

M40/M41 Transmission DISASSEMBLY

Restoring an M40 or M41 Volvo transmission to perfect working order is not nearly as intimidating a task as it first appears. You will need a few tools beyond what's in a typical basic kit and a certain amount of organization is required, but the only thing most of us won't be able to do at home is pressing in new main bearings. The total cost of tools, parts and pressing is far less than most shops will charge for a rebuild of uncertain quality.

Please see the ["How it works" article](#) to get an idea of what's what inside one of these gearboxes.

We are not covering rebuilding an OverDrive unit in this article; that's a separate subject for another time. Once the OD unit is detached, the M41 rebuilds almost just like the M40. We'll note the few differences for you as we go. [M40-only procedures are contained in brackets.] *M41-only procedures are denoted by italics.*

You will need:

- A clean, uncluttered working surface. There are a lot of small pieces involved and you need to be able to lay them out in recognizable order where they won't be disturbed. Cleanliness is particularly important when working on an M41 -- any dirt in the gearbox will be pumped right into the OD unit and do its rubber seals no good at all.
- A few small jars or plastic bags to keep the really losable parts in.
- A press or access to a shop that can do pressing for you (read the section on "Putting it back together" below for details).
- Your standard tool kit.
- [M40 only: A large socket to fit the output flange nut (either 15/16" or 1-1/8", depending on year).]
- A 3/16" Allen wrench for putting the front bearing cover on and off.
- A really big gear puller -- a long reach is more important than enormous pulling force.
- A heavy hammer.
- A small punch, something under 1/8" in diameter. You can improvise -- I've successfully used a #16 nail with the point ground flat.
- A 12" (or longer) metal pipe or rod, about 1/2" in diameter, to use as a drift.
- A length of copper or plastic pipe to use as a "dummy" countershaft spindle. You'll need to be able to hacksaw this accurately to the length required. Diameters vary with the year of the tranny being worked on -- the diameter must be the same as, or slightly less than, the spindle's. If you're handy around the

house, you may already have something that can be adapted.

- Strong snap-ring pliers.
- A small amount of axle grease -- the sticky petroleum-based kind (not white lithium or black moly).

Some of you may think that list is pretty long -- but just think: one trip to a big hardware store and a \$50 bill will get you everything you need (except a press). A trip to a transmission shop and a \$50 bill will possibly get you a detailed estimate and a torn-apart transmission -- if you're lucky. I consider this thought motivational.

Parts: what wears out?

- Gaskets and seals -- probably best to get a kit, and supplement it with individual parts from Volvo if necessary. The M41 gearbox does not use a rear oil seal (it's part of the OD); if you have an early M40, the kit rear seal may be the wrong size. Obtain the correct one from Volvo or a local industrial bearing house. Most kits won't include the round gasket that goes between the OD and M41 gearbox adapter; Volvo has it.

- Main bearings -- several sizes and styles. I recommend you remove the ones you have, take them to the local industrial bearing house for measurement and buy replacements there. They will be less expensive and you'll know you have the right ones.

- Synchro rings -- these are expensive and you may not need to replace them. If your transmission was giving you good downshifts and staying solidly in gear, you might consider reusing the ones you have. They will not be the source of any noise you're trying to get rid of, in any case.

- Wire spring clips for the synchro assemblies (four required). These lose their springiness with age and also get grooves worn into them from use. You can get a set of four from Volvo for about \$5 -- do it!

- Thrust washers (a brass washer at each end of the countershaft to take up any endplay between shaft and case) -- we would once have replaced these as a matter of course; now most are NLA from Volvo (several part numbers, depending on age and model of transmission). If you can get them, do so and don't throw away the old ones. If not, your old ones may well be OK to reuse unless the tranny was run without oil or was otherwise damaged.

