

Moto 4T

Repsol Lubricants

The most advanced technology
tested at the highest level of competition



REPSOL

Let's invent the future



Marc Marquez
with Repsol, 8-time
World Motorcycling
Champion



We've renewed our range of lubricants for four-stroke motorcycles



At Repsol we work with **the most advanced technology** to develop the most innovative lubricants for 4-stroke motorbikes, all of which are able to meet the major challenges faced.

- The main challenge faced by oil for 4-stroke motorcycles is to **protect and lubricate an engine** which operates at **higher revs** and working temperatures than a car engine.
- They also have to meet **another major challenge: responding to the thermal stress** to which motorbike oil is subjected. This is **significantly higher** than that of the oil for a car because of the lower sump capacity.

This enables us to guarantee that **all your demands for your motorcycle are met:** protection against wear, engine cleanliness, durability and a smooth ride with a quick clutch response.

In addition, engine oils play a key role in complying with strict European regulations on the emission of pollutants into the atmosphere.

The **Moto 4T Repsol Lubricants** have been formulated by the same team that designed the lubricants for our **MotoGP team**. The result is a range of lubricants which take better care of your engine, providing you with a smoother ride and higher performance for longer.

We have therefore developed the following study which shows the effectiveness of these lubricants and the benefits they offer to motorbike engine and how we have adapted to new environmental regulations.

The highest proven quality in four aspects

At our research center, **Repsol Technology Lab**, which is at the forefront of R&D&I worldwide, we have performed a set of scientific tests to produce a market study which evaluates the performance of the Repsol Moto 4T oils.

To do this, we have analyzed and contrasted the **qualities of 3** of our most-renowned competitors' products, as well as our formula's quality prior to the update, on the **10W-40 viscosity grade**.

The results of this study focus on the **four aspects** of most concern to motorcycle riders:



Engine, clutch and gearbox protection

Engine cleanliness and durability

Oil lifespan

Riding comfort

Shown below are the **conclusions of the 14 laboratory tests** performed at the Repsol Technology Lab.

Discover which lubricants are best and why.

Why do we update our formulas?

In 2020, the Euro 5 standard for 4-stroke motorcycles came into force, taking another step towards reducing emissions into the environment.

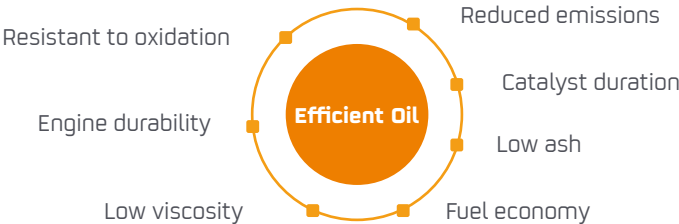
To ensure compliance, manufacturers have had to redesign several elements, such as injection systems, on-board diagnostic systems, or exhaust aftertreatment systems. These changes place even more demands on lubricating oils and prompt the updating of our entire range of products.

As we can see in the following table, there are several conflicting properties, and now more than ever, it's necessary to find the right balance:

> CONFLICTING PROPERTIES

	DRIVERS				
Adjustments to old formulas	Fuel Economy	Catalyst durability	Gear box and gear durability	Oil oxidation	Clutch friction
Low viscosity	✓		✗		
Friction modifiers	✓				✗
Low phosphorus		✓	✗	✗	
	Emissions		Equipment protection	Periods between oil changes	Quality perception

