

## SyTy Transmission Rebuild.

Use some kind of small storage containers (like Styrofoam coffee cups) and mark what your screws are for when you place them in individual containers SO YOU DON'T LOOSE THEM

Anyway:

Disconnect the TV cable from the throttle body and bracket. This way you don't tear up your cable when you lower the tranny slightly later.

Get the truck up high as you can. AutoZone has an SUV jack that can go 21". This way you don't have to crib anything up. Just get some heavy duty 6 ton jack stands, they go much higher than the 4 ton. Get front and rear both off the ground and the truck even as possible. Make sure it is secure and stable. Use cribbing if you have to in order to get the truck STABLE. No one wants to hear of someone dropping a truck on themselves because they weren't careful.

Take off the tranny pan and drain the fluid into a catch pan. I used a Tupperware clear storage container (like you get at Wal-Mart). It is 5 inches deep, 18 inches wide and 30 inches long. Holds lots of fluid. Put the pan back on. Use some paint and mark the respective points on the rear shaft's universal to the yoke on the rear differential. Take the four 7/16" bolts that hold the rear driveshaft to the rear differential. Spray with PB blast. Take a small pry bar and pop it out. Hold onto it while you pop it out so it doesn't fall. If you have a tranny adapter, put it on the jack and jack it up until you just make contact with the tranny pan plus a little extra pressure. Just a little.

Use PB Blast whenever possible. I remove the trans cross member first after the rear driveshaft. Use a 15mm socket and remove the two mount bolts on the bottom of the shelf for the mount. Put another jack (I have two) under the cross member. Just put it up until it makes contact. Use a 15mm deep well socket with a 3" extension and a 15mm wrench to back up the bolts and nuts when you remove them from the cross member where it meets the frame. Do the driver's side first since it will hold itself up. Then do the passenger side. Lower it. Check your "shelf" for the tranny mount. The weld on the passenger could be cracked. Look closely. I could just see daylight through mine. It was only \$13 to have the whole thing professionally re-welded. They did triple welds on both sides of all welds (even redid the ones that weren't broken). They guy told me GM didn't do the best job he had seen. GM's weld didn't even penetrate the steel.

Now for the mount bolts that hold the mount to the transfer case adapter. Use a closed end 15mm wrench. Get on the bolt head and work it slowly with PB Blast and the wrench. Once it breaks loose. Work it back and forth. And then take it out. Take your time on these. Don't use a socket on them. It will catch at a slight angle due to the tranny mount interference and as soon as the bolt breaks loose you will snap the head off or crack the adapter. The adapter is \$64 new from GM if it doe break.

Now take off your front driveshaft. I use a 3/8" 12 point closed end wrench on the front and a 7/16" close end 12point on the rear. The way my prop-shaft is made, torx type socket that is made for the bolts won't clear the double cardan in the rear and catch at an angle. Something here that helps: take out the cotter pin and slip the shift cable off of the manual lever on the tranny. Hang the cable back out of your way. Now you can shift it between park and neutral while you are working on the prop without having to get out from under the truck.

You can take the TC inspection cover off now. USE THE PROPER TORX BIT. I can't stress that enough. The previous owner tried to use an Allen wrench. It only caused headache for me.

Use a big flat head screwdriver to get under the mounting pads of the TC and turn it until you can get a 15mm closed wrench on the bolts. Use the screwdriver to back up the TC so it doesn't turn while you take the bolts out. There are 3 of them. I took a 15mm close end wrench and cut the open end off. I could then use a small 3/4" copper pipe and break them loose. Don't turn the TC too fast or the compression from the engine will turn it back the other way. And the screwdriver can get you. Remove bolts and free the TC. These 3 bolts have orange lock tight on them. You can now slide the TC toward the tranny ever so slightly.

**On to the transfer case.** With the front prop and tranny cross member out, you can get to the transfer case to transmission bell housing brace easily. Use a shallow 14mm socket and your wobble extensions connected together so you get a slight arch to clear the tranny pan. Break it loose and get it out. The bolt is very long. You will have to leave it in the brace sleeve but loose from the bell housing. Now you can use a 15mm shallow socket on the rear bolts that hold the brace to the bracket on the transfer case. You take out the two that face up and down. The other two that actually hold the brace bracket to the transfer case you leave alone. Wiggle the brace out.

Use a shallow 10mm to take the screw out of the little bracket on top of the transfer case that holds the fuel lines to the transfer case. Disconnect the electrical connector for the Speedo out of the side of the transfer case. Also use a pair of small pliers and squeeze the spring loaded clamp on the vent for the transfer case. Slide the clamp forward and carefully pull the rubber hose off of the white plastic vent.

