G-2156 Motorcycle Oil Study to see all of the test results.*

| Motorcycle Oil Study | | |
|---|---|---|
| **Stock #** | **U.S.** | **Can.** |
| G-2156 | 2.00 | 2.60 |

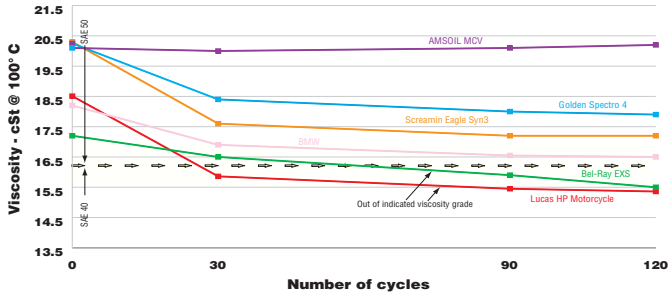
### Results, Viscosity Shear Stability, SAE 40 Group 1



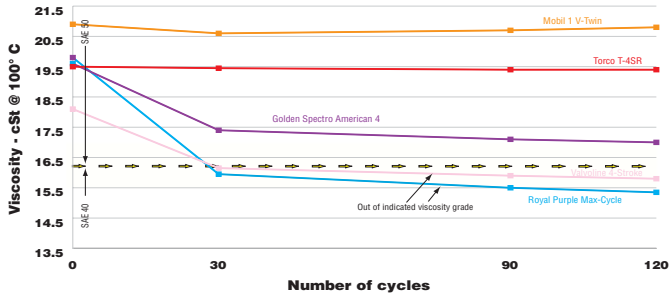

### Results, Viscosity Shear Stability, SAE 40 Group 2




### Results, Viscosity Shear Stability, SAE 50 Group 1




### Results, Viscosity Shear Stability, SAE 50 Group 2




### Results, Viscosity Shear Stability, SAE 50 Group 3