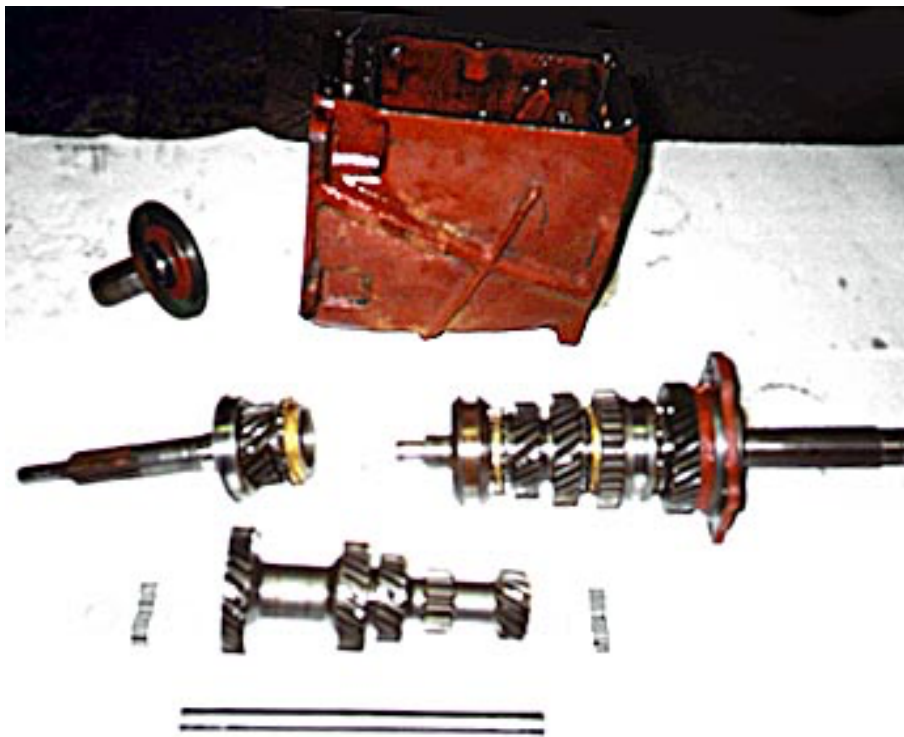
Beyond that, clean and inspect everything that comes out of the gearbox, particularly the polished surfaces on steel parts. These are "case hardened," meaning they received a heat treatment when they were made that toughened the outside of the part -- but only a thin layer. Perceptible wear on those surfaces means the soft underlying metal is exposed (or about to be exposed). You likely won't encounter this -- it's more in the "damage" category than "wear," but look for it on bearing surfaces, rollers, etc. Don't even think of reusing such damaged parts.

Taking it apart:

Before we do this, drain any oil out of the gearbox (and OD). Clean off the large amount of dirt that's probably coating the unit. *M41 only: Undo the eight nuts where the silver OD unit bolts to the red gearbox adapter and separate the two. Mop up the mess where a bunch more oil just gushed out of the OD. Wrap the OD in clean newspaper so dirt can't get inside and put it away somewhere until the end of this article.* Place what's left on your clean, tidy work area.

Again, what follows might seem like an excessively long list, but take my word for it: once you have your tools and parts in place and have had a little practice, this can be done in a few hours. If this is your first time, allot a leisurely weekend to the process. It really can be done.

First, we're going to take it apart about this far:



Here we go.

- Remove the top cover and gasket. Toss the gasket and set the cover aside.
- Pull out the three springs sticking up from the top front of the case and store carefully. The balls under the springs probably won't go anywhere for now, but don't bang the case violently upside down or anything until we fish them out later.
- [M40 only: Push the center and left-hand selector rods forward all the way together. Turn the input shaft while you do this and take it in small stages. If

damage prevents them going forward, back is just as good. This selects two gears simultaneously and locks the shafts so they can't rotate.]

- [M40 only: Undo the flange nut at the very back of the transmission. Now you see why we locked the shafts.]

- [M40 only: Using your large puller, extract the flange from the rear bearing housing. Now, return the selector rods to neutral position.]

- [M40 only: Remove the bolt at the rear of the speedo drive, grasp the threads where the speedo cable screws on and pull the drive gear unit straight out of the bearing housing.]

- Undo the two Phillips head screws holding on the rear selector rod cover and remove it.

- Undo the three Allen head bolts that hold on the front bearing cover and remove it.

- *M41 only: Hammer back the locking tabs on the four bolts that hold the OD adapter casting and the rear bearing housing to the case and remove them. Pull off the adapter casting, but leave the bearing housing in place for now.*

- Using your small punch and hammer, drive out the rolled pin that holds on the rear fitting on the center selector rod. Rotate first gear (the rearmost one) so there's enough clearance for the pin to drop out. If it falls into the case, leave it there for now.

- Undo the screw that locates the 1st - 2nd yoke to the center rod. Pull the rod through its fittings right out the rear of the case. Lift out the yoke -- do not lose the two tabs at the bottom that contact the synchro locking ring.

- Remove the right-hand rod and then the left-hand rod in similar fashion.

- Poke the three balls in the front top of the case up through their holes (a small Allen wrench is handy) and store them with their springs. If they've fallen into the case, that's fine, too.

- [M40 only: Undo the four bolts that hold the rear bearing housing to the case.]

- Rotate the bearing housing so the rear of the countershaft spindle is exposed.

Important change to article here:

- Mark the rear of the spindle with a permanent felt pen so you'll know which end that is later. Using your heavy hammer and long pipe as a drift, drive the spindle out the **rear** of the case, driving it from the front. Some force will be required for the first 1/2" or so of travel, then it should go more easily. The countershaft will fall into the bottom of the case (that was the point of this exercise).

End change.

- Pull the input shaft out the front of the case. The 4th gear synchro ring will fall off and some of the roller bearings inside the rear of the input shaft will probably fall into the case. Remove any that don't and don't lose them.