Now the hard part use a 15mm deep and shallow with extensions in different combinations to get the 5 bolts out that hold the transfer case to the tranny. Leave the bottom one in. That way the transfer case doesn't spin down on you. IT IS HEAVY. If this is the first time you have taken it out, it won't spin. It probably won't move. Back out the bottom bolt but leave a few threads of the bolt in the transfer case so transfer case can move but not spin. Now, grab hold of the tail end of the transfer case where the rear driveshaft went into the transfer case. Work it up and down while pulling or pushing toward the rear. Some fluid that was trapped in the rear of the adapter where the governor is will pour out as the transfer case moves toward the rear of the truck, use a small pan or some towels to catch it. It is very heavy. Have someone help you get it out. Really, unless you are in a hurry like I was myself. There is a gasket between the transfer case and the tranny adapt. I made mine from 1/16" inch gasket material like you get at any auto parts store using what was left of the stocker so I don't know the part number. Don't use form a gasket or anything like that. It can contaminate your tranny fluid or jamb stuff up, like a governor that is right beside it and is very important to shifts as well as some other valves.

There is a plug for the TCC. Pop it out like you do any other weather pack connector. Pull out on the tabs while pushing up. There is a rusty 8mm screw just over top of that that holds everything to the side of the tranny. Take it out. There are 6 bolts in the bell housing. One of them is out because the transfer case brace went through it on the bottom driver's side.

The Next one that comes out is the TOP one on the passenger side. It is a 14mm and does not have a flange on it since it has the brace for the dipstick tube acting as a washer. Use a shallow 14mm, your wobble extensions and several extensions until you can get square on the bolt head. You do NOT want to strip these off. I used a halogen lamp placed facing up at an angle on the passenger side so this area would be illuminated. I was on my right side, legs sticking out the driver's side so I could see it. Get it out. It goes back in easier than you would think. It is a bear to get out. GM used a white lock tight like stuff on it. You HAVE to take this one out first or your socket won't fit squarely on the top nut I'll talk about next. The vent tube for the transfer case is held up there also. Pull it out and lay it aside. When you put the vent tube back on, run it zip tied to the fuel lines and run it up the driver's side. Don't know why they didn't do this the first time. It makes R&R so much easier. After you get the bolt out, get up on a small step stool and use a pair of needle nose pliers and grab a hold of the dipstick tube and pull up, and slightly forward. It will be tough but will pop out of the tranny. The seal will come with it. That's OK. You'll have to replace it anyway. Turn it so it just clears some of the wiring and let it hang in there. You don't have to pull it all the way out.

I now went to the two lower nuts you can get your hand on the passenger side where the down pipe bracket is. Use PB Blast again on the 15mm bolt that holds the bracket to the down pipe. Use a shallow socket and wobble extensions arranged again.

Now the 14mm nuts that are over the bracket. The bottom one is cake. Shallow 14mm with wobble extensions. The top one had me scratching my head. There is a pinch weld on the body that would not let a deep well 14mm on it. The stud stuck out too far for a shallow socket. I had an extra 14mm deep. I took a Dremel and cut 1/2" off of it. Cleared the pinch weld and seated squarely on the nut despite the stud. Take it off.

Now the bracket for the down pipe. Get your hand up in there (it will fit) and work the bracket until only a couple of threads hold it on there. It will not just come off. Once you get it there, Take a long, sturdy flat head screwdriver, get under the bottom hole on the brace and pop it off the stud. It won't hurt the threads of the stud. The threads are made of stronger steel than the brace. It may bend a little, that's OK. A regular deep well 14mm socket will get both studs out now.

The top one on the driver's side is next. Work your wobbles and move your light so you can see it. Use a shallow 14mm on it. It is a little tougher because of the fuel lines but get square on it and take it out. Have a magnetic extension for grabbing the socket or the bolt in case they fall out up there. They will more than likely.

The last one uses just a closed end 14mm wrench. Once it is loose, you can get your hand up in there and get it out the rest of the way.

If you have never had your tranny out before, it will be bonded to the engine of sorts. Corrosion between the cast iron block and the aluminum bell housing. I used a very thin flat head screwdriver with a long shaft on it. I stuck it at the joint and tapped on it with a hammer. I worked both sides evenly. Once I got them as far as the thin screwdriver could get them, I used a cold chisel I had that was about 1/2" thick. I placed it at the now open slot and tapped it in until the trans cleared the two alignment dowels on the engine. Thank God GM used these!! Use some scotch-brite and clean the mounting surface up and wipe off with some of the PB Blast or WD-40 to get rid of some of the corrosion.