> A CHALLENGE FOR NEW OILS





Engine, clutch and gearbox protection

Essential in high-performance engines

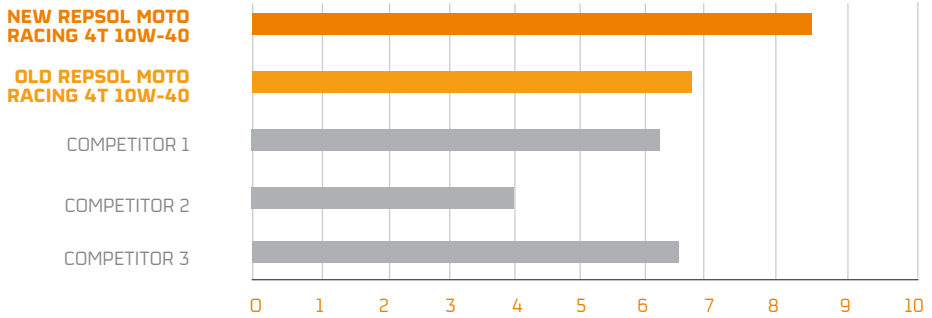
The main mission an engine lubricant must accomplish is to protect and ensure good lubrication, especially in **high performance engines**.

The **friction** generated in these types of engines can lead to a loss of lubricity, causing increased metal **wear** in gearboxes. This situation may sometimes even be noticed by the rider due to the noise and vibration it generates.



Protection ranking

The ranking obtained from the average of the 5 critical engine, clutch, and gearbox protection tests performed is shown below:



Motorcycle engines operate at high temperatures and high revolutions, so ensuring excellent protection under these conditions is essential.

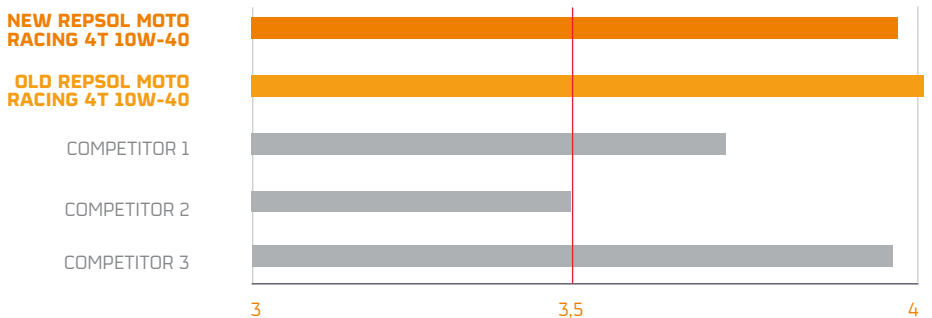
The **HTHS VISCOSITY** [high temperatures and high shear] indicates the thickness of the protective film created by the lubricant under these conditions, and that's why it is one of the most important properties to classify products in terms of engine protection. The higher it is, the thicker the film, and the better protected the engine will be. However, friction losses will also be higher, increasing fuel consumption. That's why relatively high values are more appropriate. The lower SAE J300 limit is shown in red in the following chart.

The higher the
HTHS viscosity



The higher the protection
against wear

> HTHS VISCOSITY



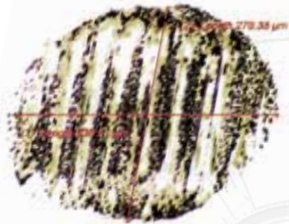
Another critical test carried out at the **Repsol Technology Lab** is the 4-ball wear test, which indicates the lubricant's capacity to protect metal parts against friction wear.

The test produces a friction mark on metal surfaces, and oils with better anti-wear additives will have smaller marks.

The lower the wear

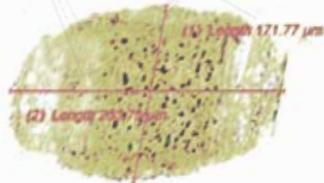


The higher the protection



In this photo you can see the wear scar that occurs when the lubricant of a competitor brand is used.

And in this photo you can see the scar left when a Repsol Lubricant is used, which has a smaller area of wear.



The **diagram below** shows the position of Repsol Lubricants against other brands, **comparing the wear caused**.

Samples with a smaller mark show less wear, and as such, a better result.