- Pull the mainshaft assembly out the back of the case. Hold the front

synchro locking ring on as it comes out so it doesn't pop off and dump small parts who knows where. Set the whole assembly aside.

- Lift the countershaft out of the bottom of the case and feed it out the rear bearing's hole. There are a bunch of roller bearings and two washer-like spacers in each end of the countershaft. Remove any such parts that haven't already fallen into the case and don't lose them, either.

- Fish out the two thrust washers and everything that fell into the bottom of the case. Sort out the parts that go together and lay them out so they stay that way.

Take a break! If you've never done this before, this has taken a while and you've accomplished a lot. If you've done this a number of times, this has taken you about half an hour, so you have time to spare.

At this point, you are in a position to evaluate the condition of the main bearings, even though you can hardly see the rear one in its housing -- do they spin without notchiness? Is there play in them? Also clean and inspect all the rollers and their bearing surfaces inside the input shaft and countershaft, its spindle and the forward tip of the mainshaft.

I presume you took this thing apart this far for some reason other than that you like taking things apart; if it was because of noisy running, you should now be able to locate the cause. In any case, don't despair. We're not done taking things apart quite yet.

Mainshaft disassembly:

- Slide the forward synchro locking ring, the three sliding dogs inside it and the forward spring wire off the shaft. **It may or may not be obvious to you later how the following stuff goes back together. It is better to take notes as you go than to be in doubt later. "Left-over" spacers are not permitted.**

- Remove the retaining snap-ring and slide the synchro assembly's hub, the second spring wire and the 3rd gear synchro ring off the shaft.

- Similarly remove 3rd gear and its spacers, the horrible snap-ring behind it, 2nd gear and its spacers and synchro ring, and such parts of the second synchro assembly as will come loose. Its hub is cast onto the shaft, so don't even try to pull it off -- the rest of the parts have to slide off from the back.

- *M41 only: Remove the circlip aft of the OD pump eccentric. Slide the eccentric off the shaft (light tapping to start it is permitted if required) and remove its Woodruff key. Remove the snap ring aft of the bearing.*

- Supporting the shaft by first gear (not the synchro hub), tap the shaft out of the bearing. [M40 only: The worm gear for the speedo drive will pull off the shaft at the same time.]

- Remove 1st gear and everything else that's left on the shaft.

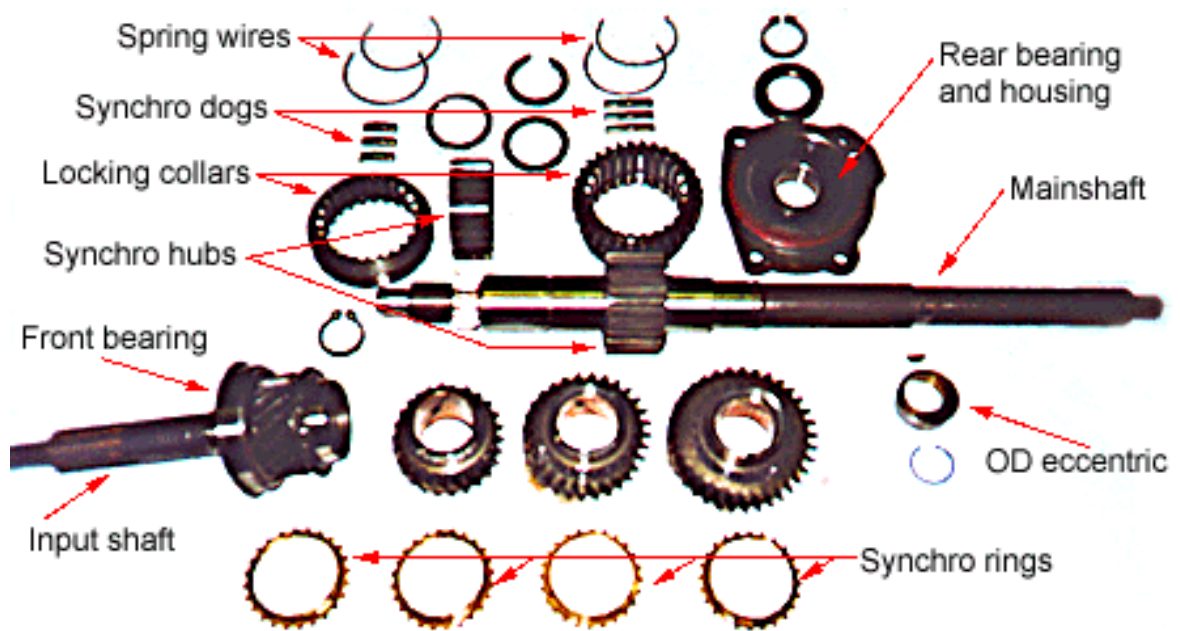
- Remove the snap-ring that holds the rear bearing in its housing.

