TORQUE AND HORSEPOWER

While torque and horsepower ratings are common vehicle selling points, many consumers don't fully understand what the ratings mean or the relationship between the two.

Torque

Most often measured in pound-feet (lb-ft), torque is a twisting or turning force applied to an object such as a wheel, crankshaft or nut. When tightening a nut with a wrench, for example, the level of torque placed on the nut is determined by multiplying the force applied at the end of the wrench by its length. Applying 100 pounds of force at the end of a one-foot wrench translates into 100 lb-ft of torque, while applying the same amount of force at the end of a two-foot wrench translates into 200 lb-ft of torque.

In automotive applications, torque measures the engine's ability to perform work. The torque created by displacement of engine cylinders spins the engine crankshaft, and the transmission applies this torque to the wheels of the vehicle, moving it forward. The more torque applied to the crankshaft, the more work the vehicle can do.

Horsepower

While torque measures the turning force produced by a vehicle's engine and measures the engine's ability to perform work, horsepower measures how fast the engine can perform the work. Engine horsepower ratings indicate how much power an engine can produce similar to how light bulb wattage indicates how much power the bulb will use.

Steam engine inventor James Watt coined the term "horsepower" in the 18th century for the purpose of comparing steam engine performance to the better-understood performance of horses, which were used as the power sources for everything from transportation to plowing fields and pumping water. It's believed Watt arrived at the now-standard 33,000 lb-ft per minute (550 lb-ft per second) figure for one horsepower by measuring how quickly a horse turned a gear-driven mine pump and estimating the amount of force the horse exerted to perform the work over a given time.

Torque/Horsepower Relationship

Torque and horsepower are related by the following formula:

$$\text{Horsepower} = \frac{\text{Torque} \times \text{Engine RPM}}{5252}$$

Plugging various RPM values into the equation provides an idea about the range of power an engine can produce. Because torque and RPM are divided by 5252, torque and horsepower are equal when the engine speed is equivalent to 5252 RPM, while torque is greater than horsepower below 5252 RPM and horsepower is greater than torque above 5252 RPM.

The level of horsepower an engine can deliver is directly proportional to the level of torque generated by the crankshaft, which is directly proportional to the total displacement capacity of the engine. Because there is a limitation on the maximum displacement an engine can generate, there is also a limitation on the amount of torque the engine can produce, which in turn sets a limit on the engine's maximum horsepower.

While it's been hotly debated whether torque or horsepower is more important, it just depends on the driver's priorities. A vehicle with a higher torque value can perform more work, providing an advantage for pulling trailers or hauling heavy loads, while a vehicle with a higher horsepower value performs work faster, making it better-suited for highway driving or racing. ■