TORQUE CONVERTERS

— *Know the Product and Avoid Grief*

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For decades, volumes of technical and product information has been generated concerning transmission and related systems, yet there was little focus on torque converters. Most of the information that was available was limited to the transmission and external controls that operate the converter. Manufacturing of torque converters and how they function was somewhat of a mystery to many technicians in the field.

During the last couple of years, however, there has been, out of sheer necessity, much more emphasis on torque converter issues up to and including rebuilding standards.

As with transmissions, converters have undergone many changes over the years to reflect the different operating modes of newer vehicles. These changes are probably not over. Fuel economy, driveability and durability are still some of the key factors concerning torque converters.

There are four main areas to address when dealing with torque converters: ***operation, identification, diagnosis*** and ***rebuilding***. A good understanding of all four is necessary in order to avoid wasted time, effort and expense.

Operation. To begin with the torque converter was a second-generation component. The first generation component was the fluid coupling. What's the difference? In a word, "the stator."

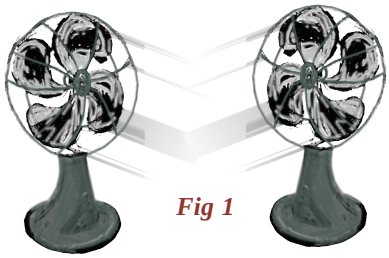

Fig 1

An example of a simple fluid coupling is to set two fans four inches apart facing each other and turn on one of them. ***Fig. 1*** The air from the driving fan will impinge upon the blades of the stationary fan and "voila" the stationary fan starts to turn. Now envision an engine hooked to the driving fan and a transmission input shaft hooked to the stationary fan. At some point the driving fan air velocity overcomes the stationary fan's resistance and the input shaft starts to turn.

The problem with fluid couplings is waste. The loss of engine torque is quite noticeable and makes for a sluggish take off. This is where the stator comes into play. Without getting too involved in vortex flow and

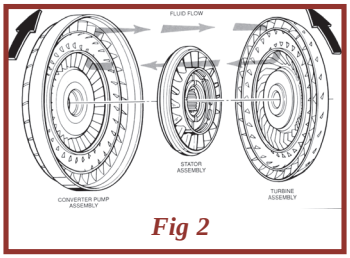

Fig 2

rotary motion theory, basically the normal oil path from the drive to the driven coupling member is redirected to the drive member in the same direction which helps the engine turn, hence torque multiplication. ***Fig. 2*** The stator must remain stationary on take off to provide that torque multiplication. It must, however, freewheel at higher speeds to avoid acting as a dam or restriction to normal oil flow, which would prevent the vehicle from going over 25-30 MPH. This is why a stator must be mounted onto a one-way clutch.

Although the torque converter is much more efficient than the old fluid coupling, it was not as efficient as a standard clutch due to internal slippage. A refinement was the addition of a ***lock up piston***. Broad use of lockups started in the late 1970's, however Packard used one of the original lock up converters back in the 1950's in the Ultramatic transmission.

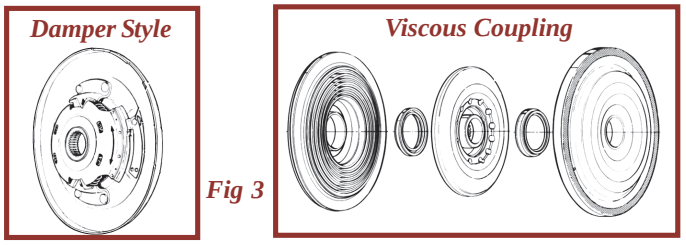

Fig 3

Lockup apply has been modified over the last twenty years due to driveability and fuel economy issues. The older lock ups were simple on-off types that were at times too aggressive during apply. Application of the piston had to be delayed to a higher speed to avoid the bump. One of the first changes to remedy this was the addition of a viscous coupling to the piston, which allows limited slippage. ***Fig. 3***

As time went on lockup converters were controlled by ***PWM*** *(Pulse Width Modulation)* solenoids to soften apply and lower lock up speeds. As demands changed, fluids, linings, pressures and controls have all been modified accordingly. Caution must be used when choosing the converter or big problems could result.

There have been variations of converters from time to time, such as the ATX planetary type, AOD/AG4 damper

spring and the C5/Subaru CLC (Centrifugally Locked Converter) but the predominate design today is a regular lock up.

Identification: Converter identification is not always easy and can result in major problems if the wrong one is chosen. Some general observations need to be made.

Turbine shaft issues are diameter, length, spline count and oil feed (solid or hollow). Put a 25 spline AX4S converter in where a 23 spline came out, and on top of a no movement condition, the stator support could break off.

Diameter and stack height are often overlooked but are certainly important. Diameter will, of course, affect the stall speed and vehicle performance. The bolt hole pattern may be the same for two different diameter converters allowing an incorrect choice. Stack height is critical to check before installing because flexplate to mounting pad clearance is not always possible to determine. A certain Honda converter, for instance, may be installed and the drive splines just fall short of touching the pump gear.

