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CUSTOM TRANSMISSION BUILD

Words & photos by Derek Trent

These days when it comes to building a serious Ultra4 race car or rock crawler an automatic transmission is one of the most important and yet misunderstood items to consider. It is also the item that a lot of people choose to skimp on during a build and in my experience as a car builder it is usually the first part of the drivetrain to fail if an insufficient transmission is used. It is often said in the transmission industry that the budget stops at the flexplate because people are always willing to spend big money on the engine and don't understand why a top quality, custom-built race transmission is important until they are stuck on the side of the race course with a broken one.

The General Motors TH400 transmission has been the "go to" transmission in the offroad industry for years because of the durability of the internal parts. The weak link has always been the stock case. I personally have had a number of stock cases fail at both the tail and the integral bell housing. Another failure point is the internal locking lugs that will fail one at a time before losing all of them at once in a catastrophic failure. The 4L80E, being an evolution of the TH400, retains the same style of internal lug which is still a failure point in stock form. Each time this happened to a TH400 case I had a harder time finding a replacement case because the last factory produced cases were built in 1990. In 2012 Reid Racing released the heavy duty Super Hydra 400 transmission case and solved the problem of the stock case not being strong enough to handle use in offroad racing applications. Super Hydra 400 cases have now become the most common transmission cases used in Ultra4 racing.

Every season Ultra4 racing gets more competitive and the cars get faster. In the last couple of seasons the popularity of the TH400's successor, the GM 4L80E, has been on the rise. The reason is that the 4L80E has a 4th gear that is an overdrive. This allows builders to utilize different combinations of drivetrain gearing components. Axle gear ratios and transfer case gear ratios that were not used with the TH400 are now being utilized to maximize performance on race courses. The overdriven 4th gear allows higher speeds in low range and some builders are even using transfer cases that are used in monster trucks that don't have a high range at all.

Competition inspires innovation and Dennis Reid, the owner of Reid Racing, understands this better than anyone I know. He is no stranger to engineering and designing a transmission case. In the '90s

he started producing the Superglide transmission case, a stronger replacement for the GM two-speed Powerglide. The Powerglide transmission is very popular for drag racing because of its simplicity and strength. However, its case was weak so Dennis developed the Superglide case. The Superglide case is SFI 4.1 certified and does not require internal or external shields like stock Powerglide cases do. This safety margin is carried forward on the SH400 and Super 80 too. With tens of thousands of Superglide cases sold it is a product that paved the way for the development of the Super Hydra 400 and Super 80.

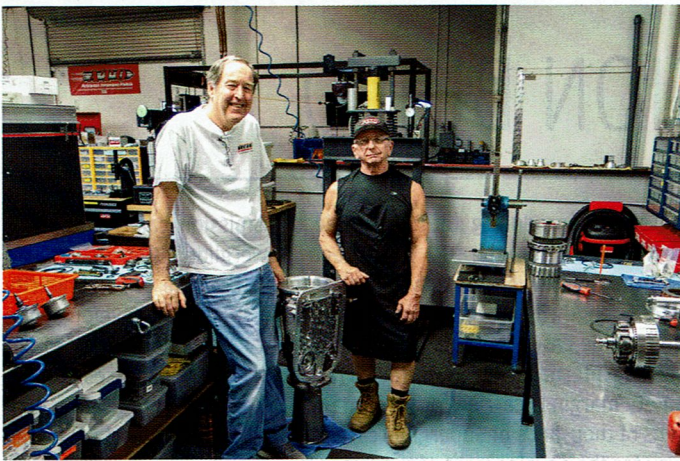
Since Reid Racing only builds transmission cases and does not offer complete built transmissions you will need to find a competent race transmission builder to put together a Super 80. My choice is Jim Galatioto, owner and founder of ATO Performance in Rancho Cordova, California. Jim has over 45 years of experience building automatic transmissions and developing new components. If you are looking for a full manual/fully mechanically controlled Super 80 then Jim is your only option in the world right now. Jim's Super 80 transmissions don't have a wiring harness attached to them and don't need a computer to operate. Just like a traditional TH400, they are completely self-contained. Other builders offer full manual 4L80E and Super 80s but the E stands for electronic because they are electronically controlled. Jim built the world's first and only full mechanically controlled 4L80 valve body by hand on a manual mill. He starts with a factory electronically controlled valve body and modifies it by milling new fluid passages and plugging some of the old ones to eliminate the electronic controls. The ATO Super 80s feature an improved & cooler flow lubrication system and other internal improvements to increase the flow of lubrication throughout the transmission. Every transmission at ATO is built to order. Internal components are chosen by Jim for each build to accommodate the customer's needs and budget. **[C]**

