

The Porsche Type-915 Transmission - Part VIII

(All of these parts are available to purchase through [RedLine Technik](#). For more information, call (310) 993-6440, or email us at RedLineTechnik@gmail.com)

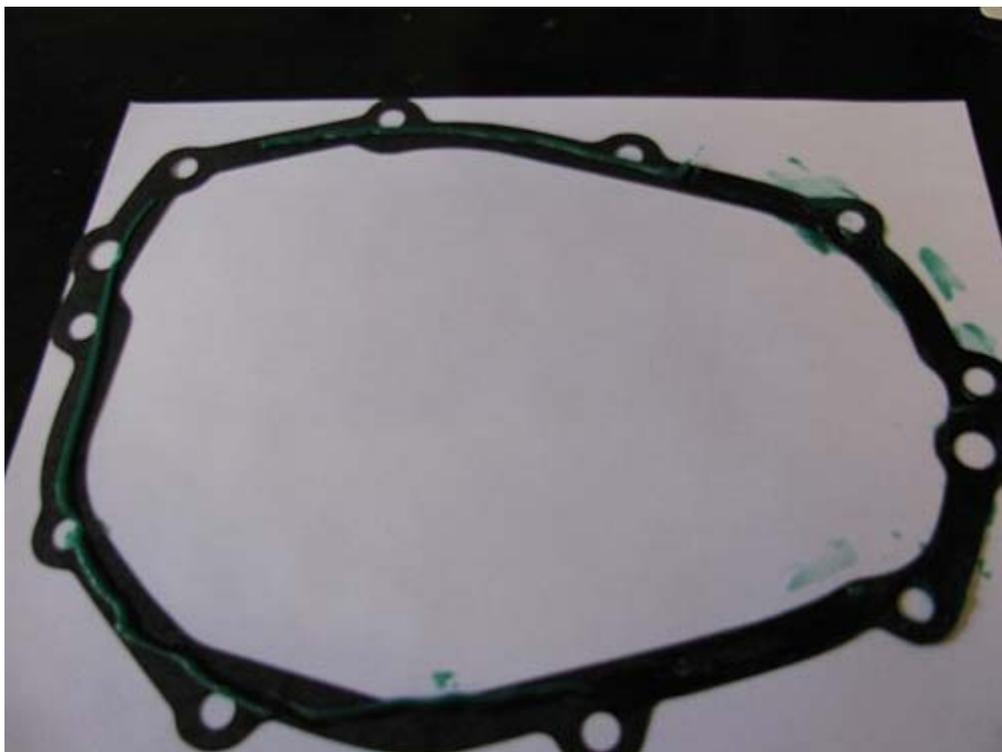
It's been an interesting journey, and now it's time to finish our subject.

We'll start with the final prep of the center housing, which means that we'll scrape away any remaining bits of gasket material still stuck to the three surfaces. A gasket scraper can be used for this, but I prefer to do it by hand using new, single-edged razor blades.



After the three surfaces look good, clean them with Q-Tips and lacquer thinner, and, at the same time, clean the differential housing sealing surface.