**DON'T FORGET TO DISCONNECT THE TV CABLE AT THE THROTTLE BODY!!!!** Now that the trans is separated from the engine, drop it down slightly. Just enough to where you can get the 10mm socket on the small bolt on the passenger side top of the plate the pan bolts to. This is the TV cable housing where it enters the tranny. After the bolt is out, push up and slightly toward the front of the truck at an angle. It is tough but it will slide out. You can push up on the housing and see where the cable slides over the little bracket for the TV line rise valve's spring loaded bracket. Just wiggle it a little and it will slide off.

You can now see the tranny lines. Drop it down just a little more so you get your arms up in there. I can't remember for sure but I think the brass fitting at the tranny is a 5/8". The part that is tough to get loose is the 13mm for the tranny lines. I used line wrenches and PB Blast but it still rounded the corners off of the bottom one. The top one comes out first and was easy on mine.

The bottom one I had to use a 6" small pipe wrench I had and careful worked it loose. No real damage. I stopped as soon as I saw the rounding off crap going on and went for the pipe wrench so as not to render the nut unusable.

Pop the line out of the hole in the fitting and the tranny is free. Lower it down. I had to slide mine off of the jack and onto the floor onto some waiting cardboard. It cleared the frame by a 1/2" or so. If yours isn't that high, slide the TC off (lots of fluid in there too, have towels ready) and tip the rear up. This will angle the front down enough to get it out from under there.

### Get ready for the rebuild.

Have two 2x4's about a foot long to stand the trans up on. Place these inside the same container that you drained the fluid into before. Hopefully you have emptied it by now so it is completely empty. Lay the 2x4's on the wide flats in there and set the transmission on the tail end. You need this clearance because the output shaft sticks out 3/8" to a 1/2". Let it sit for the rest of the afternoon if you have time. Fluid will run and run and run. Let it bleed. You'll be amazed how much is left in there. I laid the stock TC snout down in a pan and let it drain. The stock TC holds almost 3 quarts.

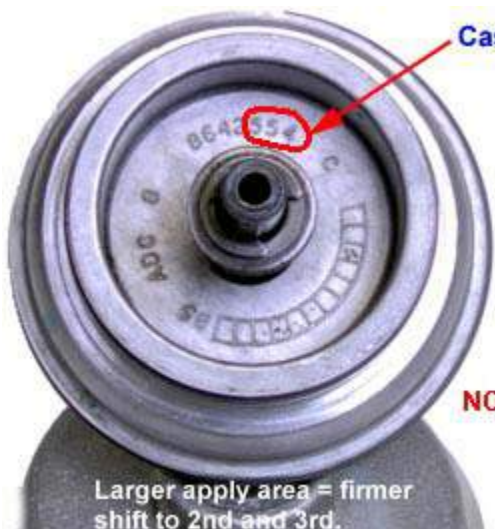
Your transmission is out. Take the trans pan off so the fluid can drain. Get a large rectangular Tupperware clothes storage bin (your new drain pan) about 6 inches deep by 18" by 24". You've got a couple 2x4s about 8" long laying flat on the 4" side down in the catch pan so you can stand your trans on the transfer case adaptor and the output shaft isn't touching the floor. Support the tranny appropriately so it doesn't fall over. It will bleed severely into the catch pan (even if you let it drain for a long time while it was in the truck, there's a lot in there). Your cardboard is laid out in a very clean, well lit work area and you've got a huge bag of kitty litter in the corner for your cleanup later (just in case). Trust me on that one. Just let it drain for a while if you have the time, it really makes working on it so much cleaner later.

You'll need 6 to 8 large cans of carburetor cleaner, a pair of safety glasses, and a well ventilated area to do the cleaning of parts. Any rubber seals you wish to keep cannot be sprayed with carburetor cleaner as they will distort and fall apart. Don't wear latex gloves while using carburetor cleaner, the latex will come apart and get lodged where you don't want it to be. Use the heavy blue chemical resistant gloves for that so your cuticles don't take a beating.

Put the pan back on. Put duct tape over any holes, spray the tranny with degreaser, let it set for about 10 minutes and then THOROUGHLY scrub the exterior with a nylon bristle brush. Rinse thoroughly. Repeat if it was nasty like mine. Let dry and then spray PB Blast onto the servo cover snap ring retaining groove because it will most likely be full of crud. Let it soak, scrub with a wire brush, soak until you get to where you can see the ring.



Take a large screwdriver and pop out the snap ring as above. You may have to work around it for a while to get it out without damage. Now grab the nipple with channel locks and work it out to where you can get to the blue colored o-ring.