RESOURCES

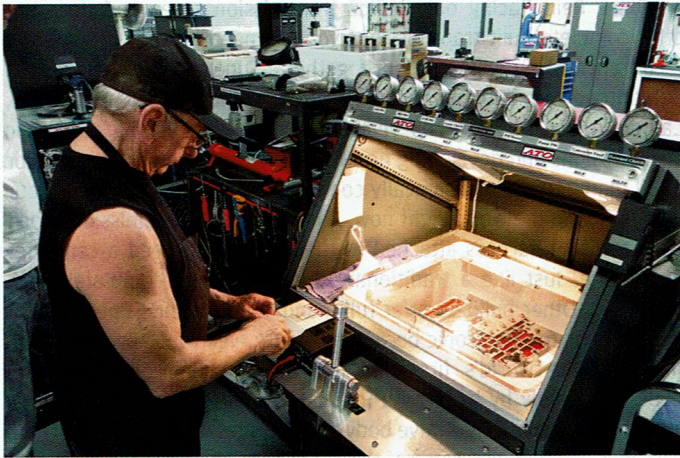
Reid Racing
www.reidracing.biz

ATO Performance
atotransmissions.com





Dennis Reid (left) and Jim Galatioto (right) get ready to show me how a Super 80 transmission is built. Jim is the builder and will be doing all assembly. He has prepared all of the parts for this transmission ahead of time and many of them were built or modified in house by Jim personally. Dennis is the engineer that designed the case and he will be explaining the differences between the Super 80 case and a stock GM 4L80E.



Jim built his own valve body testing dyno so he can test all of his custom built valve bodies without putting them in a transmission. It monitors pressure in 10 places and can be run through all gears.



While running the transmission through all of the gears, Jim watches the gauges to make sure the valve body works perfectly.

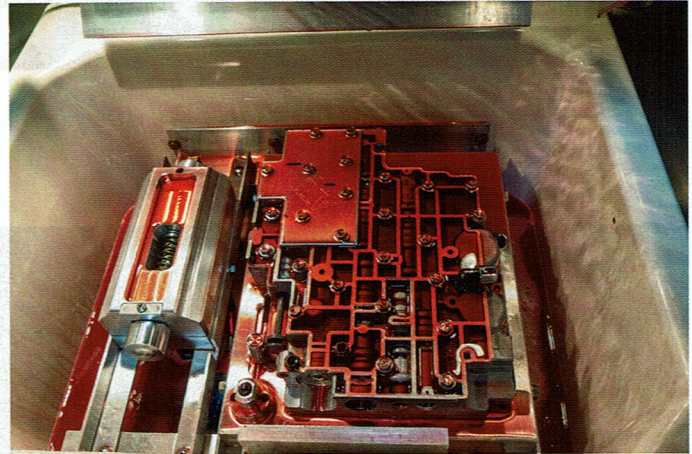


Jim and Dennis discuss pressures in each gear as Jim runs all of his tests. Jim's 45 plus years of building automatic transmissions really shows. He has built a shop full of custom built tools and equipment because in most cases they are things that can't be bought because before Jim built them they only existed in his mind.