Mounting pads or studs, pilot diameter and length, ring gear tooth count and hub type all must be checked closely. Chrysler now uses ***offset*** as well as ***90° bolt patterns***. An incorrect pilot diameter will allow the converter to bolt up off center. Certain import applications like Honda may use various ring gear tooth counts. Always check mounting pad thickness to avoid using a ***long bolt*** in a ***short hole***. *(That's never happened on Chryslers).*

Not using a converter with the same type of balance weight could result in your ending up with a shaker *(the dashboard bouncing up and down is a good indicator).*

Stall speed and "K" factor are much more difficult to determine at times. ***Fig. 4*** If the converter has dimples on the impeller or an ID label, it is much easier to pick the right one but that doesn't always work. Even damper spring loads may be tough to check. The converter rebuilder catalog and part number becomes very important for choosing the right one.

Fig 4

A more recent nightmare has been getting a converter with the correct lockup piston lining. Older lockups had simple paper linings to handle the on-off apply. As the PWM units started to surface a change was made to a ***carbon fiber*** type lining to allow some slippage during apply for driveability. Fuel economy demands have resulted in even lower lockup speed and more slippage requiring an even better lining. Currently there is ***woven carbon fiber*** to handle it. The industry is now getting a handle on the various production codes and what they mean, but when in doubt, R & R.

Diagnosis. The upside is that a converter can only cause so many problems. Unlike the transmission, which can have countless symptoms, the converter is somewhat limited. Using good diagnostic procedures is a must, just like a transmission.

Noise can be localized by shifting from neutral to drive and back. This stops the turbine from spinning and causes the noise to appear. Knowing the converter is also important because an AOD, for instance, could make noise in neutral due to the direct shaft always turning.

Vibration or shakers are normally due to incorrect balancing during rebuilding, however, installing the wrong converter will also do it. Some converters are balanced with the crankshaft so always check the unbalance weight style.

Loss of power can be attributable to a bad one-way clutch in the stator. If the one-way clutch can freewheel both ways the stator fails to redirect the oil back to the impeller and has no torque multiplication.

A good procedure for a slipping one-way clutch is to butt the front wheels up against a four-inch curb and nail it. No matter how bad the engine runs it should pull the curb as long as the one-way is good. Conversely, if the one-way is bad even the best engine won't pull the curb.

Another way the one-way clutch fails would be it locking in both directions. This will prevent the vehicle from going much over 30 MPH and generate extreme heat.

Converter shudder is probably one of the hardest symptoms to diagnose because ***engine stumble can mimic shudder***. Drive over speed bumps of a freshly paved road at 50 mph and watch the dashboard vibrate up and down, that's converter shudder. Seriously, shudder is a rapid, steady vibration, whereas engine stumble or bucking is more irregular and a slower vibration or jerk. There are various ways to determine which it is.

continued

No lockup or uncontrollable lockup can stem from several things, internal or external. A no lockup condition could be the converter, transmission or external lockup signal. To start with, if needed, hot-wire the transmission to get lockup. Then hook up a gauge to the cooler out line and see if the needle flips when solenoid current is applied indicating that the transmission at least commanded lockup. Other tests can be performed as well. Uncontrollable lockup is never the converter but usually the transmission. Developing good test procedures is important.

Remanufacturing. Over the last several years more shops are rebuilding their own converters, however, the vast majority of shops still buy converters from production rebuilders.

As with transmission rebuilding, torque converter remanufacturing is dependent upon the rebuilding operation's dedication to quality. Here are some questions to ask of any torque converter rebuilder:

- Are valid policies and procedures adhered to and enforced at every level of the process?
- What are the specific guidelines concerning parts replacement on every family of converters?
- After assembly, is there a **final check** procedure, which addresses aspects of the remanufacturing process to pinpoint any deficiency of the converter?

Final Check. To start with, once converters have been welded and allowed to cool they should go to the final check stations. Final checks are among the most critical functions that are preformed during the remanufacturing process. The most experienced people should be assigned to the final check positions. This will ensure the best quality torque converter possible.

The first step in the final check process is visual. The technicians should inspect areas such as welds, threads, pilot, hub, flywheel, and overall appearance. Once that is done the torque converter should be put onto a turntable to check for certain specifications such as hub run out. The hub run out is to be kept to .010 or under and the body run out is to be kept to .025 or under. Turbine endplay is another specification that is important and a special tester is used to accomplish this. Turbine endplay is to be kept to .030 or under.

Last is stack height. Stack height is what will affect the installed converter clearance between the transmission and the engine. Checking stack height also requires a separate gauge to verify the correct dimension.

The next thing the technicians should do is check the stator one-way clutch to make sure that it freewheels and holds. They should also check the variety of splines to make sure that the shafts fit properly and that there are no burrs on the splines. Hubs should be checked where the pump gear, bushing and seal ride. If it is a bushing type ***(hub)*** a shaft should be inserted to verify proper fit.

From that point, torque converters will go to a lock up tester. It is important not only to test converters to make sure that they lockup properly but also to test for excessive leakage around the piston as well as testing internal components such as poppet valves. The integrity of a viscous clutch must also be verified.

From lockup the converter should go to the leak test machine. The torque converter is submerged into water and air pressure is applied to test for leaks. Air bubbles are an indication of faulty welds or other defects. Once leak checks are completed, the converter should then be checked for proper balance. If the converter is out of balance a weight should be welded to the O.D. as needed.

The best measure of the quality of a torque converter remanufacturer is comebacks, which all shops should track. But before placing a checkmark in the defective converter box ☑, make sure it is bad and not the transmission.

Transtar brand torque converters meet the stringent quality standards discussed here. They have to—Mike Riley is watching! If you haven't tried a Transtar torque converter yet, call your sales rep today and find out for yourself just how dependable Transtar torque converters are.