**Casting # Engine/ Shift Quality**  
554 ---- 4 cyl., 2.5L & 2.8L V6  
Softest Shift

553 ---- V8, Diesel & 4.3L V6  
Medium Shift

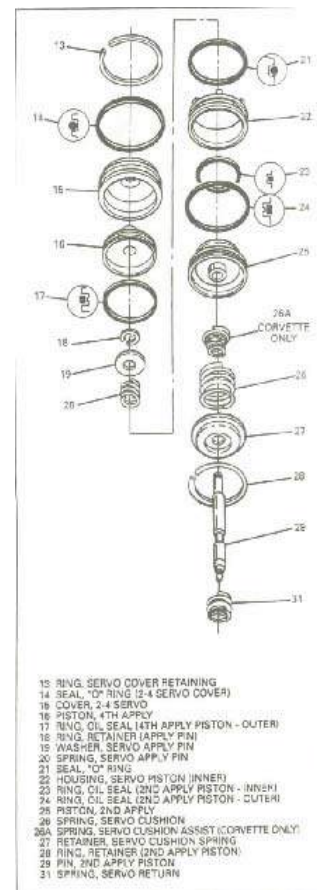
093 ---- Corvette, Trans Am, Z-28,  
GMC Syclone & Typhoon

**NOTE!!**

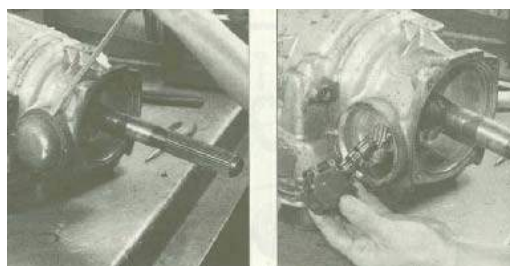
Many replacement SyTy  
trannys have the 553 or  
554 servo because  
shops think its just a NA  
V-6. Burnt band cometh  
quickly.

Take a pair of needle nose pliers and grab the blue o-ring and pull it out the side and cut it with a pair of side cutters while continuing to hold the o-ring with the needle nose and then just pull the blue o-ring out. Pull the 2-4 servo line-up out. SyTy's have a 093 2<sup>nd</sup> servo from the corvette line.

Here's your servo lineup. See that conical spring called item 26A? Typhoon's servo lineup was the 093 but it was missing this conical spring. This additional spring firms shifts even more. Items 25 through 28 is all one piece with snap ring 28 holding it all together. Use a c-clamp and CAREFULLY SLIGHTLY compress the subassembly just enough to get the snap ring out and look in yours. Clean it out with carb cleaner while you are in there. You'll see the large white spring #26. If #26A isn't in there, use an old 1-2 or 3-4 accumulator spring (a black accumulator spring, not a white one), set it inside the big white spring compress it down again and put your snap ring back in. Firmer 1-2 and 2-3 shift at a fraction of the cost of a replacement servo. If you don't want to go through all of this, go to a tranny shop and ask them for a corvette servo and they'll know what you are talking about. They'll hook you up. They are a dime a dozen, don't pay more than \$30 for it. This spring assembly functions kind of like a water hammer arrester. The additional spring keeps the 25-28 assembly from compressing as much and firms the shift by keeping the band firmly applied thus preventing burning.

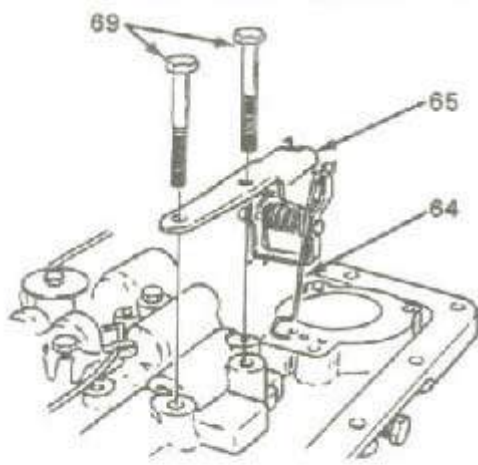


Now onto the governor cover and the governor. It may be very difficult to get the cover off. I bent the lip of mine up pretty good getting it off. Just take a screwdriver and hammer and start working your way around until it pops out. Then the governor will just slide out. Make sure the tranny is setting flat on the pan so the governor doesn't just fall out. The SyTy governor part number is #24202127 if your shifts are too high or your old one is damaged. Much easier to just replace than to rebuild. Make sure that when you pull out on the wings with it held as pictured that the valves move freely. If not spray it out with carb cleaner and work it, more carb cleaner and work it until everything moves freely.

