Octane Requirement Increase (ORI)

Summary: The octane appetite of an engine goes up as mileage increases up to about 20,000 miles.

The Octane Requirement (OR) of an engine is defined as the highest octane number gasoline that will provide a repeatable audible knock when tested by a trained rater using the Coordinating Research Council (CRC) Octane Requirement Test Procedure. As miles accumulate on a new engine, the OR of the engine goes up. A typical engine tested when new, and again at 5,000, 10,000, 15,000, and 20,000 miles, will have OR data as shown in the accompanying table. Not all engines are the same, but the table shows what happens with an average passenger car engine.

Miles	Octane Requirement
0	Baseline
5000	Baseline +2
10000	Baseline +4
15000	Baseline +5
20000	Baseline +6

As you can see, the OR jumps up very quickly in the first 10,000 miles and then levels off between 15,000 and 20,000 miles. In most cases it will remain constant at the 20,000 mile level (assuming normal maintenance) until the rings and valve guides wear enough to allow oil to get into the combustion chamber and deposits increase thereby increasing the OR of the engine. This increase occurs around 100,000 miles.

The increase in the Octane Requiremnet of an engine over its life is referred to as Octane Requirement Increase(ORI). A gain of four to six numbers is typical during the first 15,000 to 20,000 miles.

Studies conducted by the CRC have suggested that ORI can be attributed to two major causes. The first is the influence on ORI of combustion chamber deposits. These deposits contribute to reduced heat transfer from the combustion chamber so the chamber remains hotter. The second is the increase in mechanical compression ratio due to the deposits. The first is thought to have the greatest influence on ORI.

EXAMPLE 1: A new engine has an OR of 82. Over the next 20,000 miles it gains some deposits and the OR increases by five numbers to 87. The owner does not know the difference since 87 octane gasoline is the lowest octane available in most parts of the US. In this case, an ORI of five is not a problem.

EXAMPLE 2: A new engine has an octane requirement of 90. The owner will notice detonation right away if he is using 87 octane gasoline. Over the next 20,000 miles the engine gains some deposits and the Octane Requirement increases to 95. The owner will definitely notice the detonation and will have to resort to using an octane booster, or blend in ***Rockett Brand*** ™ ***100 Octane Unleaded Gasoline*** with his 92 or 93 octane gasoline. In this case, an ORI of five is noticeable and will require higher octane gasoline to keep the engine satisfied.

The CRC Octane Requirement Test Procedure includes testing at Wide Open Throttle (WOT) and also at Part Throttle (PT). The procedure recommends testing on a chassis dyno at an ambient temperature of 70° F. with humidity controlled to 50 grains of water. Controlling temperature and humidity provides the most consistent data over the test period

If the driver does not operate the engine at the speed and throttle position where the OR is the most severe; he/she may be able to get by using lower octane gasoline. Since high performance engines are built to have more horsepower, and the owners are more likely to run the engine hard, they are also likely to hit that most severe operating condition and need the higher octane gasoline. Keep in mind that about 70% of the cars on the road are satisfied by 87 octane gasoline. Many automotive enthusiasts have modified engines and therfore fall into the category of needing 92 or 93 octane gasoline (and sometimes higher, especially with engines equipped with superchargers, turbochargers, and/or nitrous oxide systems).

The initial OR of an engine depends on the compression ratio, cylinder bore size, cylinder head material, operating temperature, air inlet temperature, and barometric pressure. The CRC Test Procedure specifies a desired temperature and humidity for testing , so these are not significant variables in the test, but there certainly can be on the road. That is why an engine is less likely to detonate in the early morning compared to later in the day when the temperatures increase, air conditioning is on and the cooling systems are stretched to the limit.

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