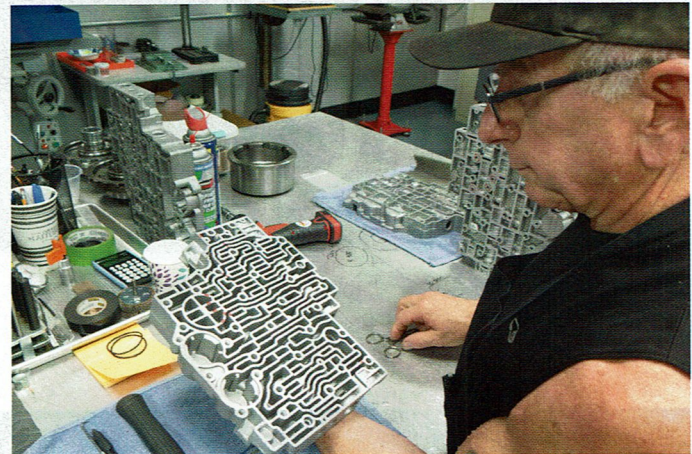
The heart of Jim's valve body dyno is an electric pump that simulates transmission pump pressure. Jim used all anodized aluminum fittings with steel braided lines and, with the exception of the electric motor, his dyno is completely mechanical and works off hydraulic pressure.



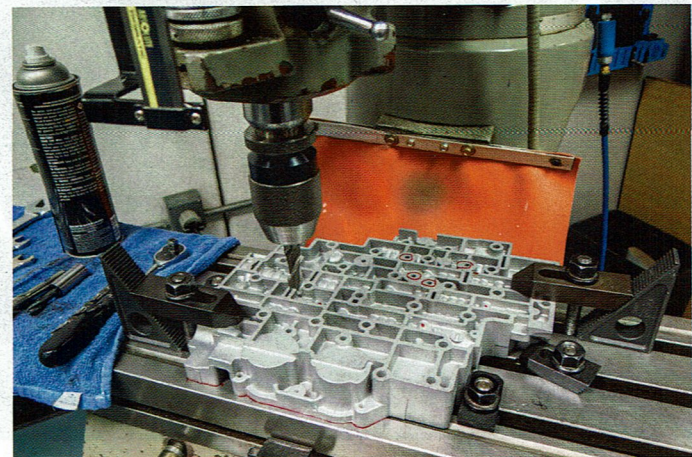
This ATO valve body passed dyno testing and will go into Super 80 case #21, the first Super 80 to be built outside of the Reid Racing testing program.

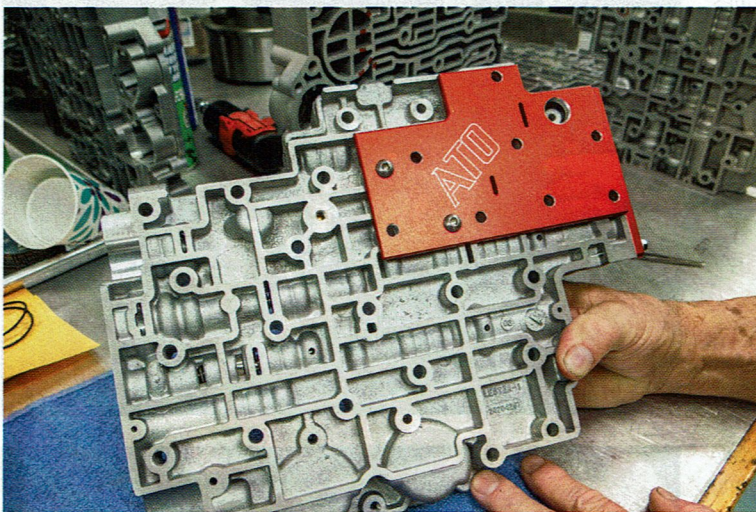


Jim starts with a stock GM 4L80E valve body. He marks all of the areas that will need to be modified.



