

MOTORCYCLE OIL MATTERS

Maximizing Motorcycle Reliability Through High-quality Lubrication Formulations

By Shiang-Lin Tay

As countries around the world continue to invest in transportation infrastructure that enables citizens to travel more efficiently, motorcycles have quickly become one of the most frequently used means of personal mobility. In fact, in 2016, global sales of motorcycles exceeded 135 million units¹, and the market was valued above \$76.4 billion in Asia alone².

With more personal vehicles on the road, many countries are continuing to establish guidelines regarding the efficiency and environmental performance of today's motorcycle models. This has caused further discussion among the motorcycle manufacturing industry as well as among some governments regarding how to set standards to meet performance, safety and govern-

ment-mandated emissions standards.

For instance, in April 2020 India officially rolled out its Bharat Stage VI emission standards for all light- and heavy-duty vehicles as well as two- and three-wheeled motorcycles. The BS VI standards specify mass emission standards, type approval requirements and on-board diagnostic levels for each category. For motorcycles in particular, this standard primarily aligns emission limits for two-wheeled vehicles with some of the most stringent standards, including those managed by the European Union.

Using the right finished lubricant formulation can improve the efficiency of motorcycle engines. In fact, lubricants are the lifeblood of the motorcycle. Selecting

¹ <https://www.goldsteinresearch.com/report/global-two-wheeler-market-size-analysis-market-forecast-2016-2024>

² <https://www.goldsteinresearch.com/report/asia-pacific-two-wheeler-market-report-analysis>



	Sale Ratio of the Top 3 MCO Viscosity Grades (base is 15W-40/50)		Weight Ratio of Light Neutral and Heavy Neutral Cuts for MCOs	
	India	Indonesia	LN	HN
15W-40/50	1	1	45	55
10W-30/40	2.2	13	75	25
20W-40/50	2.6	19	5	95

*High-level approximation based on ExxonMobil assessment of publicly available, subscription-based, and consultant information
Source: ExxonMobil

the right ones can play a large role in helping to maximize performance and extend the vehicle's life while also aiming to increase fuel economy and lowering emissions.

With this in mind, carefully formulated lubricants support motorcycles by providing a more customized, high-quality oil specifically designed to help motorcycles operate efficiently.

The Evolution of Motorcycle Oils

When evaluating finished lubricants, there is no one-size-fits-all formulation that can optimally support every application. This is especially the case with lubricants designed for motorcycles and passenger vehicles.

Until the late 1990s, traditional lubricants for passenger vehicles were commonly used to lubricate motorcycles. However, as the engine technology in passenger cars began to change to meet consumer demand for increased power, the way that lubricants were evaluated and applied began to change as well.

These new passenger car oils were then formulated with new additives and friction modifiers that rendered them incompatible with the engines, gearboxes and clutches in motorcycles.

Thus, bespoke motorcycle oils for these components became necessary.

In order to properly and officially distinguish some of the differences between passenger car and motorcycle oils, the Japanese Automotive Standards Organization, also known as JASO, introduced its T903 standard for four-stroke motorcycle oils in 1998. JASO is dedicated to setting automotive standards in Japan. Under this standard, the JASO MA performance category was defined for oils used in motorcycles with a wet clutch to provide the right amount of friction to prevent clutch slippage while maintaining overall performance.

The JASO MB performance category was defined for oils that use friction modifiers to provide

fuel economy benefits in automatic motorcycles. For two-stroke motorcycle applications, JASO also introduced the M345 standard that sets a minimum level of engine protection and exhaust emissions control performance. The JASO standards are consistently reviewed and updated in order to ensure that today's motorcycles are meeting all the applicable performance, safety and emissions standards.

Selecting the Right Base Stock for Motorcycle Lubricants

Lubricants are used in a wide range of motorcycle applications, including engines, transmissions and gearboxes. Given that the base stock can account for 75%-99% of a finished motorcycle lubricant's formulation, the type of base stock used in each application should be carefully evaluated.

When evaluating base stocks for motorcycle lubricants, some of the key attributes to consider are:

- Viscosity index: Viscosity index refers to the change in an oil's viscosity in relation to temperature changes. When applied in motorcycles, lubricants should experience minimal viscosity change, as temperature changes occur often to maintain performance.
- Volatility: A lubricant's volatility is primarily controlled by the type of base stock in the formulation.

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Essentially, Group II+ base stocks have the same viscosity as Group II base stocks, but they come with improved volatility and higher viscosity index, which correlates with improved cold cranking simulator properties.

Motorcycle oils typically require a low volatility in order to minimize the rate of oil consumption and reduce oil thickening to maintain fuel economy benefits. Determined by the Noack test, volatility is one of the most important characteristics of a motorcycle lubricant.

- Oxidation stability: Oxidation refers to the impact of oxygen exposure on a finished lubricant. It can cause the lubricant to degrade, leading to damaged components that could eventually result in engine failure. Oxidation can be controlled by proper base stock and/or additive selection. Focusing on the base stock, the more resistant that a base stock is to oxidation, the less likely that a finished oil using that base stock will thicken or form deposits on the components being lubricated.

When evaluating categories of base stocks, it is important to have flexibility in creating a wide range of finished lubricant formulations. On this front, Group II base stocks are the most versatile for blending motorcycle lubricants.

With a saturate content greater than 90% and sulfur content of less than 0.03%, Group II base stocks provide improved oxidation stability over Group I base stocks. Because of this, Group II base stocks are some of the most reliable base stocks on

the market right now. Furthermore, in order to blend products with a variety of viscosity grade requirements, it can be useful to keep both heavy neutral and light neutral Group II base stocks on hand.

The Value of Group II+ Base Stocks

There is a growing need for lubricants that provide enhanced fuel economy through a lower-viscosity lubricant that can still provide necessary protection to motorcycle components. This has ultimately led to a growing interest in using higher-performing lubricant products. This is where Group II+ base stocks can play an important role.

Group II+ base stocks share similar characteristics with their Group III counterparts. Essentially, Group II+ base stocks have the same viscosity as Group II base stocks, but they come with improved volatility and higher viscosity index, which correlates with improved cold cranking simulator properties. These Group II+ characteristics enable lubricant manufacturers to reduce or even eliminate the need for Group III base stocks from certain formulations while providing performance advantages compared to a traditional Group II base stock.

Given the intricacy associated with producing a finished motorcycle lubricant, choosing the right base stock is a key component of the

lubricant formulation's quality.

Editor's Note: Group II+ and III+ are unofficial, industry-established "categories" originally developed in response to blenders' needs for a base oil suitable for SAE 10W-XX and 5W-XX multigrade motor oil blending. They are marketing terms, not official API definitions. Group II+ offers higher viscosity index—usually between 112 and 119—than many Group II base oils. ♦



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