The Porsche Type-915 Transmission; A Repair Tutorial Part I

By: Peter M. Zimmermann

Thank you to my 17-year old stepson, Michael Hartsfield, for the physical assist in accomplishing a task that, due to shoulder replacement surgery, would take me many months to complete.

We all know and love, or hate, the 915 transmission used in 911s between 1972 and 1986. There seems to be little room in the middle for ambivalence, the reasons are; (1) driver incompatibility, or (2) poor state of repair. I can't do much about number one, but I will offer some time-honored driving tips at the end (months from now) of this discussion. We can definitely deal with number two. Any reproduction, sale, or use, other than a repair guide for personal, individual use, of this tutorial is strictly prohibited without the express permission of the author.

This tutorial will take a while to get through, and I'll be available through this forum for Q & A, but I will not address questions that might jump ahead of the tutorial. I will discuss, and use photos, to describe the entire repair process, and include information regarding wrench and fastener sizes. There are different versions of the 915 transmission, even a few 4-speed models, but for simplicity sake I think that it's best to use a far more common 5-speed model from a 911SC, for this tutorial. Basically, 1972 – '74 models were fitted with a 7:31 ring and pinion, a mechanical speedometer drive, and built inside of a housing made from magnesium. 1975 transmissions were largely the same, but '75 was the first year to use the 8:31 ring and pinion, a stronger unit that also delivered better highway fuel economy due to its longer ratio. 1976 cars only saw one change, the switch to an electronic speedometer drive. 1977 was the last year for the magnesium housing, the first year for the earliest aluminum housings, and the first year for the clutch release mechanism that would be used through the end of 915 production; 1986.

So much for history, let's repair a 915 transmission!

Our "victim," aka subject, is an aluminum housing type 915/63 model that carries the designation "74D", which indicates that it's from a 1983 car.

Its gear ratios are: 1st – 11:35, 2nd – 18:32, 3rd – 23:29, 4th – 26:26, 5th – 28:23. Each gear set is made up of one "fixed" gear, and one "loose" gear. Fixed gears are pushed onto splines on either the main shaft or pinion shaft, as the application requires. Loose gears ride on a needle caged bearing, which in turn rides on a bushing that's pushed on to either the main shaft or pinion shaft. Each loose forward gear is fitted with a synchronizer assembly, and has a small amount of axial play to accommodate rotation.

The differential in our transmission is an 8:31 unit, which means that the pinion head has eight teeth, and the ring gear has 31 teeth, resulting with a final drive ratio of 3.88. As a reference, going back in time to the muscle car era of the late '70s and early '80s, a 3.30 final drive was considered a street friendly, mildly aggressive ratio, while a 4.11 final drive would allow a car to literally jump off the starting line, but still be

able to deliver highway cruising speeds without the tachometer needle flirting with red line in top gear. A 4.56 final drive ratio was also popular, but was really only suitable for drag racing.

OK, back to our transmission. It helps to pressure wash the unit prior to putting it on a stand, but disassembly can also be done dirty. I prefer clean, because it's less work (nuts don't get stuck in wrenches, hardware and dirt/grease don't get impacted in sockets, and fewer changes of latex gloves are needed). I'm all about efficiency, which is why you're going to see a heavy duty engine stand and professional tools used for this tutorial.

NOTE: You will remove the nose cover from a 915 transmission filled with oil once. Only once. Transmission oil will seep into your shoes, and between your toes, as you frantically try to push the cover back in place to stem the flow of oil. After that one experience you will never again believe the person who removed, or sold to you, a transmission, and told you that the oil had been drained.

As you can see in the photos, I put cardboard under the transmission, in addition to a drain oil pan. If you don't have a stand I urge you to build or buy one, or I must defer to you to devise a way to do this disassembly, and keep your work area tidy at the same time.

Remove the drain plug, drain what's in the unit, and put the plug back in – loose is OK. The drain plug tool, depending on the year model of the 915, will be either a 19mm socket/wrench, or a 17mm hex socket/wrench. The choice of tool is your decision; you can see what I use.

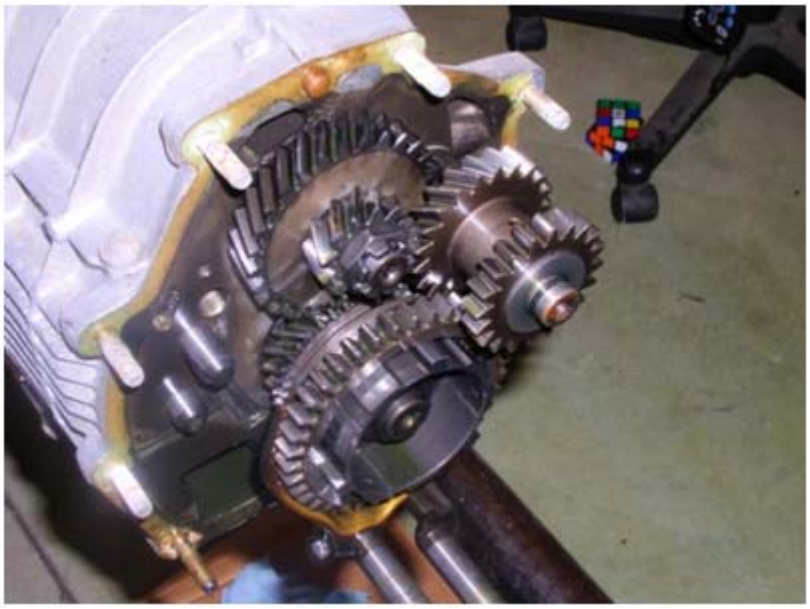
Remove the reverse light switch (22mm box end wrench), the switch activating pin (needle nose pliers), the throttle linkage bell crank (cut and remove the cotter pin), and, if the transmission has one, the small, right-angle metal bracket held by a cover nut just above the throttle bell crank. That bracket, and its strap, can be discarded; it was only used with the original clutch cable, but was determined to be unnecessary.