Support the housing firmly (a large vise is handy now if you've got one) and tap the bearing out of the housing with a suitable arbor. This is much easier when

working with the plain M41 housing. Haynes speaks of the bearing being "easily pushed out," but that would not be my first choice of words.

- [M40 only: Remove the speedo drive worm and its friction spring from the bearing housing.]
- [M40 only: Pry the oil seal out of the housing. You'll probably crunch up the seal in the process, but be careful not to chunk out the housing.]
- Pry the oil seal out of the front bearing cover (see note immediately above, even if you've got an M41).
- Using the large puller, remove the front main bearing from the input shaft.

You should now have something like this (except with the main bearings loose and no labels):



Unless there's some damage to the reverse gear idler still in the case or the sliding plate in the top cover, that's as far as we're going to take this apart. In fact, there's nothing much left to take apart. Clean up all the parts that aren't already and inspect for wear / damage carefully. If you'd like to paint the case, have it pinstriped, media-blasted, powder-coated or whatever else it is you like to do to iron parts to show your Volvo how much you love it, now's the time.

THE DISSASSEMBLY IMAGES

This is intended as a photo guide supplement to the V Classics transmission article: <http://www.vclassics.com/archive/tranreb.htm>

I recently blew 2nd gear in my M40 as I was shifting hard into 2nd.

I removed the shifter from the interior of the car. I put the car on jack stands and

crept under the car. I removed the 4 bolts from the driveshaft and the support bearing strap was removed and the driveshaft relocated as far to the rear of the car as possible. I jacked the rear of the transmission up slightly, and removed the transmission crossmember. Using 3/8" allen socket, extensions, air impact gun, breaker bar, and finally Dremel cutoff wheel on one that stripped to remove the 4 bolts from the bellhousing. I won't be using this transmission case because of the slight damage done to the mounting flange when I used the Dremel. I slid the transmission out, and in reverse order, installed a temporary replacement used working gearbox for now.

With the old one out of the car and a spare I obtained in disassembled but good condition, I set out to make a better transmission out of good gears, and replace all bearings, worn parts, seals, and gaskets, and replace the rest of the driveline parts and rear main seal before reinstallation for a full driveline mechanical restoration.

I started with the used, broken unit on the bench by draining it's murky, metal-laced contents:



Lots of chips on the magnetic drain plug:

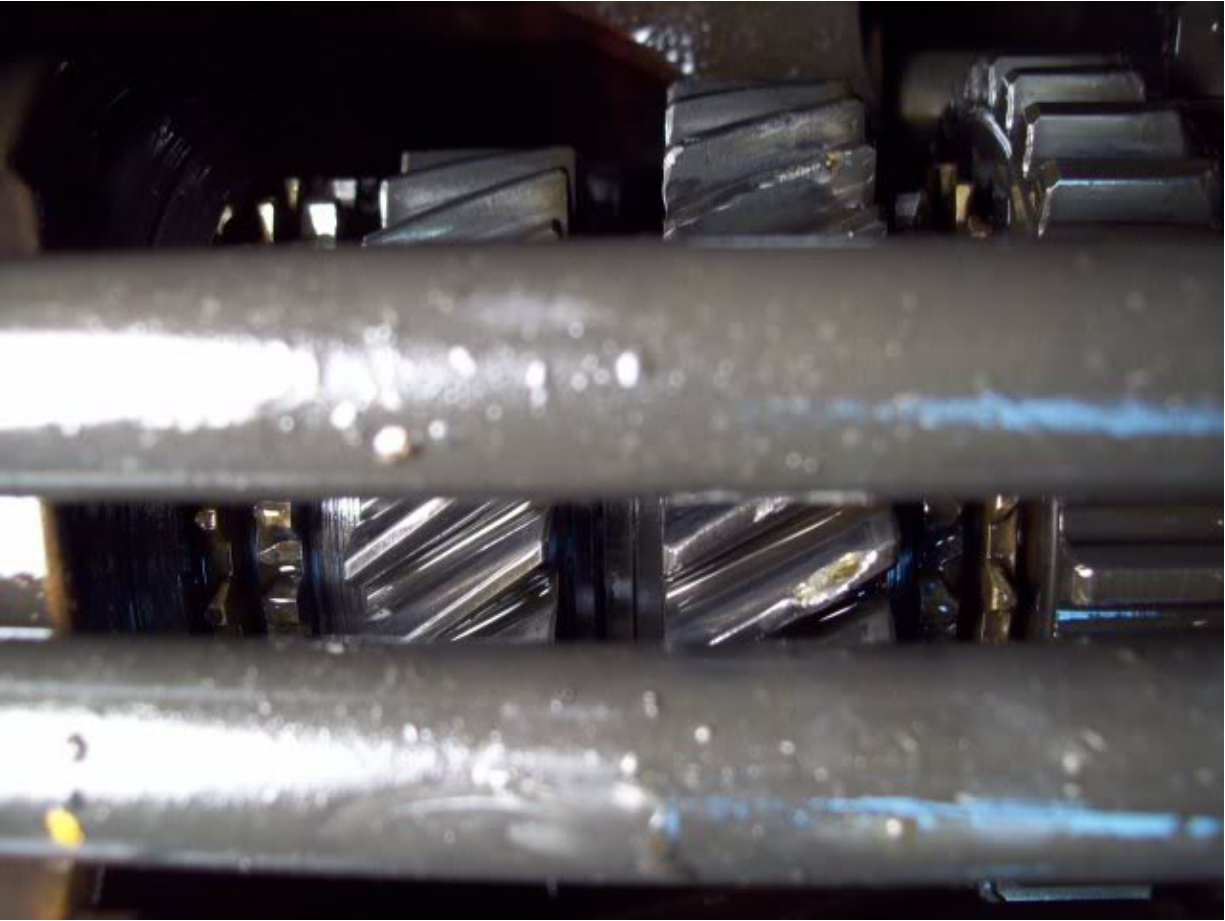


looking inside and cleaning the top:

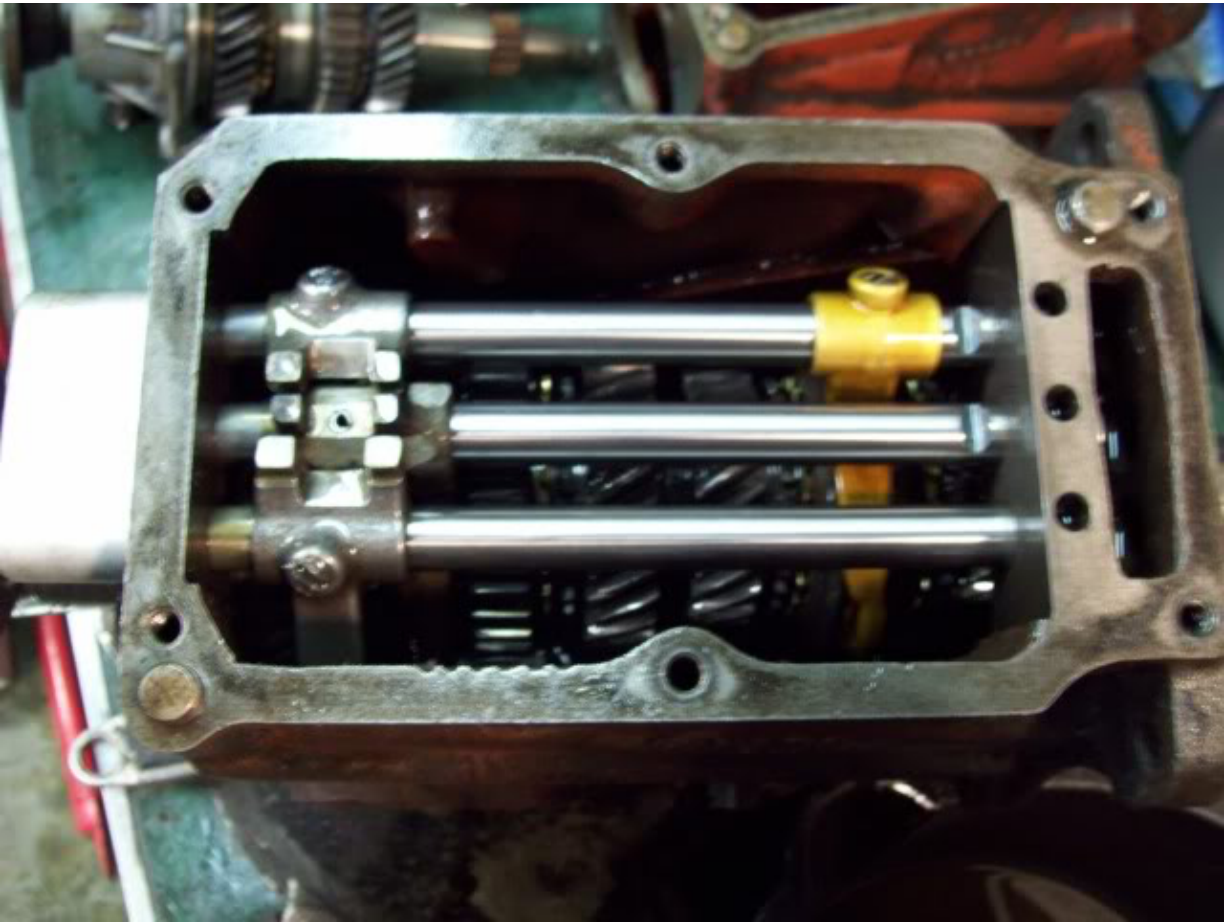


We can see the damaged gear from here:





Cleaning the outside:







I used an impact gun on the driveshaft flange nut, but you can lock the gears by moving 2 of the shift rods at the same time and remove the nut by ratchet instead. Then a puller can be used to remove the flange:



Removal of the bearing cover, input shaft side:



Removal of the speedometer drive gear assembly retainer bolt, the gear assembly, then the rest of the output bearing cover bolts:

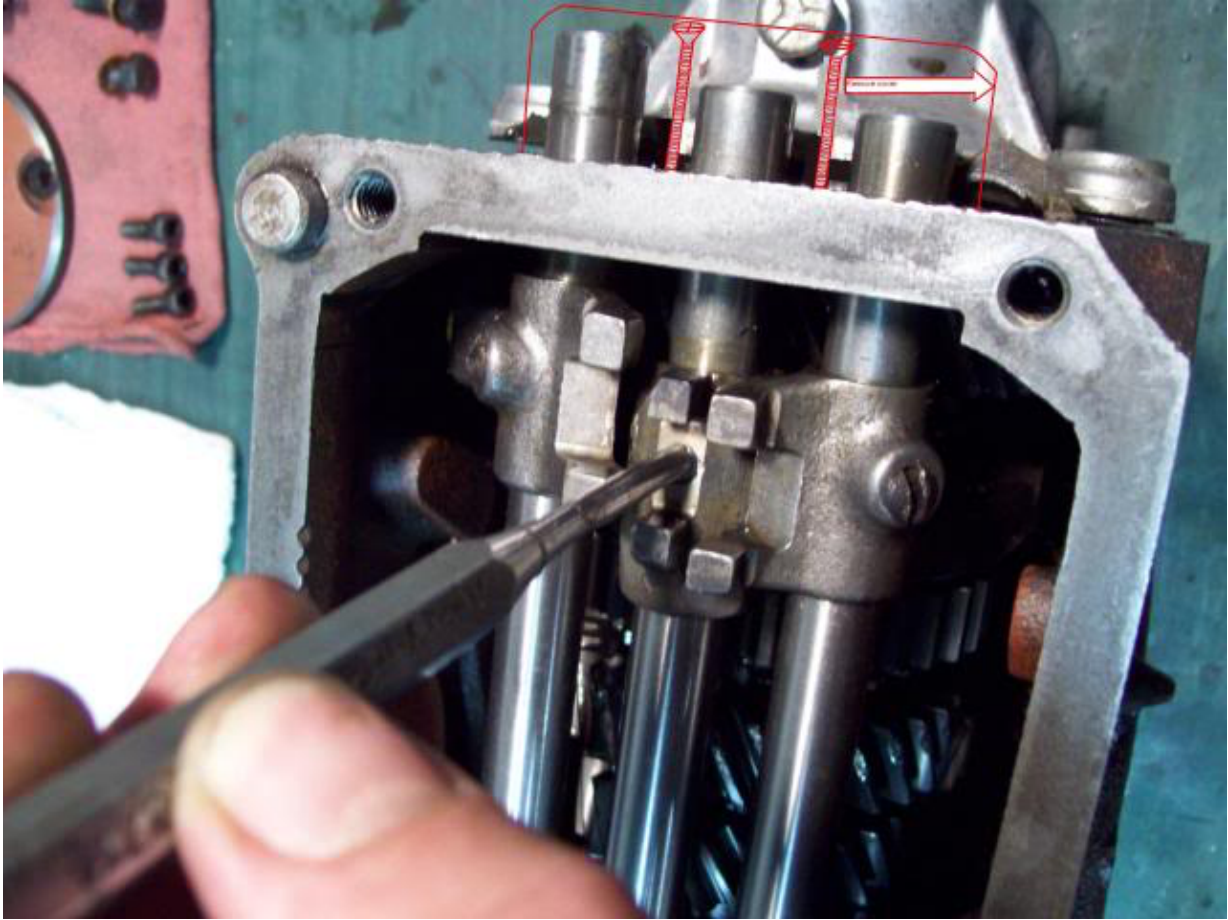






Remove the shift rods end cap cover on one end, then drive out the middle rod's tension pin to free the shift actuator from the shaft, and remove the rod. Remove the others by freeing them from their shift forks with the flathead set screws. |

specifically ground and extra screwdriver for these fasteners:







Next step is to drive out this long countershaft pin. We haven't been able to see the countershaft yet, but it needs to be freed before we can see it. The pin is visible here, and it is advised one mark the ends to distinguish which way it came out so it can be reassembled likewise. Not a problem for me, I haven't been able to get it out yet. I will need to eventually, because it looks to be the better of the two countershaft rods.