Modifications are done on a manual mill by Jim personally.

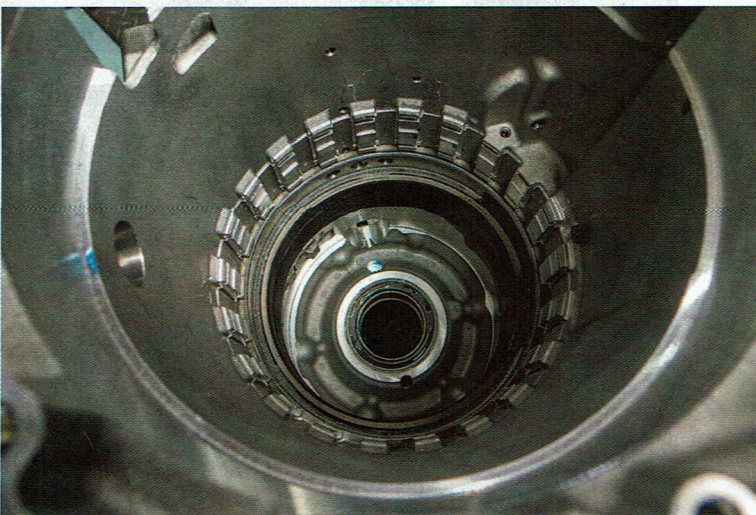




The finished product looks beautiful and, if you want a full manual-full mechanical 4L80 valve body, the only place you can get one is from ATO performance and it only comes in a fully built transmission. Jim will not sell the valve body alone.



This is the inside of a stock GM 4L80E case. The internal cast lugs that retain the center support and pressure plate only cover roughly 80% of the case's circumference. At high horsepower levels the lugs closest to the gap become overloaded and fail. This then sets off a chain reaction and all of the remaining lugs fail in a zipper-like fashion ending up in a ruined transmission case.



This is the inside of the Super 80 case. The lugs cover the full 360° circumference of the case. The Super 80 case is not only better by design, it is also formed using a better casting process for increased strength over stock cases. GM cases are die cast which uses different alloys than permanent mold casting which is how Reid casts their cases.

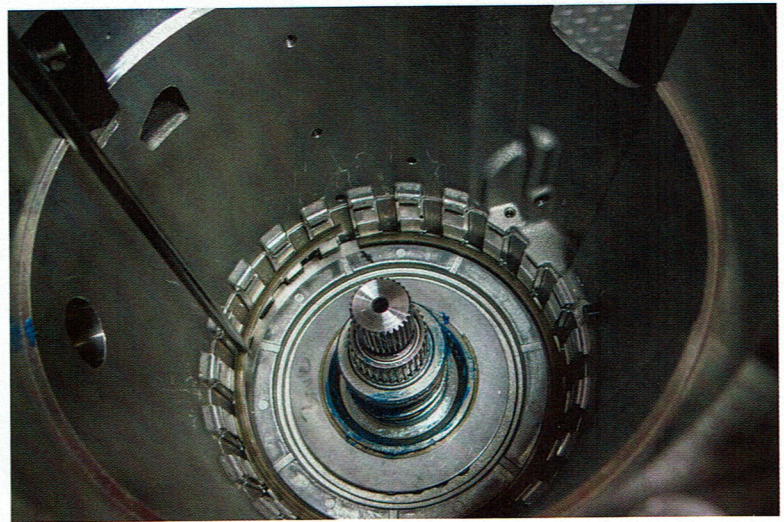
Reid uses A356 alloy heat treated to T6 temper. The "A" refers to virgin alloy with no scrap, it comes straight from Alcoa in pure ingots.

A356 and permanent mold use results in a strong casting that is extremely tough with exceptional ductility. Die castings and sand castings are brittle and break like glass; Reid's flex and pop back.

Jim lifts the first cluster of hard parts into the transmission case. The output shaft, 5 pinion straight cut planetary, center support, and immediate shaft are all installed together.