Remove all of the 8mm nuts (13mm wrench size) from the nose cover, and put the hardware and parts, except for the switch, in a tray suitable for cleaning.

Remove the nose cover by tapping on the raised surfaces pictured with a soft mallet
.

While tapping the cover support the underside of it with your free hand. This procedure can be anything from very easy to very hard, depending largely on who was in the transmission last. Good fortune has shined on us, it appears that our subject 915 might be a virgin and is literally falling apart in front of us. I've disassembled 915s that were assembled with everything from silicone sealants to epoxy-like compounds – each transmission is an adventure. This particular unit does not have sealant of any kind on its housing gaskets, which was how the original assembly at the Porsche factory was done.

OK, the cover is off, and set aside. In front of you, in all its glory, is the reverse idler, on the pin with the o-ring at its end, the small reverse gear (not synchronized), and 5th gear.



You can also see a sliding selector sleeve, the large, round gear with external and internal teeth, mounted on a shaft, for 5th and reverse, in addition to two large nuts.

You first step from this point is to grip the 5th/R sliding sleeve with both hands and pull it toward you past the straight-cut teeth on the reverse idler. This action will necessitate overcoming the pressure of a shift detent (to be covered later), so it's important to hold the part perpendicular to the "spider" gear on which it moves. It is not necessary to loosen or remove the fork, or the small roll pin that activates the reverse light pin, for this procedure.

The next step will be to use a dentist's pick, or similar tool, and remove the o-ring from the end of the reverse idler's mounting pin. Now the reverse idler can be removed, be aware that it turns on three bearings. Two are needle bearings that operate inside the idler gear, the other bearing is a flat bearing, the approximate size of a silver dollar, and provides a way for the idler to turn against its pin. Keep these parts in order, exactly, because if they are re-used they must be put back in the same places, facing the same direction.

Now you must remove the roll pin from the castle nut, which will require a good ball peen hammer, and an even-better pin punch. The punch should have a flat tip, with a shaft that is 4mm (5/32") in diameter. Carefully drive out the pin, being certain to not allow your hammer to contact any of the surrounding gears and parts. Removal of the two large nuts can be done in a variety of ways; I use an air-driven impact

wrench and ½" drive impact sockets. The castle nut requires a 27mm socket/wrench, and the collared nut requires a 36mm socket/wrench. If you choose to use hand tools; (1) the transmission must be stable, (2) the main shaft must be locked, and (3) a gear must be engaged to also lock the pinion shaft.

The tightening torque for the two nuts is 116 lb/ft (castle nut), and 181 lb/ft (collared nut), so bracing is important. If you're trying to loosen the nuts by hand, with the unit on a workbench, you'll be better off putting it on the floor and building some kind of fixture that will resist a heavy application of counter-clockwise torque. You will also have to build, or buy, a tool capable of holding (locking) the main shaft. This can be done by modifying an old clutch disc so that its splined center can be slipped onto the splines on the main shaft, in addition to being bolted to a piece of flat bar that can be secured to the bell housing using a bolt passed through one of the four holes used to fasten the transmission to the engine. Or, you can buy the factory tool, P37A (see next picture), from any number of sources.

OK, you have won the battle of the nuts. Before any gear removal happens, use a box cutter to cut up a large, clean, cardboard box into three 6"x18" sections, and place those on a clean surface close to you disassembly area.
Use the fingertips of both hands, and pull the spider gear, the part on which the 5/R slider slides, straight off the end of the pinion shaft and place it at the far end of one piece of cardboard. Every part that you will remove will be placed "away-side" down. You must be consistent with this; it's a discipline that will greatly improve your final product.

Next, grasp the half of the 5th gear set that is fitted with a synchro ring, with both hands, and pull it from the pinion shaft. It will have an internal needle cage bearing, as will all the other gears fitted with a synchro ring, and they all turn on a bushing. Be careful to not drop the bearing, or let it get turned around with respect to the gear. Sometimes the gear and bearing will come off without the bushing; if that's the case set the gear with bearing away side down, in line behind the spider. Then remove the bushing and place it away side down inside the bearing, which should be inside the gear.

Now you only have one part left on the pinion shaft, a thick spacer washer. Remove it, and place it in line behind 5th gear/bearing/bushing. Be aware that sometimes the spider, the bushing, or the spacer washer, will need a little coaxing for removal. You have a large variety of options, but always use something (a small pry bar, small screw driver, dentist's pick, etc.) that will not leave a mark on any involved surface.

Move up to the main shaft, and pull off the small reverse gear and place it to the side of the spider gear, away side down (different shaft, different row of parts). Remove the large remaining gear and place it on the cardboard, in line with the small reverse gear.

You have probably noticed numbers hand-inscribed on every gear (not on sliders). Each gear set is paired with a mate to insure long life and quiet operation; all gears must be matched by number, so if your transmission has a suspect past, now is the time to verify that nothing is mismatched.

Now, we rest. Until my next installment, keep the shiny side up!