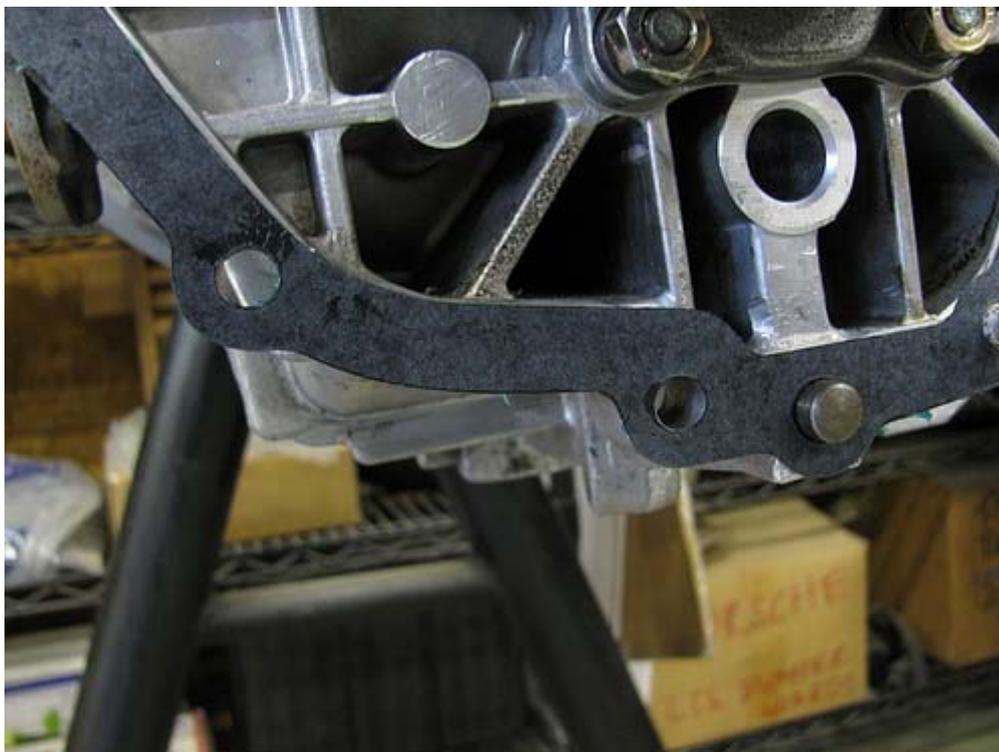
I'm sure there are many ways to accomplish the sealing task; I'll tell you how I do it. I put a clean piece of printer paper on my tool box, and I put the gasket for the center housing to diff housing on the paper – diff side up. I cut the cotton tip off of a Q-Tip, and, after I put a thin bead of Curil T sealant onto the gasket...



...and then use the Q-Tip's shaft to spread it evenly across the gasket.



After the gasket's surface is covered, put it over the studs on the diff housing and gently seat it against the aluminum, paying particular attention to the two holes that the pair of lower studs on the center housing will pass through.



NOTE: This is the first gasket kit that I've ever used that came with a black gasket. You never know what you're going to get, but if you stick with o.e. kits you'll always be OK.

Care must be taken to not tear the gasket while installing the housing. There are few things that will deflate the bubble of euphoria as quickly as a torn gasket, especially if you only have one!

Back to the center housing. Put it on the bench with the diff housing side up, lay a bead of sealant on the sealing surface, and spread it evenly.



Slide the shift rod into the housing (put a dab of white grease on about an inch of the rod's tip)...



...and put the housing over the gear stack. Check to be sure that the pesky upper detent is where it should be, and begin to push the housing into place. As you get close to the diff housing, push the shift rod into its hole, and get those two lower studs into their holes. You will probably have to turn/wiggle the main shaft and pinion shaft while you're doing all of this, which helps the shaft bearings engage the races in the housing.

Once the housing is far enough on to engage its pair of locating dowels, it might require a gentle tap with a mallet to seat it, but more often than not a firm shove does the job. Now you're going to learn something that I've shared with only a handful of people throughout my career.

First; a little history is in order. In the late '70s and early '80s I put 356 after 356 up on my hoists at Red Line, and just about all of them leaked from their differential side covers, which were sealed using paper gaskets. Transmission fluid stinks, and leaves ugly spots on the floor, and the seepage nagged at me. I knew that 911 engine cases were assembled using aluminum sealing washers under the nuts on their 8mm perimeter studs, so I figured, "Why not try that?" I had a particularly "wet" 356 in for service that day, so I removed a lower side cover nut and its wavy lock washer from a diff housing stud. As I did that a few drops of oil dripped to the floor at my feet – from the stud hole in the diff side cover.

I washed the area that showed seepage with cleaning solvent, and one by one I put a 911 rocker cover/case sealing washer, followed by a new wavy washer and nut, on each stud. I torqued each nut to 17 lb/ft, and did the procedure to all of the studs that were at or below the internal oil level of the transmission. That car returned after about 3,000 miles (this was back when people still drove their 356s daily) for routine service. I put it up on a hoist, and stood under it almost dumbfounded. The diff housing area was dry and clean; I had never anticipated that level of success.

From that day forward I have used an 8mm sealing washer on every stud (that secures a surface sealed with a gasket) of every transmission that I've repaired. My transmissions stay dry and leak free for well past 100K miles, and rarely show seepage at assembly joints.