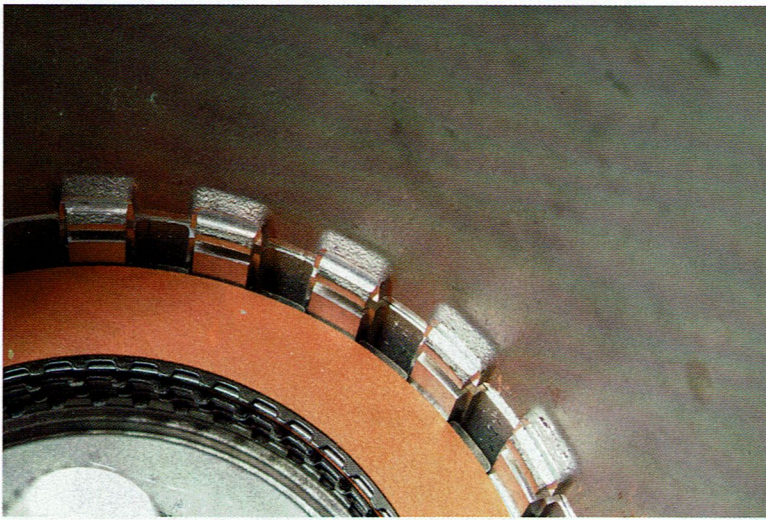


A snap ring that is larger than the factory GM one holds all of these parts in the case. Beyond the lugs is a groove that is machined into the case and runs the whole circumference of the case to give the snap ring 100% contact with the case.

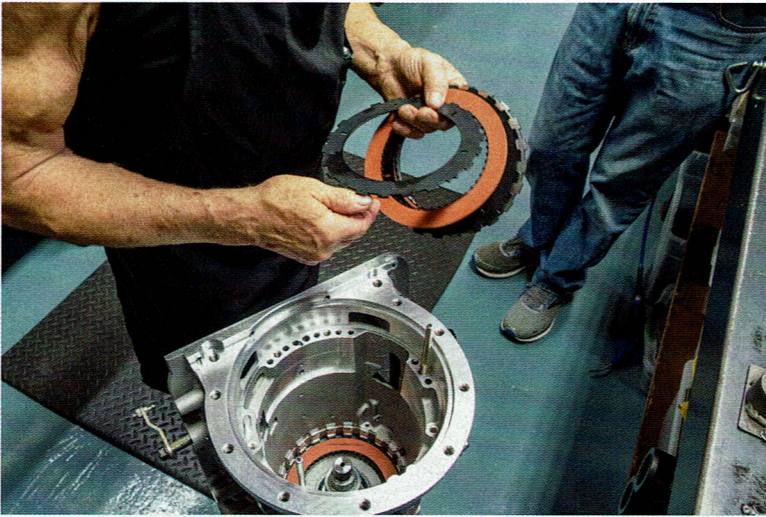


This is a factory snap ring on top of a Super 80 snap ring. The Super 80 snap ring is both larger and thicker than the factory GM. The outside edge of it fits into a groove that is machined into the case in the top half of the lugs section.