> **4-ball wear test**

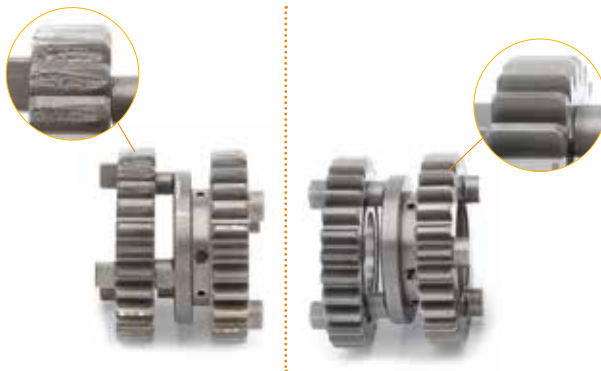
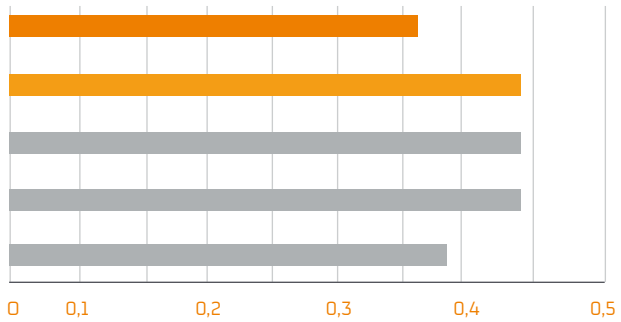
NEW REPSOL MOTO RACING 4T 10W-40

OLD REPSOL MOTO RACING 4T 10W-40

COMPETITOR 1

COMPETITOR 2

COMPETITOR 3



Comparative image of gears which are kept in perfect condition and those in which wear has occurred.



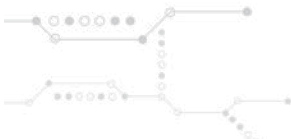
Engine cleanliness and durability

Clean engine,
with increased
**oxidation
resistance**

As well as lubricating and protecting the engine, lubricant oil helps to **keep it clean**.

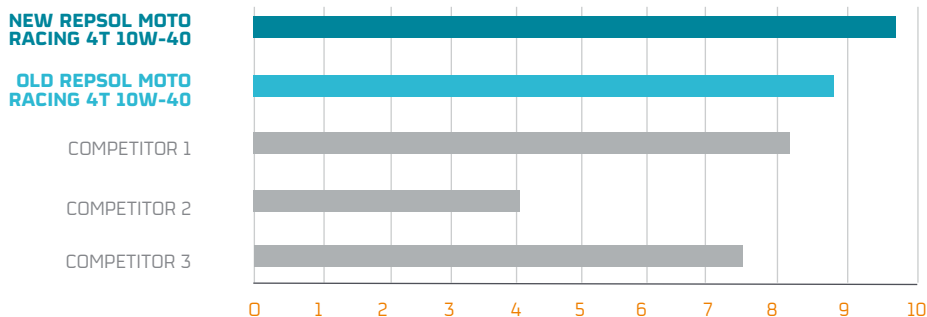
Its detergent and dispersant properties **minimise external contamination** such as water, fuel, dust or the **carbon deposits** generated in engine combustion, preventing accumulation on the piston and piston rings and stopping scuffing from occurring on the liners.

The lubricant must also offer **oxidation resistance** in order to prevent the oxidation products from reacting with the pollutants, causing sludge, varnishes or even corrosive products.



Cleanliness ranking

The ranking obtained from the average of the 4 critical engine and catalyst cleanliness tests is shown below:



It is necessary to keep the combustion chamber clean. The port fuel injection systems necessary to comply with the new Euro 5 environmental regulations increase the severity of conditions within the combustion chamber, resulting in greater deposit build up.

Less deposit build up means less wear on cylinders and piston rings, better sealing, and a prevention of power loss.