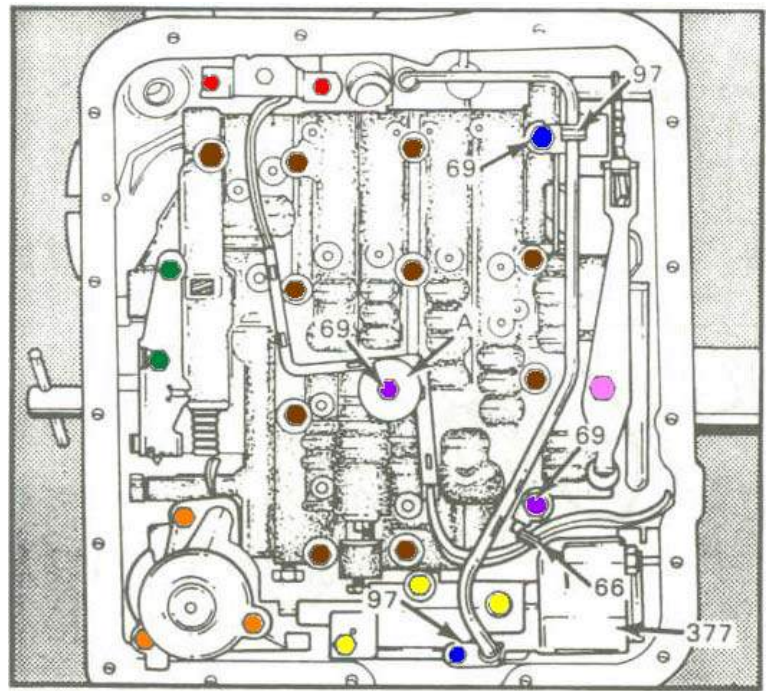


Now on to the fun stuff. Get a pack of Styrofoam coffee cups and a black felt tip marker to label each one depending on what you put in it. Use some 2x4 situated so that the tranny pan is belly up, sturdy, and LEVEL. You'll see why in a little bit. Now take all the pan bolts out (don't forget the two non flanged bolts that held on the shift cable bracket) and put them in a cup and label them. Pull the pan and set it aside for cleaning and pitch the gasket in the garbage. Grab a hold of the filter and kind of wiggle, twist, pull straight up. The orange o-ringed gasket may stick in there. Use a screwdriver or snap ring pliers and pop it out. DO NOT SCRATCH THAT BORE! Things start getting fun and dirty now.

