A Little Automotive History to Put the Discussion in Perspective

What is the History of the Transmission & Torque Converter?

Quite simply it was born from the desire for convenience! Almost from the beginning of automobiles themselves the trend was to move away from a (standard shift) transmission with a clutch and a 3-Speed gear box to a completely effortless fully automatic transmission. Early iterations of automatics or semi automatics came in the form of a viscous coupling (fluid drive) in addition to a conventional clutch and gear box. While the clutch pedal still existed it did however offer the convenience feature of allowing the vehicle to idle in gear without your foot depressed on the clutch. As the accelerator was pressed the transference of power was made through this coupler and acceleration began, at a rather leisurely pace I might add, as there was no torque multiplication going on in the early fluid drives. From this rudimentary beginning the handwriting was on the wall that that the automatic was here to stay and that a new more efficient fluid coupler was desperately needed to make public acceptance complete. A new fluid coupler that offered very strong acceleration like the comparable standard shift equivalent and allow the convenience of idling without having to depress and hold a clutch pedal.

From these early beginnings transmissions evolved like the 50's Hydromatic which was a 4 speed automatic with a (fluid coupler) while residing in the bell housing and having the shape of a torque converter in a modern automatic was essentially nothing more then a fluid coupler. It is not fair to call the hydro's hydraulic coupler a torque converter yet as there was no stator inside to multiply the engine torque. By definition vehicles equipped with fluid couplers without the benefit of torque multiplication the acceleration might be best described as leisurely at best. Cars like the Packard with its 2-Speed Ultramatic, GM with the 2-Speed PowerGlide, the Cast Iron Merc-O-Matic and Ford-O-Matic 2-Speeds and the best of all the 1956 introduction of the modern 3-Speed TorqueFlite in the Imperial Line of Chrysler products were the first to use to a stator equipped torque converter

So how does a torque converter work? If I have been asked once I have been asked a hundred times…

From a very basic concept we will expand the discussion but for now envision two fans that are facing one another, one that is plugged in (impeller) and one that is not plugged in (turbine). When the impeller fan is plugged in it begins to blow air at the turbine fan which now begins to rotate. Now let's say you stop the rotation of the turbine fan with your hands for a moment, now if you release the fan blade it will again begin to rotate. Over time the speed of the (turbine fan) will catch up to almost the same RPM as the driving fan (impeller). A torque converter works much the same way, but rather than using air as our fluid which would be impractical as well as ineffectual we will use non-compressible ATF (automatic transmission fluid).

Let's now discuss the impeller and turbine…

The torque converter is made up of three major parts the impeller, turbine and stator but for now let's just focus on the impeller and turbine. The pump (also known as the impeller) pumps automatic transmission fluid into the turbine. For convenience the impeller is actually welded directly to the inside of the torque converter cover. The cover of the torque is mechanically connected to the engines crankshaft through the 4 bolts on the flex plate and by default must turn at engine speed. So we can safely say that the impeller is the driving member.

The turbine is also inside the torque converter housing (known as the driven member) and is connected to the input shaft of the transmission via a splined connection. As the engine runs the impeller pumps automatic transmission fluid into the turbine thereby imparting the engine's power from the impeller to the turbine.

Again for review the important concept to remember is that automatic transmission fluid transfers the power from the impeller to the turbine which is connected to the input shaft of the transmission

Major Development - Here comes the Stator and Torque Multiplication…

The stator is sandwiched between the impeller and the turbine. The stator is only needed for torque multiplication when the impeller and the turbine are turning at very different speeds, as one might expect that would be from breakaway from a dead stop or accelerating at low road speeds and generous amounts of throttle. When the speed of the impeller is greater than that of the turbine the stator will redirect the Automatic transmission fluid returning from the turbine and in turn change its rotation back to that of the impeller. The stator is mounted on a one-way clutch that only allows it to rotate with the direction of the engine, but never against the direction of engine rotation. This one-way clutch will lock the stator when the impeller is turning faster than the turbine, and in turn the stator will redirect automatic transmission fluid flow over its stator vanes in an outward radial direction to increase engine torque thereby creating torque multiplication. So it is fair to say torque multiplication is totally controlled by the shape and direction of the stator vanes. The stator will capture energy from the automatic transmission fluid that the turbine has not and will use this energy to increase engine torque. At the impeller and turbine speeds almost equal one another we will now be "OFF THE STATOR" and now the one way clutch will permit it to freewheel till again the impeller speed is far higher then turbine speed and the stator will again be called on for some torque multiplication assistance. Another important measurement is efficiency when the stator is freewheeling we want the ATF direction to influenced by the stator as little as possible thereby increasing torque converter efficiency. Remember efficiency is controlled by limiting spacing between the stator vanes. APS Precision Mfg in its line of high performance converters will choose from 8 different alternatives the correct stator for your Dodge/Jeep Application to maximize torque multiplication for your application.

Stall Speed and the Relation to Performance…

Stall Speed is simply the engine RPM at which the torque converter will not allow the engine RPM to increase any further and has for all intensive purposes has reached stall. This measurement can be tested while your vehicle is being held in place with the emergency brake as well as the service brakes. It is easy to test the stall speed of your torque converter, but be aware this test generates a lot of heat and is VERY hard on your transmission. With the engine running and at normal operating temperature, the emergency brake set, and the brake pedal pressed firmly, put the selector in drive and press the accelerator pedal firmly to the floor for a few seconds. Your stall speed can be measured by the maximum RPM shown on your tachometer before you lift your foot off the throttle. Do not hold the maximum RPM for any longer than necessary to perform this test. Now if we examine the potential performance aspect of torque converters let's say for instance you have a Dodge 5.9L and with the modifications you did your motor increases your HP and Torque Ratings higher up in the RPM Band. Now with the stock converter with about a 1900~2000 stall converter in a vehicle with a high output engine may become BOGGY right out of the hole till you get "up on the cam". So you would be much better off to match your APS Precision High Stall High Efficiency Converter to your application with one that will match your converters stall speed to your engines torque curve.

Most low buck run-of-the-mill one size fits all type converters costing $250 or less achieve stall by spacing out the internal members not by building torque and efficiency as discussed in this article. These entry level units may actually hurt overall performance, be devastating to fuel economy, and have a generally spongy feel around town.

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