**Less deposit
build up**

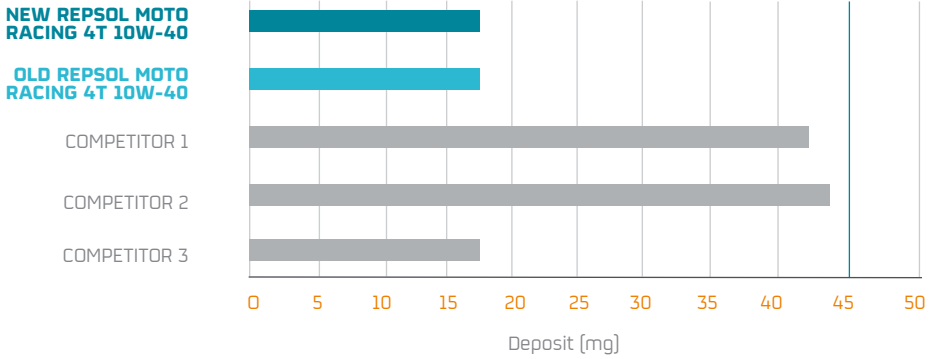


**Better engine
performance**

One of the critical tests we carry out at the **Repsol Technology Lab** to determine engine cleanliness is the Thermo-Oxidation Engine Oil Simulation Test (TEOST). This test predicts deposit build up on the rear sprocket and piston rings area. TEOST values are shown in the following chart along with the limit set by API SN.

The lower deposit build up value, the better the result.

> **TEOST**



The results obtained for the two Repsol products as well as for competitor 3 are very similar and have a notably higher quality versus competitors 1 and 2. Values are less than half of the strict limit set by API SN.

The compatibility of the oil with the catalyst is essential to ensuring it functions correctly. Catalyst poisoning causes a constant increase in harmful emissions to the environment until it must finally be replaced.

Less sulfated ash



Longer catalyst life

Lubricating oils incorporate a series of additives that are essential in protecting the engine, gearbox, and clutch, as well as improving their physicochemical stability, thereby extending the oil's lifespan. These additives burn over time, due to the high engine and combustion chamber temperatures, and produce ashes called sulfated ashes due to their sulfur content.

However, sulfated ash is harmful for the environment, so reducing it is desirable. In addition, due to increasingly stringent environmental requirements, motorcycles require aftertreatment systems, such as the 3-way catalyst to reduce CO, HC, and NO_x emissions. They also reduce sulfated ash and phosphorus, which are responsible for the premature poisoning of these aftertreatment systems.

A lower percentage of sulfated ash provides better results, leaving less residue in the combustion chamber and lowering catalyst contamination.