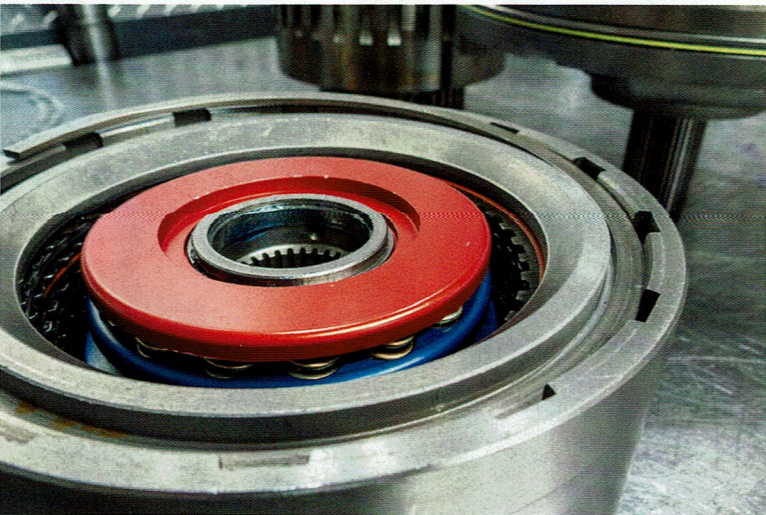




The groove is deeper than the voids between the lugs so that the Super 80 snap ring can make almost 360° of contact with the case. The only place it will not is the gap between the ends of the snap ring.



After the snap ring is installed the intermediate clutches that actuate 2nd gear are installed.



This is the direct drum and its return spring retainer. The springs disengage the clutches quickly when downshifting from 4/3 to 2nd to reduce drag. Jim uses an upgraded aftermarket assembly that has upgraded springs.

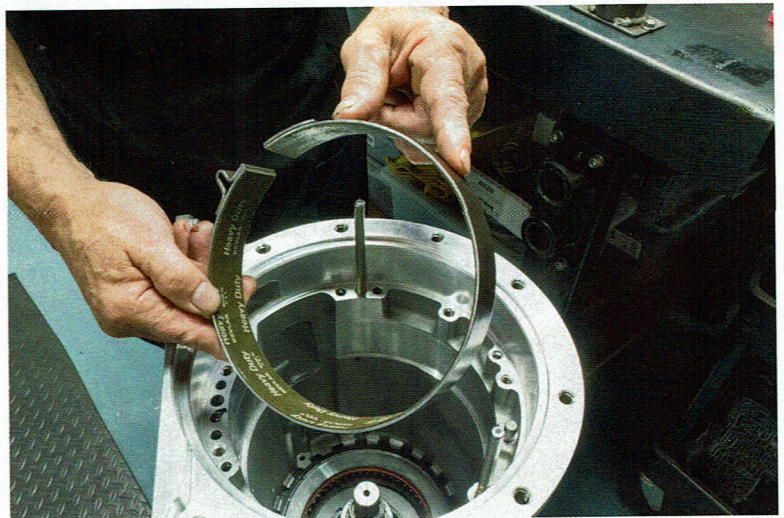
On the left is a factory GM spring. On the right is an upgraded spring from the aftermarket assembly in the last photo. It's a better quality spring with a flush taper for even pressure, like a coilover spring.

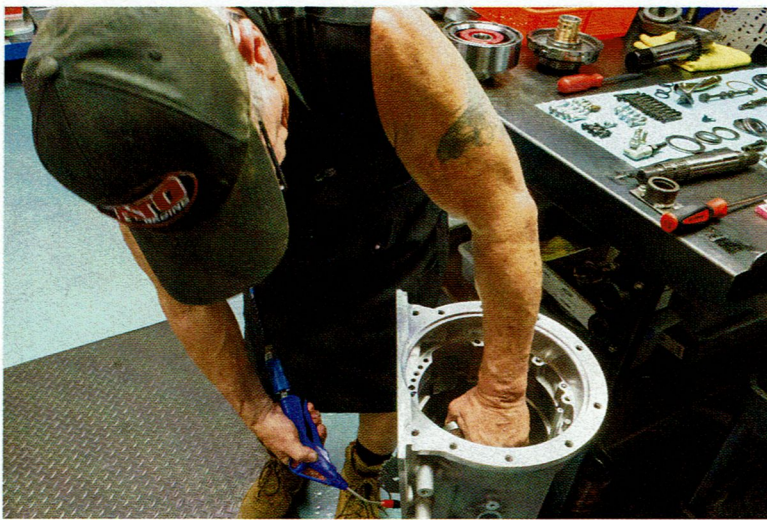


Jim uses air to seat the center support and intermediate pressure plate snap ring.



