Frequently Asked Questions

Question
Torque

Answer
Torque is a force that tends to rotate or turn things.

You generate a torque any time you apply a force using a wrench. Tightening the lug nuts on your wheels is a good example. When you use a wrench, you apply a force to the handle. This force creates a torque on the lug nut, which tends to turn the lug nut. English units of torque are pound-inches or pound-feet; the SI unit is the Newton-meter.

Notice that the torque units contain a distance and a force. To calculate the torque, you just multiply the force by the distance from the centre.

In the case of the lug nuts, if the wrench is a foot long, and you put 200 pounds of force on it, you are generating 200 pound-feet of torque. If you use a 2-foot wrench, you only need to put 100 pounds of force on it to generate the same torque.

A car engine creates torque and uses it to spin the crankshaft. This torque is created exactly the same way: A force is applied at a distance.

The combustion of gas in the cylinder creates pressure against the piston. That pressure creates a force on the piston, which pushes it down. The force is transmitted from the piston to the connecting rod, and from the connecting rod into the crankshaft.

The point where the connecting rod attaches to the crank shaft is some distance from the centre of the shaft. The horizontal distance changes as the crankshaft spins, so the torque also changes, since torque equals force multiplied by distance.

You might be wondering why only the horizontal distance is important in determining the torque in an engine. When the piston is at the top of its stroke, the connecting rod points straight down at the centre of the crankshaft. No torque is generated in this position, because only the force that acts on the lever in a direction perpendicular to the lever generates a torque

Eh?

Torque is the power of a rotating force, which is the product of one of two equal, opposite, and parallel offset forces and the distance between them. When this is applied to a car this means the effort exerted on a shaft to move the vehicle along. When torque is great enough to move a shaft through a given distance in a given time this is expressed as power and measured as horsepower.

OK in English

if you have a centre nut on one of your wheels and then put a socket on it with a 1ft bar (bear with me on the imperial). The car will be at rest until you put a weight on the end of the bar to try and turn the wheel. So if you now put 50lb on the end of that 1ft bar and the car moves, the force that has moved that car from a standstill, at that speed, is 50 lb ft. So if the engine of that car produced the same amount of twisting force at its peak it would have been said to have a Torque of 50lb ft.

Now if you take that theory one step further and double the weight on the end of the bar and let go, the wheel would rotate again, only this time because the amount of force pushing the bar down was greater, the wheel would move off quicker and with more ease. Apply this once again to the engine producing the force and it would have been said to have a Torque of 100lb ft.

So you can see the more Torque you have the quicker the wheel would move off from stationary.

This is all fine and good on a light car as it means my 0-62 time will be decreased?
Yes the theory does indeed point to that, however do bear in mind that if a car produces 100 lb ft of torque and your car does 0-62 in 10 seconds, it is NOT going to do 0-62 in 5 seconds if you give it 200 lb ft of torque due to the inefficiencies of the engine, transmission etc, but it will be significantly reduced.

What about overtaking?

The samne theory applies to overtaking. The more force you can use to make the wheels go from say 50mph to 70mph the less time it will take to get there.

Why is torque important if I tow a caravan etc?

The more torque you have the more weight you can move forward from a standstill. Or in other words if the wheel you are trying to turn is stiffer it may not turn at al with 50 lb ft - it requires more force to turn it. Therefore if you increase the force by 50lb and the wheel turns then need 100 lb ft torque to move it. Apply that to a car with a trailer, you require more force to propel that whole unit (car and trailer) forward than you would with just the car. So once again with more torque you can move your car and trailer off from a standstill quicker and with less effort than you could before.

What about wheel spin?

With more torque available the quicker you can move the wheels from stationary. When this happens the wheels can spin before the vehicle has chance to move and you of course waste energy and move off slower. Therefore you need to alter your driving accordingly if the torque has been increased.

OK before I nod off, how is torque calculated?

The theory (oh no - not that word again!) is that torque has nothing to do with engine speed (revolutions per minute (RPM)). The torque figures depend on the mean effective pressure in the cylinders (MEP), which is

calculated by taking away the total of the average pressures on the induction, compression and exhaust strokes from the average pressure on the expansion strokes. That's the theory.....

In reality the MEP (you should have read the previous paragraph) of an engine, decreases at high speed and the torque drops off. So the MEP is calculated from the Brake Horse Power (BHP) figures for an the engine, taking into account the inefficiency of the engine, so now the MEP becomes the Brake Mean Effective Pressure or BMEP, which is measured in lb in sq! Phew - that was easy.

Details
Info 07 October 2009 by C6Dave