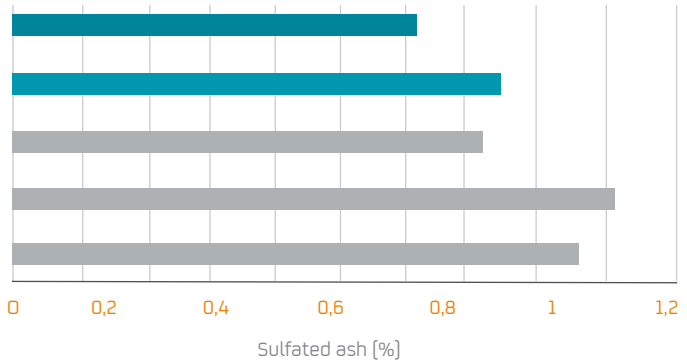
NEW REPSOL MOTO RACING 4T 10W-40

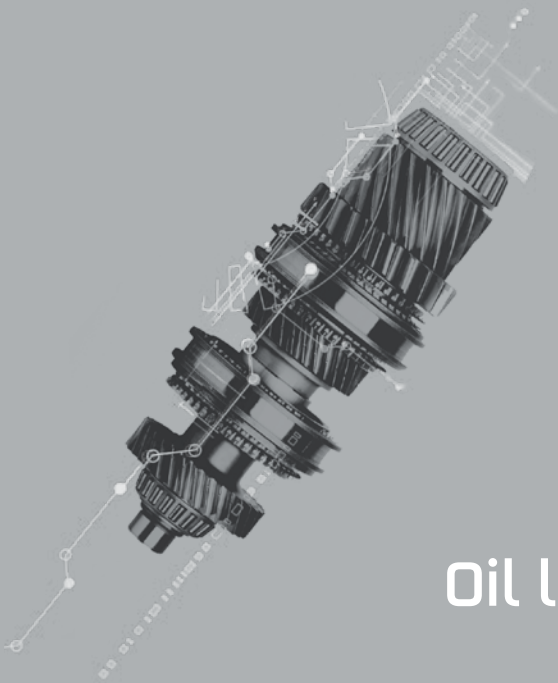
OLD REPSOL MOTO RACING 4T 10W-40

COMPETITOR 1

COMPETITOR 2

COMPETITOR 3





Oil lifespan

Quality lubricants with lower volatility

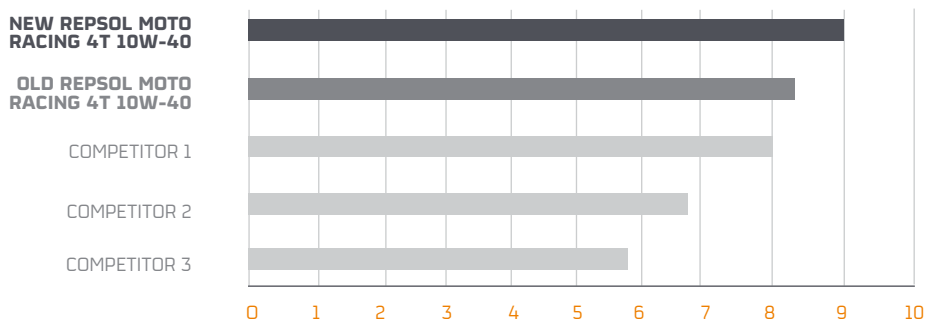
It is very important to take into account that lubricants can be degraded by **thermal oxidation and the loss of volatile components**, which leads to a thickening of the oil; in other words, an increase in its viscosity [which impairs engine performance and increases fuel consumption].

Oils with high oxidation stability and low volatility maintain their properties in good condition during their service period and avoid the need for refills or premature changes.



Lifespan ranking

The ranking obtained from the average of the 4 critical oil lifespan tests performed is shown below:



OXIDATION RESISTANCE is fundamental in high-performance air-cooled motorcycles in order to prevent the generation of deposits and keep the engine cleaner, thereby increasing its durability.

The quality of the base oils used is essential in the performance and duration of engine oil. 100% synthetic oils perform better than partially synthetic or mineral oils.

The oxidation test performed at the high temperature of 170 °C at the laboratory allows for the comparison of some oils' performances against their oxidation resistance. Oxidation is calculated by spectrometry by measuring the height and peak area increase (PAI). **The larger the area, the more oxidized the oil will be.**

The lower the volatility



The longer the lifespan

In the **chart below**, small increases in peak area indicate little oil oxidation, and as such, very high lubricant base quality. The high-quality bases delay oil degradation, **effectively protecting the engine for longer.**

> PAI oxidation

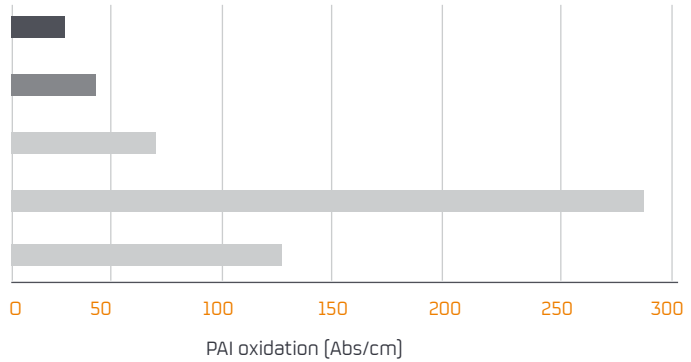
NEW REPSOL MOTO RACING 4T 10W-40

OLD REPSOL MOTO RACING 4T 10W-40

COMPETITOR 1

COMPETITOR 2

COMPETITOR 3



Repsol technology shows better oxidation performance compared with its competitors' products, including ester-formulated products!