NOTE: Not all sealing washers are created equal. There are washers made in Germany that are found in high quality engine gasket and rocker cover gasket kits, including those assembled by Wrightwood Racing available through RedLineTechnik.com. The washers are a dull gray finish...



...and will not crush as the required torque spec is reached. Other washers come from Taiwan and who knows where else, have a shiny, silver finish, and are junk. At far less than 18 lb/ft of torque they will crush and collapse into the fastener's threads, which is not what you want to happen.

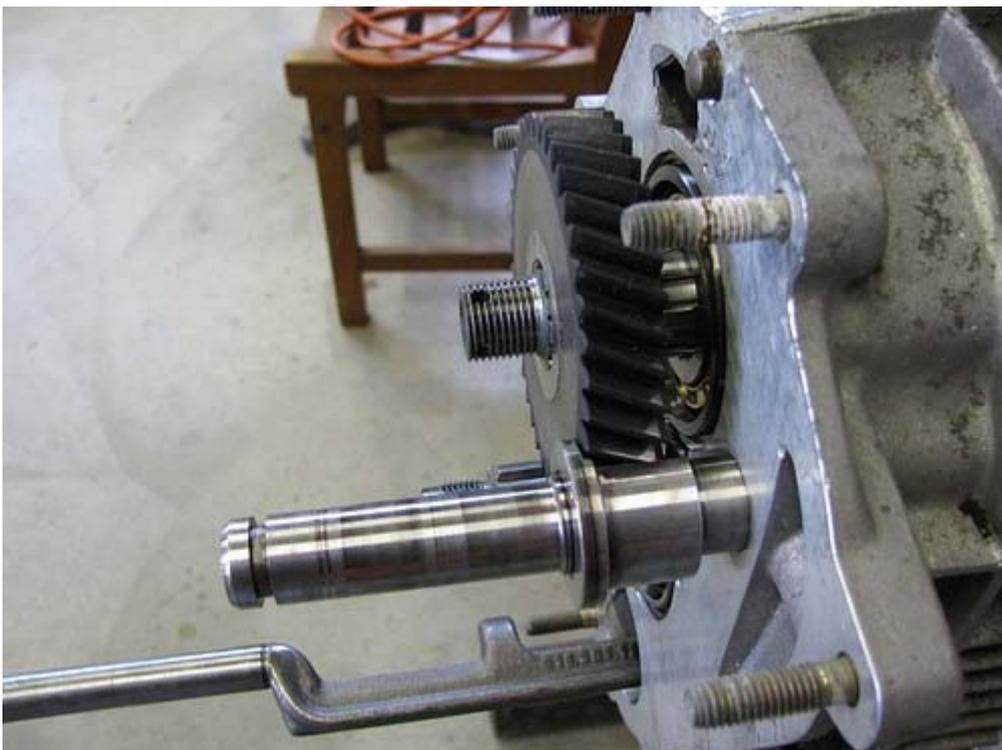
NOTE: Our host, redlinetechnik.com has a kit available that contains 35 nuts, 35 wavy-type lock washers, and 23 sealing washers, along with a tube of Curil T sealant.

Put a sealing washer on each stud, followed by a wavy washer and nut.



As was the situation with the clamping plate nuts, unless you own a Stahlwille torque wrench set that can torque fasteners that a mere mortal wrench can't, tighten the nuts in a crossing pattern until they're all snug. Use the box end of your end wrench and try to get each nut as close to 17 lb/ft as possible. If necessary, practice some more using that bolt and nut that we had in your vise.

OK, we're done with the center housing. Now it's time to install 5th and reverse gears (yes, I found a good, used, 5th gear to replace the bad original gear). We put the gears on to measure backlash, and again to set shift forks 1st – 4th. This time we need to use more parts, specifically the reverse idler, its bearings and mounting pin. The pin must be installed together with the gear, of the 5th gear set, that fits on the main shaft.