Then the band that actuates the 2nd gear compression braking is installed. Jim modifies this band in house by welding two parts of the band housing that are riveted together because he has seen the rivets fail.





Jim used a custom made tool to install the direct drum. The tool is put in place of the direct drum pressure plate with the snap ring 3/4 installed for ease of removal and then he lowers the assembly into the case. Once it's in the case the snap ring is pulled out so the tool can be removed and the actual pressure plate is installed followed by the snap ring.



Jim air tests the direct drum then installs the forward drum, and back half of the overdrive assembly.

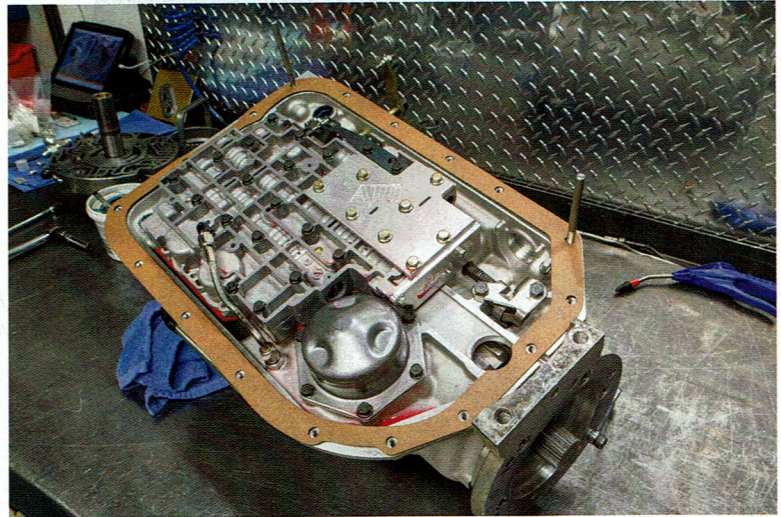


The turbine shaft, housing assembly, and overrun clutch are then installed and bolted in place from the bottom of the case. The circuit is then tested with air for proper function.

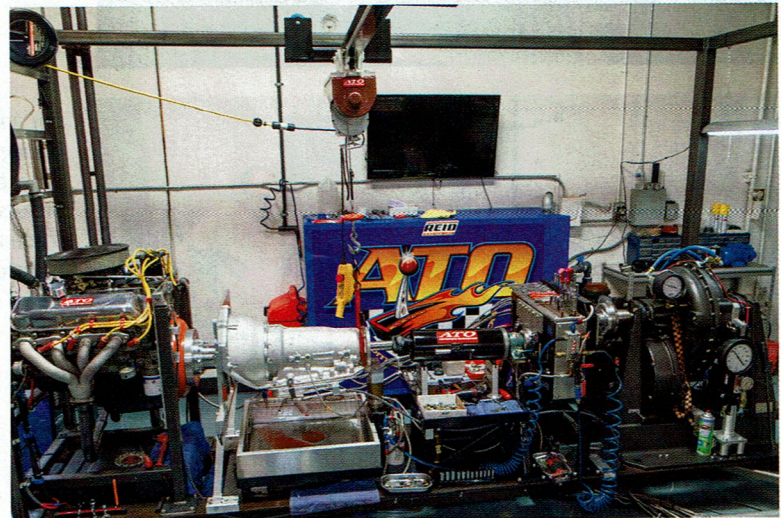
The pump is then installed and that is the last thing done to the transmission while it's in this position. After the pump is bolted on we picked up the transmission and put it on the bench.