Having a high-tech lubricant which minimises losses due to VOLATILITY is fundamental, as this will mean that you will have lower consumption due to evaporation. In other words, the lubricant will have a longer lifespan.

The lower the volatility



The longer the lifespan

The diagram below shows the resistance of different lubricant brands to becoming volatilised.

As you can see, those that have a lower percentage of losses will have lower consumption due to evaporation.

> NOACK volatility

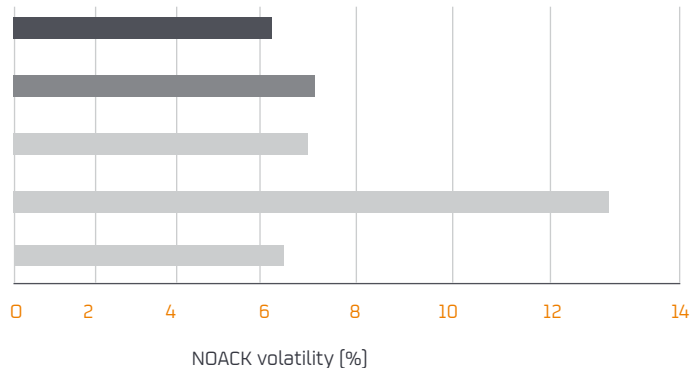
NEW REPSOL MOTO RACING 4T 10W-40

OLD REPSOL MOTO RACING 4T 10W-40

COMPETITOR 1

COMPETITOR 2

COMPETITOR 3



These photographs show the dirt left in the filters due to the thickening of the oil or an increase in viscosity as a result of its thermal oxidative degradation and the loss of volatile components.





Riding Comfort

**Controlling
friction:**
the key
to comfort

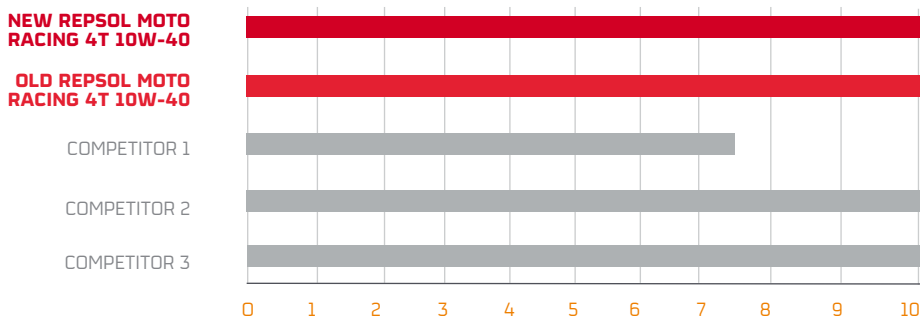
At Repsol we know that riding comfort is an **increasingly important** factor among motorcycle riders, just as much as power or speed.

That's why at the **Repsol Technology Lab** we have evaluated the **influencing factors**: ease of cold starting, smooth and fast gear shifts and the lack of any vibration or noise.