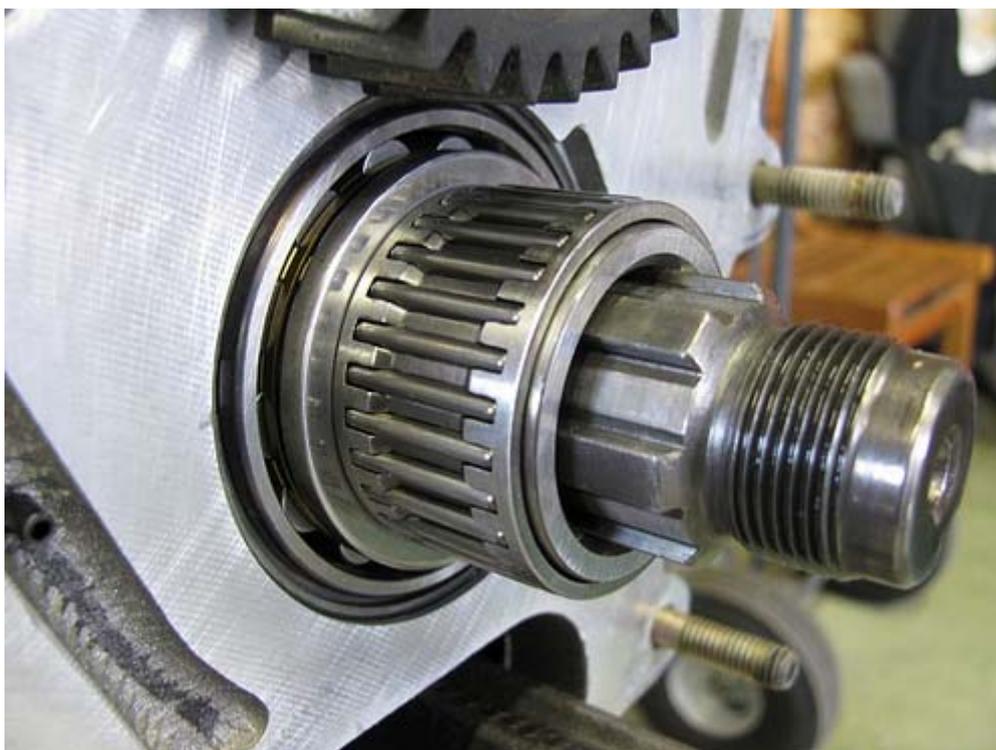
Next, slide on the small gear (as always check its contact surfaces for wear or tearing), followed by the castle nut.

NOTE: The small gear is always installed by the factory with the matching gear number facing out, but you can "read" the wear pattern if in doubt.

Move down to the pinion shaft and install the thick thrust/spacer washer...



...followed by the 5th gear needle bearing and its bushing. Yes, that's a new bearing and bushing, because our almost perfect replacement gear did not include those parts.



Install the loose gear for 5th speed, the 5th gear slider guide, the small gear for reverse, the main shaft

castle nut and a new pinion shaft flange/collared nut. Snug down both nuts.

NOTE: The small gear of reverse, and the reverse gear idler, are marked with hand-inscribed numbers that, like other gear sets in the trans, must match.



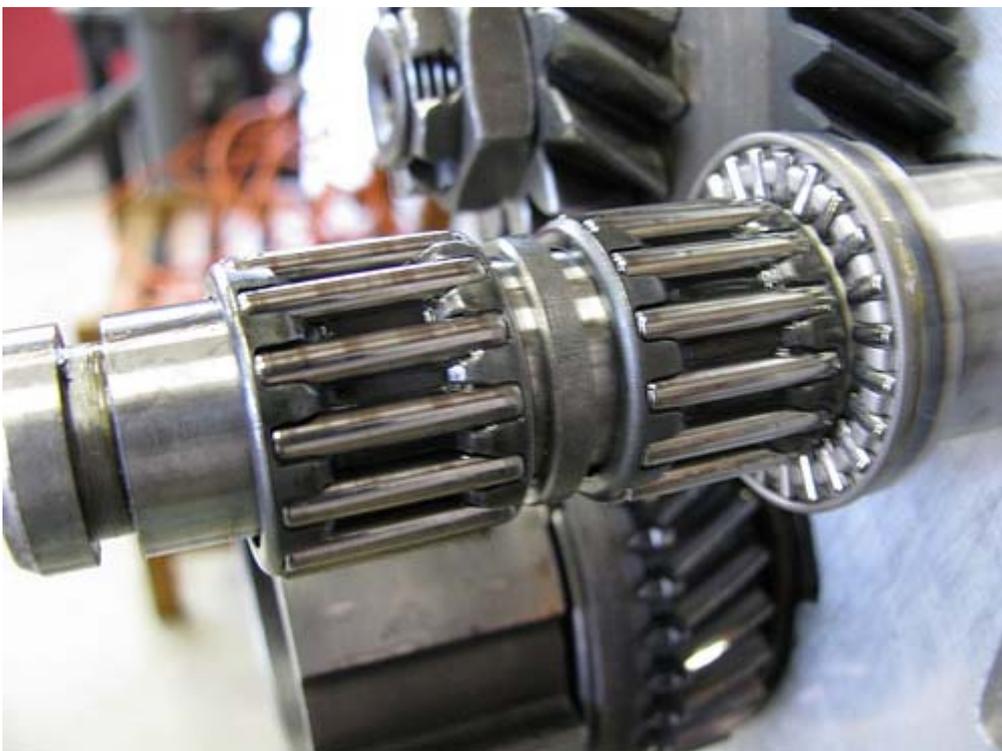
Before going further, carefully examine the bearing surface at the end of the idler, and the corresponding surface on the idler mounting pin.