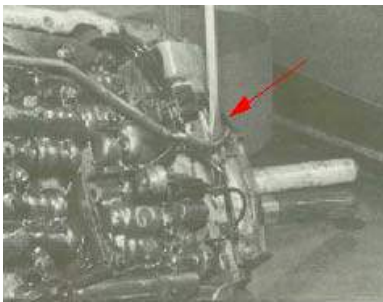




64 LINK, THROTTLE LEVER TO CABLE  
65 LEVER & BRACKET ASSEMBLY, THROTTLE  
69 BOLTS, CONTROL VALVE ASSEMBLY

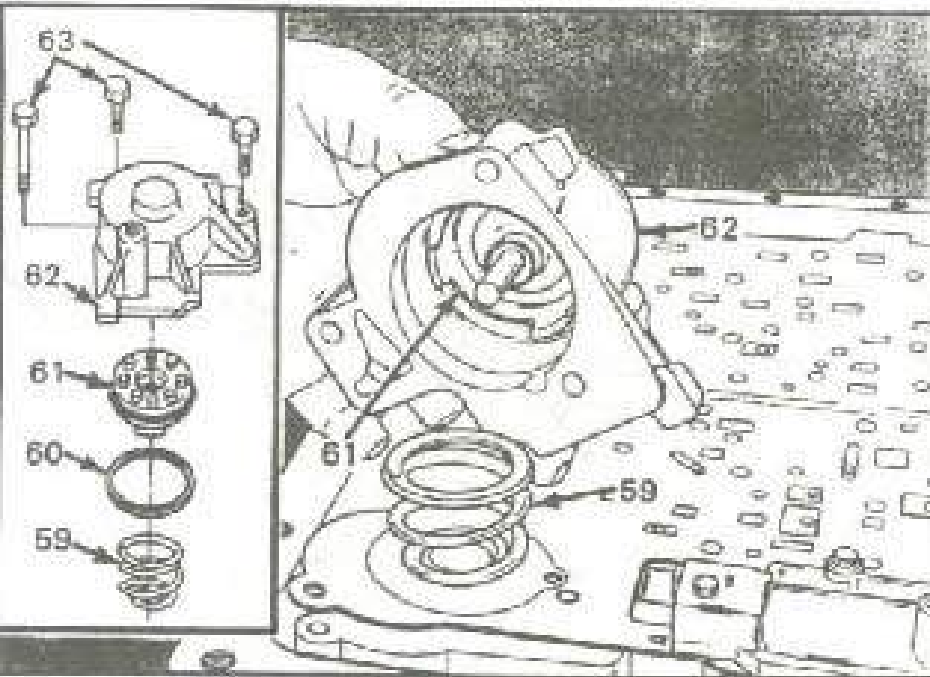


Now this picture is VERY important. I tried to color code everything. Start by taking out the two blue coded bolts. #69 has a clip retaining the forward feed tube and #97 has a clip retaining the other end. Also note that #97 is the longest bolt and is a brass color. Put these two bolts in a cup. Now pry out the forward feed tube as shown in the next pic. Next, take out the two red bolts retaining the TCC solenoid. Put them in a cup. Take out the two purple bolts. The center has a large washer that holds the plastic harness shield in place; the other purple has a wire retainer clip holding the harness in place. In a cup they go. Take a small flat head screw driver and reach down into where the wires terminate into the harness connector over on the right in the picture. There will be a small tab. Carefully, gently pull the tab slightly away from the wires while pulling up on the wire bundle and the connector will pop out. Now grab firmly a hold of the TCC solenoid and pull straight up and it will pop out. Make sure the black o-ring is still on it. Now on to the pressure switches. Make careful note of which switch the red wires go to and which switch the black wire went to and slide them off. They are tough but brittle so don't break them. Put the harness away for safe keeping with the connectors labeled as to where they went.



Here's the removal of the forward feed tube. Use a large flat blade screwdriver and pop it out of the auxiliary valve body, then pop the other end out of the pump end. It will feel like it is bent funny. It is so there will be a slight friction fit when it is reinserted later. Can't wait for that one later ☺ Use some carb cleaner and spray out the tube, wipe it off and set it aside somewhere on the bench where it won't get anything laid on it so it does NOT get bent.

Now take out the two green color coded bolts that retain the throttle lever and bracket assembly (#69 in the left pic). Don't lose the little arm #64 and make sure it doesn't get bent. Here's a pic of what they will look like. Clean the bracket and spring assembly thoroughly with carb cleaner making sure to keep the little arm in it just as it was and put all of this into its own cup.



To the left is the often talked about 1-2 accumulator assembly. It is held in place by the 3 orange bolts. One bolt is obviously longer than the others. Your spring should be white in color. You want to replace the spring with the new orange one that Sonnax now distributes as seen below.

I had a big piece of cardboard on the floor. Lay the accumulator on the cardboard with the interior up and squeeze the aluminum housing between your feet. Now take a pair of large snap ring pliers or, in my case, a large pair of needle nose pliers and put it down into the piston. Now open them up FULLY which will grab against the sides of the piston and rotate/pull it out. If you have a compressor with a rubber tip blow nozzle, use about 20psi of pressure and apply pressure to the 1-2 accumulator feed hole(just above the number 61 in the picture)and, with a phone book over the assembly and give a quick burst of air. Use caution as the piston will shoot up and hit the phone book. Now that the piston

is out, use a dental pic and pull the seal out of the piston and find a new one in your kit and put it on. Lube it up with petroleum jelly or Transgel and set it aside. Use some green scotch-brite and lightly scrub the bore then spray out the accumulator housing thoroughly with carb cleaner and let it air dry. Now lube up the bore and reinstall the piston with the new seal (#60 in the above picture) into the bore.

## Complaint 1-2 slide bump shift

**Secondary Complaint:**

- Soft 1-2 shift

**NEW**  
**Part No. 777045**  
Enhanced Performance  
5 Springs

**NEW**  
**Part No. 74926**  
"Purple" 1-2 Accumulator Spring  
5 Springs

**Cause** The OEM spring is broken or a stronger spring is needed for high performance applications

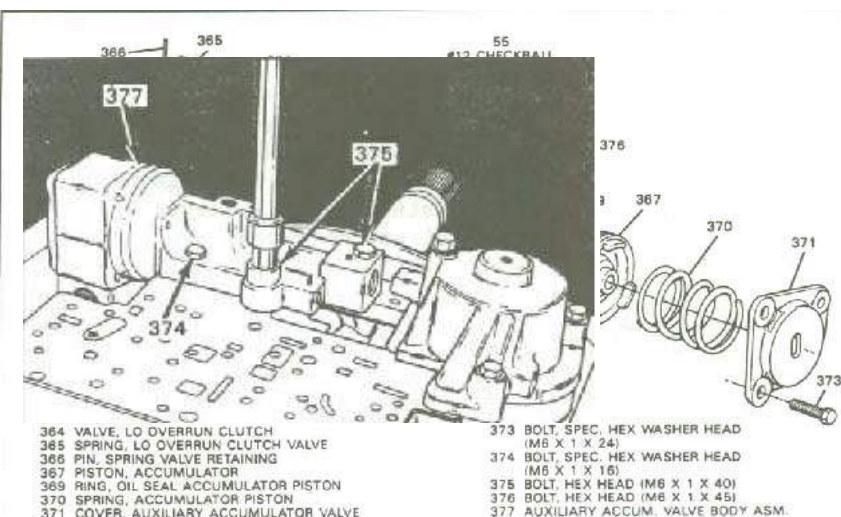
**Correction** Use the purple accumulator spring for stock and the enhanced for performance and firmer 1-2 shifts.