Comfort ranking

The ranking obtained from the average of the 3 critical driving comfort tests performed is shown below:



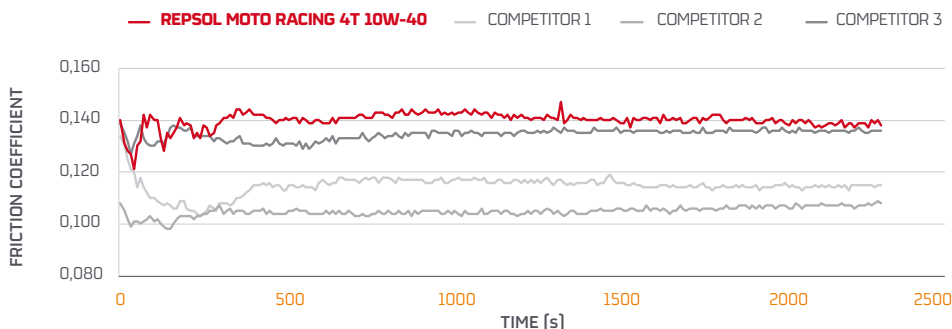
One of the parameters with the biggest influence on **RIDING COMFORT** is clutch friction. In order to evaluate the performance of each of the oils, we use the JASO friction tests.

Repsol Moto Racing 4T Lubricants have the **highest JASO MA2 level**, which means that they offer a better shift speed and response.

The higher the friction > **The better the shift response**

In this diagram we have compared the friction coefficients obtained using an HFRR instrument. **High values are seen as a good property.**

Excessively low values can cause the clutch to slip more.

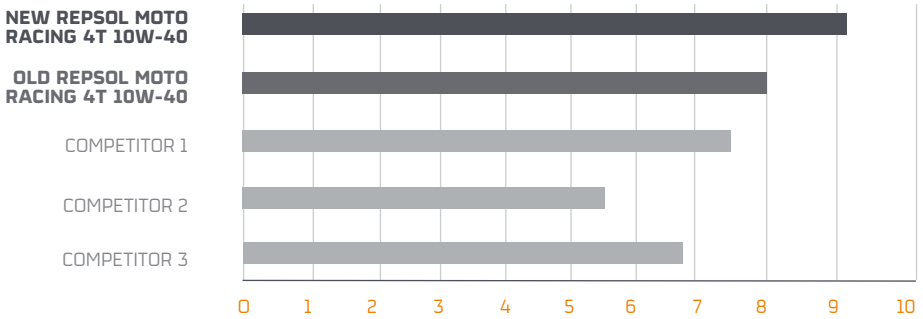




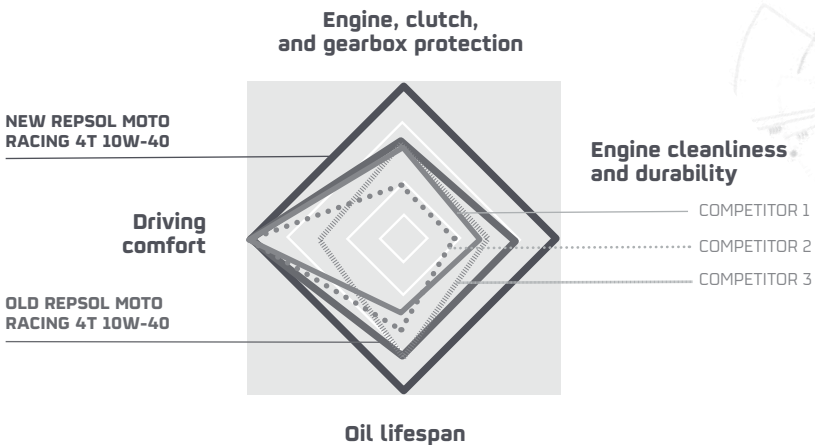
Overall performance

Through this study we have been able to evaluate the performance of the new REPSOL MOTO RACING 4T 10W-40 formula compared to its previous version. We have also compared them with other leading oils in the same range available on the market, that is to say, those with the highest quality possible.

Considering all the properties tested, we have classified the oils:



You can see that the old REPSOL MOTO RACING 4T 10W-40 formula was already superior to its competitors' formulas, but the new formula represents a significant improvement. The breakdown of improvements is clearly seen in the following radar chart:





REPSOL

Let's invent the future