No wear-through of the hardened surface, or tears in the bearing surface, is acceptable. If damage exists on either part, the best thing to do is to replace both, and the flat bearing. Put a dab or two of good quality bearing grease on the idler gear's flat needle bearing...



...and slide it onto the idler's pin. The grease will insure that the bearing stays in position during assembly (it can hang up on the pin's shoulder and make a mess out of everything). Install the pair of idler bearings, with their spacer ring in the middle.



Slide on the idler, followed by the flat washer.



Put the new o-ring from your gasket set into the machined groove at the end of the pin.

Remember how we removed the 5th/R shift fork and shaft? We pulled it past its detent, without loosening the shift fork bolt, or removing the pin that activates the reverse light switch. We will put it back the same way, by overcoming the detent. Be sure that the 1/2 and 3/4 shift forks are in neutral, coat the tip of the 5/R shift fork rod with white grease, line up the slider with its guide, line up the teeth on the slider's OD with the reverse idler, and push the shaft home.





Install your P 37A main shaft lock, engage 5th gear, and torque the pinion shaft flange nut to 186 lb/ft. Immediately lock the collar of the nut so you know that it's done. Once again always use new nuts.

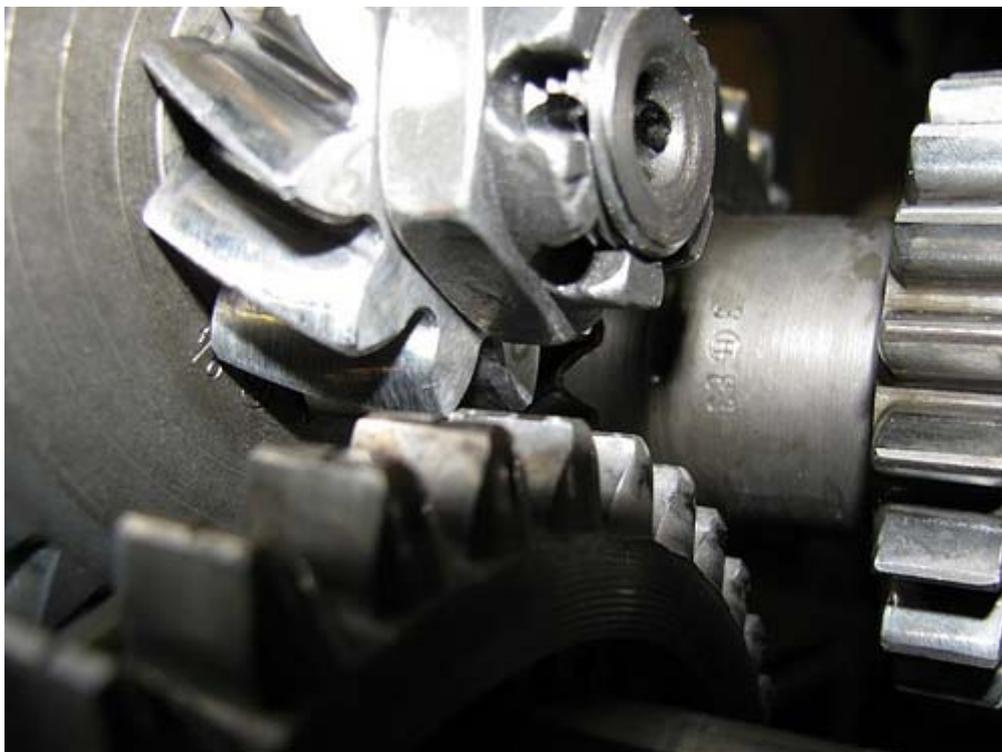


Put your 36mm socket away, get out your 27mm socket, and set your torque wrench to 116 lb/ft.