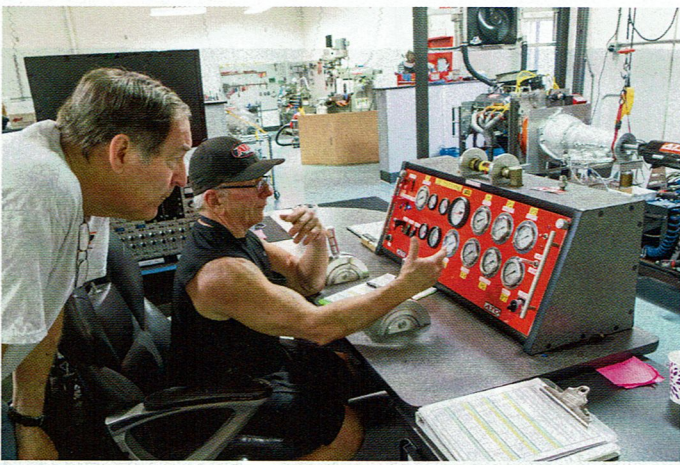


On the bench the transmission is flipped over so Jim can install the ATO full manual/fully mechanically controlled valve body. Then the filter, pan, bell housing, and torque converter are installed.

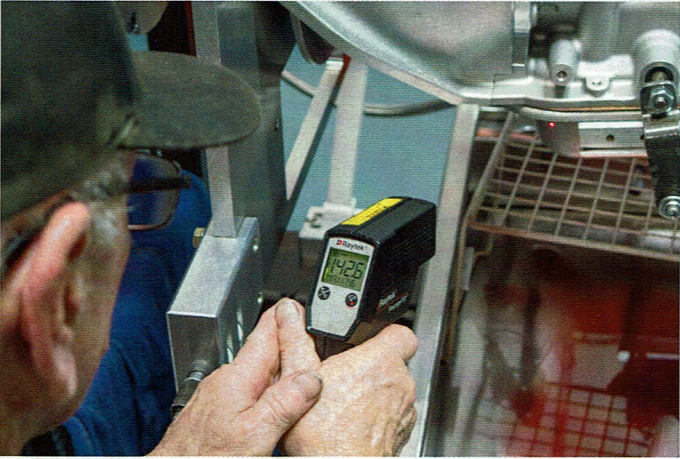


Then the transmission is put on the ATO transmission dyno for a test of all functions.

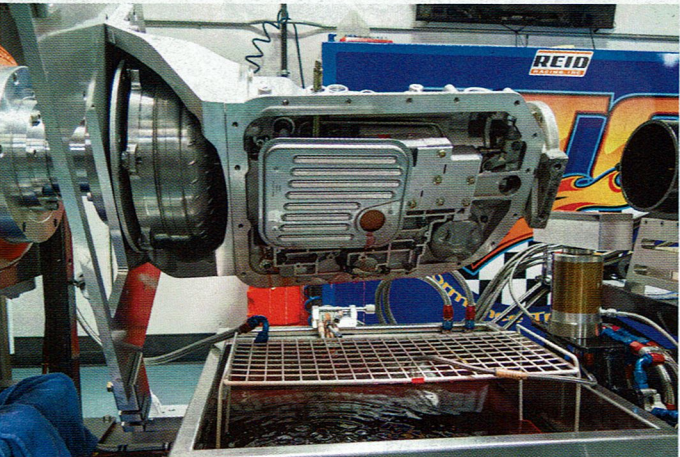




Jim and Dennis watch the gauges on the dyno while it is run through all of the gears. Like most of the specialty tools and equipment at ATO, Jim designed and built the dyno himself. The dyno gives Jim the ability to fully test every function of the transmission and torque converter without installing them in a car. When the customer picks up a transmission from ATO they can be confident it is race ready.



While the transmission is being run on the dyno Jim checks operating temperatures at multiple locations.



After Jim has given the transmission a full test on the dyno, the pan is removed to drain the fluid and the transmission is ready for installation.



Jim and Dennis work well as a team. If you do end up buying a Reid Racing Super 80 transmission case make sure you have it built by a builder that is familiar with building race transmissions and understands the top quality components that need to be put into them. If you want a 4L80 that is not electronically controlled then Jim at ATO is the only person to call.