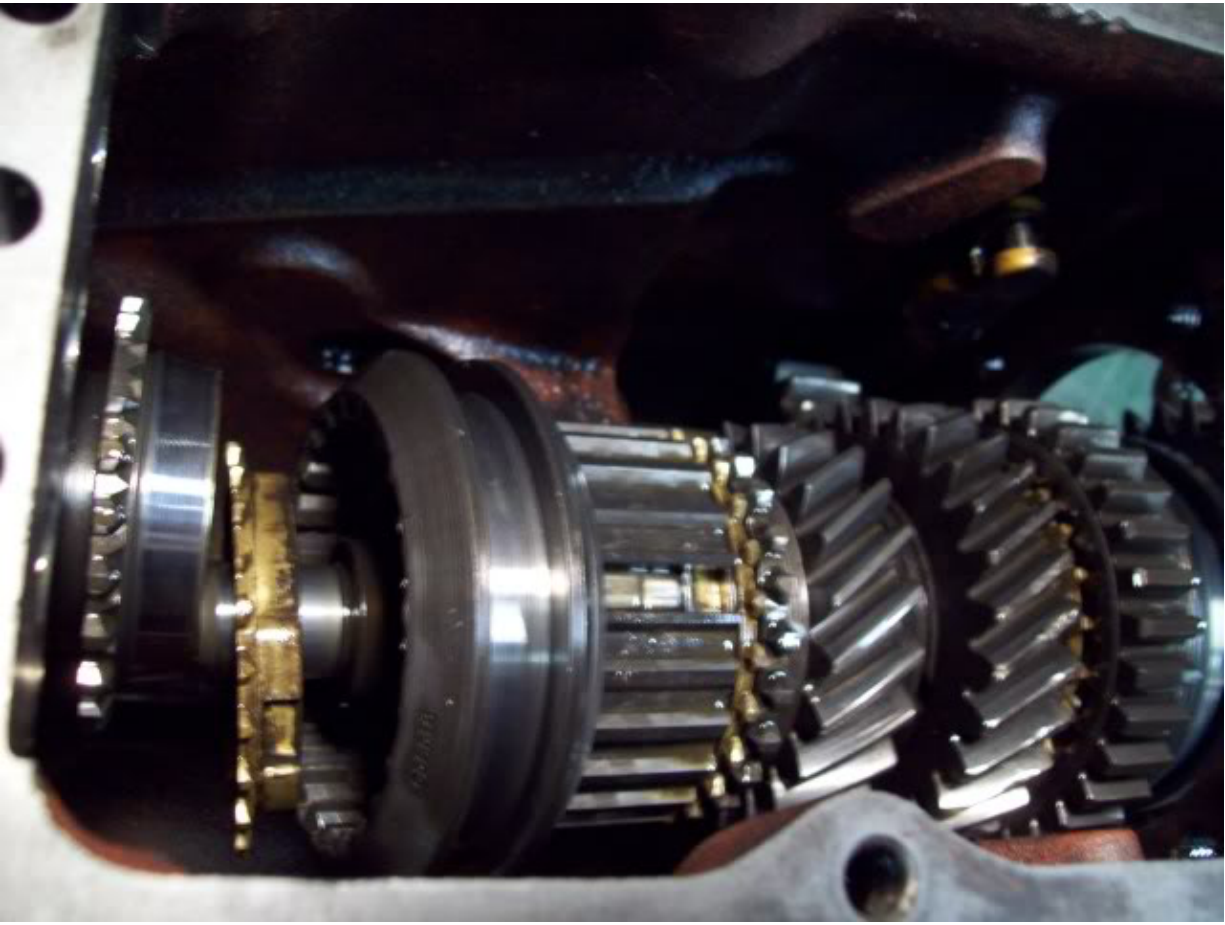




Trying to get it out to no avail using the steel driver rod I'd been using to drive it out:



Now that the countershaft rod is out, it will drop the shaft inside slightly, allowing the mainshaft to separate. There will be a brass ring and some needle bearings that fall out.













Oh wow, I chunked 4 teeth off the countershaft, so that's what this feels and sounds like:



With everything apart now, I check out the case numbers, which are slightly different:



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380100
B49C
K3



That's it for now, two disassembled transmissions. Here is everything:

Next time, we will inspect some parts and make a list of stuff, find out how much it costs, and place a parts order. Finally in phase 3, I'll show how I reassemble everything all the way through the installation, including some of the other parts of the driveline I'll be replacing.

Looking at the parts from the two different transmissions, the first thing we notice are that the two middle gears are chewed, and that the countershaft is missing 4 teeth. The countershaft and inner gears will definitely need to be taken from our spare transmission.

The input shaft steel synchro teeth are not much better on one than the other. One is more rough and pitted feeling, and the other is shiny and worn on the ridges as well, but in a smoother way.