NOTE: As 915 production evolved, the torque specs for the three major fasteners changed, but, for now, I'm only interested in the specs for the 1983 model year. The different torque specs, for different model years, will be discussed in Part IX of this Tutorial.

Torque the main shaft castle nut to spec, remove the socket, and check locking pin hole alignment. There are times when the castle nut recesses do not align with the lock pin holes in the main shaft.





NEVER loosen, or over-tighten, the nut in order to achieve alignment! It must be removed from the shaft and have a small amount of material removed from its contact surface. Use a flat surface on which you can put a piece of emery paper, then hold the nut firmly and do figure-8s with it against the paper. Go slow with this, I've had nuts that I've had to put on, torque, and take back off four or five times before a recess in the nut lines up with a hole in the main shaft. Install the locking roll pin.



OK, have patience, we're getting close! First we have to check/set the adjustment of the 5/R slider. There is no "middle" for 5/R, so ignore the distance between the slider and the 5th gear synchro ring. 5/R adjustment is all about the clearance between the slider and the straight-tooth gear on the reverse idler.

The clearance is set at 1mm, and measurement is done by holding the idler against its flat bearing, with

one hand, and gently pulling the slider toward the idler until no play exists between the slider's groove and the shift fork. Loosen the shift fork bolt and adjust if necessary. When the clearance is correct, torque the shift fork bolt to 18 lb/ft, and re-check the adjustment.



NOTE: If for some reason the reverse switch pin in the shift fork rod was removed, insert it so that about 14mm of the pin projects from the shaft (do this prior to fork/shaft installation).



Prepare the nose cover for installation by removing any gasket remnants still on the sealing surface, and then use Q-Tips with lacquer thinner to clean that area as well as the orifice for the shift fork seal. Because there is a chance that someone has replaced the shift fork seal at an earlier time, it is probable that the aluminum recess where the new seal will fit is scarred. We'll do two things to assure a dry nose and a clean

center tunnel free of transmission oil contamination.

To ease seal installation, I use a Burr-Quick tool, pictured below...



...to put a nice finish on the entry point of the seal's orifice.





Hold the seal so that you can put a very thin layer of Curil T on the outside surface of the seal, and then push the seal into place. The sealant will offset any small imperfections in the aluminum, and create a seal that will prevent trans oil from escaping around the outside of the seal.

"How do I know if the seal is in straight?" you might ask. Good question, after the seal is in place turn over the nose cover and sight down the shift rod's orifice. If the seal is installed correctly, the part of the seal lip that's visible will be of a consistent dimension all the way around. If the seal is crooked you will see more of the seal at, for example, 9:00, as compared to how much you can see at 3:00.



OK, let's install the seal. A driver can be made from wood, metal, or just about anything that you have lying around, as long as it fits inside the seal recess because the seal does not fit flush.



For what it's worth, I use an old 17mm socket that has never been used for anything else, and I ground its end, where it contact's the seal, flat to increase the surface contact area.

NOTE: Be aware that not all shift fork seals are the same size! They will look identical, but seals for 915s are 15mm ID, while some 914s use a 14mm ID seal. Always (use a magnifier if needed) confirm, by reading the tiny numbers on the seal, that the first of the three numbers is a "15."

As we did for the center housing, place a clean sheet of paper so that you can put the nose cover gasket on it, center housing side up.



Do the Curil T/O-Tip deal, and gently push the gasket over the studs and press it against the housing.

Near the tip of the shift fork rod is a hole that faces up, where the screw that secures the shift coupler attaches. Check the rod around that hole, and be sure that there are no sharp edges that could cut your newly installed shift fork seal. If in doubt, use a small file...