**1-2 ACCUMULATOR SPRING**

Purple Spring

Enhanced Performance Spring

The spring you will want more than likely will be the orange enhanced performance spring part #777045. This will give a very firm shift. I recommend keeping the spring as opposed to some other techniques for longevity purposes. Gob some jell on the end of the enhanced spring and put it into piston. The jell will help hold it in place. Put this assembly with its bolts somewhere will it will not get any dust in it and it will not get lost.



Now take out the other 3 yellow bolts out of the auxiliary valve body. You will need an 8mm to get the one out that is in the picture. It is the shortest of the aux valve body bolts. Now disassemble the valve body according to the picture below. Just use a 3/32" punch to push the pins out enough to where you can grab them with needle nose pliers. As you pull the roll pin out, put your finger over the opening so the spring loaded valve doesn't blow out in the floor. Have some lint free shop towels laid out so you can keep everything in order. Take the three 8mm bolts out of the cap. If your cap has a round hole in it instead of the elongated one, replace it with the elongated style. Use your needle nose pliers and pull out the piston just like you did for the 1-2 accumulator. Pull the old seal off of the piston and use scotch-brite on the piston bore. Spray



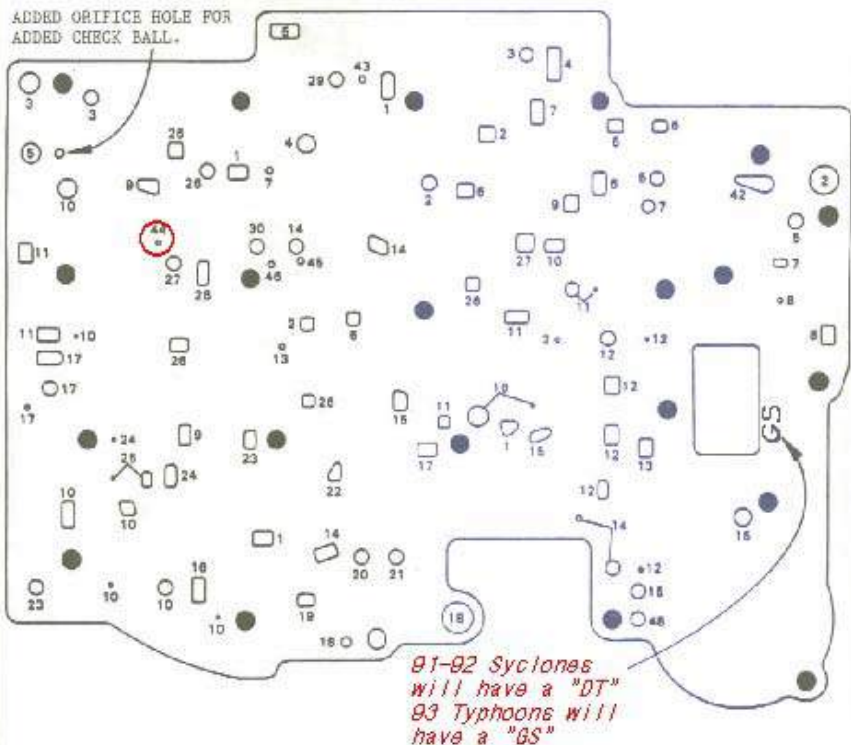
everything down thoroughly with carb cleaner, especially the valve passages. The #12 check ball in the SyTy is retained with a clip so it shouldn't fall out. Put a new seal on the piston and lube everything up with jell and reassemble. The three bolts get 8 ft. pounds of torque. Keep the bolts with the assembly and put away for now.

Now refer to the pink bolt in the picture from before. It holds down the manual detent spring. This is what gives you that positive "click" when you pull on the shifter in the truck. Hold it down with your thumb as you remove the bolt. Inspect for any damage. Spray it off and put the spring and the bolt in a cup. Now there is only the brown bolts left. Should be 10 of them. Pull them out and put them in their own cup. The only thing holding the valve body on is gravity. Make sure that the tranny is level from side to side and front to rear. There are two, maybe three check balls under the valve body. If you are lucky, as you lift up on the valve body they will stay in place on the separator plate so you can note where they go. It is heavy. As you lift straight up, you will be able to disconnect the manual valve link (the little arm) from the manual valve as the manual valve slides forward. Be very careful not to drop the valve body. Note the check ball locations and put them in a cup. We'll get back to the valve body. On to the separator plate. To the left is typical spacer plate. The Sycloons will have a 1LHM or 2LHM tranny as denoted by a "DT" and the Typhoons have a 3LHM tranny and will have the "GS" identifier as noted on the left.