The bearings on these is better on the spare as far as the wiggle test, but the cage is cracked. It would be best to replace it regardless.

So I know I have some good, usable synchros. Some are in better shape than others, but this spare is proving to be in good shape. Here are 3 of them I've

removed so far, only one looks worn. That's over \$200 in parts saved if I don't need to replace them.

The shift rods and balls are a wear consideration. The rods from the spare look best, and the two reverse rods are about the same. The balls (only included with mine, spare tranny's missing) looked worn, so I'll buy some of those.

A side note, the speedometer drive gears have different numbers of teeth. I think my speedometer may be driving at a different rate with my temporary spare, and this might be why. The yellow one has 16 teeth, the green one has 17 teeth. Irollmotors or hiperformanceautoservice have different ones available. The correct one likely has to be used with the corresponding output shaft gear. We'll see if those are interchangeable, and which one goes with my rearend for closest-to-correct speedometer gearing. If I'm going 10mph slower than displayed, it is possible that my whole speedo/odo is being overdriven, and I'm actually getting better MPG than calculable from the odo.

Ok, time to take apart the mainshaft. We'll note the bearings location in this photo first:

With the mainshaft seapaated into 2 parts, we'll be taking apart the big end. The input shaft is only one solid gear anyway. Here's the first clip being removed from the end:

Note the location of the 3 tabs and their spring ring's orientation, this is as described by the vclassics manual:

synchro ring:

next gear:

spacer:

now there is a wave ring. It has both inward and helical spring pressure. That's why there are 2 large spacers on either side. It's like a lockwasher in shape. I ended up using some craftsman flat spreaders since the spreading points are angled and have no holes. With that jesus clip off, the other spacer can come off.

With the spacers and clips off, I could remove the next gear and synchro cone. This allowed aces to the spring for the 3 engaging "dogs", I believe they're called. There is a small bump on them not quite on center. The longer par faces rear, or to the right from our view.

The springs should be oriented in a mirror image of one another as to which dog they are centered on, according to the vclassics manual. We're not sure yet if it matters what position of the possible 3, but it is unlikely.

With these off and the synchro speed ring off, we are upon the solid locking part of the shaft. This is splined. It's not coming off, it's part of the shaft.

On the other side of things, there is the output bearing. It's our old bearing, so we can do what we want to it without damaging the other parts. I found on the shaft I disassembled first, this shaft was easily knocked out of the bearing with a few gentle taps from the deadblow hammer with the shaft in my lap and my other hand holding the aluminum output flange. It would not be the best idea to perform this operation with the flange resting halfway on a countertop or some such. If showing such signs of resistance, it would need to be pressed off. Otherwise, with the shaft knocked out, the speedometer drive gear is now floating inside the end. Then with the clip around the inside of the bearing out, I knocked the bearing easily from the aluminum flange with a socket centered on top of the speedometer gear.

With everything apart, some of the synchros look kind of worn. Maybe it would be best to replace them anyway. Got to pay the price of a transmission that shifts like new. I can take my time if I like.

The two places I found that stock these internals are <http://hiperformanceautoservice.com/> and <http://www.irollmotors.com/> I can do some price comparison shopping. I bought an Asco clutch disc today for \$35.00 shipped on e-bay. The rest of the items I'll need are as follows, with price comparisons to come:

- seal and gasket kit
- input and output bearings
- needle bearings for countershaft: 48 required
- needle bearing end bushings: 4 required
- needle bearings mainshaft: 14 required
- engaging dogs: 6 required (or 3 big 3 small, update coming on this)
- engaging dog springs: 4 required
- synchros: 4 required
- balls: 3 required
- springs: 3 required
- t-shaped spacers for one of the shift forks. 2 required.

I looked up the parts on both Irollmotors and Hiperformance and the totals were \$588 and \$535 respectively for the parts listed above, except the Iroll motors list is incomplete. If I take only the less expensive parts from each and place 2 orders,

I get a total of \$532.58 for everything. If I take out the synchros, it is a more affordable \$ 361.34. Are there less expensive ways of getting near-perfect synchros? I will probably go one step further and refer to a local bearing supplier for those and see if it can be an even lower grand total. I'll take a sample pack of bearings with me tonight and their quantities to a local bearing supplier that I will look up.

The all-brass fork may be a wear item, but one is a little better and neither seem at all worn in a way that affects performance. The gears themselves have brass or bronze plain bearings with dimples for oil to gather. I don't believe these need to be pressed out and replaced, but if someone knows where to buy replacements, I'll look into buying them. This may as well be a full remanufacture in which I replace all wear parts.

Here are all the parts from out blown and spare transmission. If anyone knows a place with less expensive parts than iroll motors or hiperformanceautoservice, please post a link.

Now all that remains is for me to compile the price list, compare, place order, and carefully reassemble with the best of the best.