...or emery paper, to clean away any rough edges, and then apply a thin coat of white grease to the tip of the rod. Add additional grease to the o-ring on the reverse idler mounting pin. Clean the gasket surface one more time, with lacquer thinner and Q-Tips, and apply Curil T. Install the nose cover. A gentle push, maybe a little tap with the heel of your hand to engage the idler pin's o-ring, is usually all that's necessary to seat the cover against the center housing.

If your transmission had a metal bracket...



...with or without the remains of a fabric strap attached to it with a 6mm bolt, on the stud above the throttle lever (aka bell crank) mounting pin, discard it. The factory determined, after the fact, that there was no need to have the clutch cable Bowden tube held by the strap/bracket.

As you look at the studs you will see that the one in the lower left corner (lower right in driving direction) is longer than the others. This is where the transmission ground strap attaches, and the strap should be sandwiched between two 20mm OD x 2mm thick flat washers, followed by a wavy washer and nut.



The correct installed position for the strap is straight out to the right (driving direction) side.

Two studs up from the ground strap is where a metal bracket...



...should be installed. This bracket can be horribly disfigured by mechanics in a hurry to remove the engine and transmission from a car; and the factory wire Ty-rap (shown) is usually cut (shown) rather than released (recommended).



The correct replacement Ty-rap might be NLA (No Longer Available) from Porsche, so a substitute Ty-rap from any number of sources can be used. The Ty-rap secures the plastic tube through which the wire harness for the reverse light switch is installed. OK, torque the nose cover nuts to 17 lb/ft, and don't forget the nut at the bottom, center position, it can hide from you! Regarding the reverse light switch, don't immerse it into a cleaning medium; just wipe it off with a shop towel dampened with lacquer thinner. Insert the switch pin into its hole with the narrow diameter tip facing the switch, screw in the switch and tighten it.



The drain plug is visually the same as the fill plug, except for a small magnet. That magnet should be cleaned thoroughly because it's probably holding onto a lot of debris. Inspect the corners of the plug's in-hex design, if your socket fits nice and snug, re-use the plug.



Torque it to 17 lb/ft, and don't use sealing tape, anti-seize, or sealant on its threads.



NOTE: If the transmission is scheduled for immediate installation and use, I don't install the fill plug until after the transmission has been filled. If it's put into storage, I insert the fill plug a couple of threads, and tag the unit with a reminder to fill it at installation.

While the transmission is upside down let's install the shift fork plate. Other than gasket surface prep, and making sure that the shift rod's selector "finger" is in place, one issue needs to be handled. There are three 6mm nuts that secure the fork to the plate, and I have found these loose on a handful of transmissions. Use a 10mm wrench to snug them down, or torque them to 6 lb/ft (72 lb/in).



I can't remember ever having to do a thread repair to an aluminum fork plate, but Timeserts work well in this application. With the three nuts tight, Q-Tip the gasket surfaces, apply the Curil T, and install the fork/plate. Use the same combination of sealing washers, wavy lock washers and regular nuts. Torque the nuts to 17 lb/ft.

Stand back and look at our work! One 915 transmission ready for duty, in a car owned by a driver who will care for it, shift it properly, and be tolerant of its quirks. This would normally be the end of this Tutorial, but I've decided that more needs to be said, so Part 9, the 915 in review, will appear shortly after this part.

Here's the obligatory sales pitch! Our gracious host, redlinetechnik.com, will make this very transmission available, on either an outright sale (\$4,400), or an exchange basis (\$4,000) effective with the posting of Part 8 onto the web site. An exchange is determined by internal condition, and must have a serviceable ring & pinion. For those of you located within a reasonable distance from Long Beach, CA, an expert, technically correct, installation performed by Marc Bixen will be available, and will include a fill with proper oil, shift linkage adjustment/evaluation, clutch evaluation/adjustment, and a careful test drive. The buyer's only worry will be the delivery of the car to Red Line Service, and Marc will take care of the rest. Marc will not mark up the transmission, and will only charge installation labor plus parts (CV joint gaskets, oil, etc.). The buyer's car will also become a future Tutorial! Marc has agreed to photograph the engine/transmission drop process, as well as installation/adjustment, and use this Tutorial's format to produce a Tutorial for that process. If you have questions please use the contact information on this web site. Thank you!

Don't forget to look for Tutorial Part 9 in a couple of weeks!