#### TYPICAL SPACER PLATE

THERE IS AN ADDED ORIFICE HOLE IN THE 1993 SPACER PLATE THAT THE 1987-1992 SPACER PLATE DOES NOT HAVE. THIS HOLE IS TO ACCOMMODATE THE ADDED CHECKBALL IN 1993 MODELS.

ADDED ORIFICE HOLE FOR  
ADDED CHECK BALL.

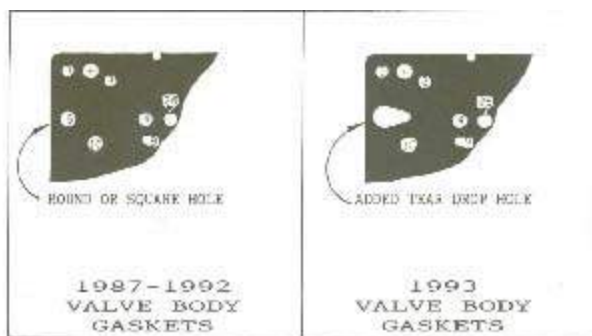


ILL. NO.	DESCRIPTION	ILL. NO.	DESCRIPTION	ILL. NO.	DESCRIPTION
1	LINE	14	2ND CLUTCH	27	3-4 CLUTCH
2	D4	15	3-4 ACCUMULATOR	28	RND4-3
3	D2	16	T.V.F.	30	3RD CLUTCH
4	LO	17	OVERRUN CLUTCH	31	IDENTIFICATION
5	REVERSE	18	T.V. EX.	42	D4 ABUSE
6	GOVERNOR	19	D3/PART THROTTLE	43	3RD FEED
7	LO - 1ST FEED	20	PART THROTTLE	44	3-2 HIGH SPEED
8	LO/REVERSE	21	D5	45	2ND FEED
9	3RD ACCUMULATOR	22	4TH CLUTCH	46	3RD CL. EXHAUST
10	T.V.	23	C.G. SIG.	47	4TH FEED
11	M.T.V.	24	MOD. UP	48	1-2 ACCUMULATOR
12	ACCUMULATOR	25	MOD. DOWN		
13	4TH SIGNAL	26	DETENT		

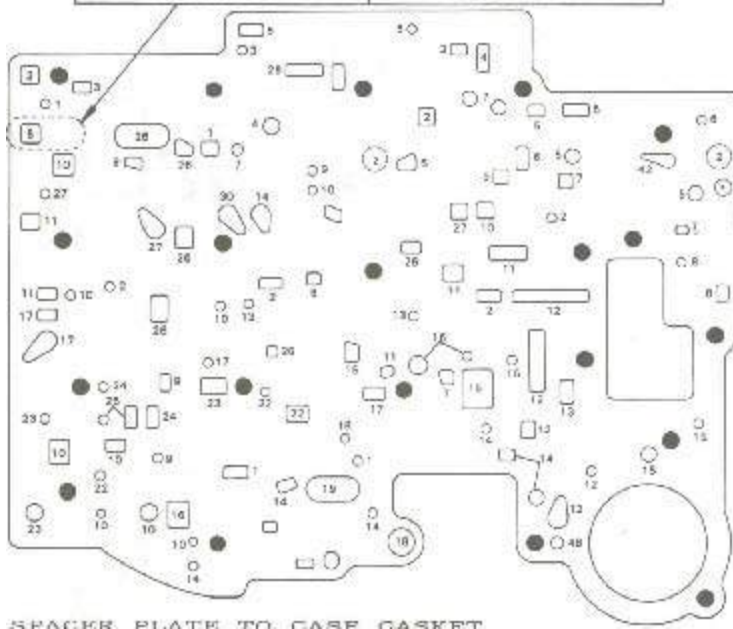
"DT" carries part #8678328

"GS" carries part #8681285

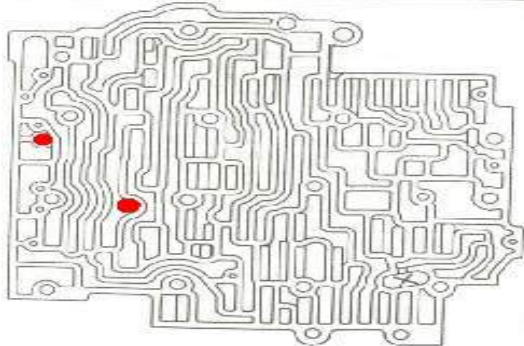
Look at your plate carefully if you have a Sy and see if you have the little added hole discussed in the picture. If you were really careful when you removed the valve-body, the check-balls will still be in place. If yours has the extra hole, you should have 3 check-balls. If yours did NOT have the extra little hold for reverse, you will have two check-balls. #44 hole is highlighted for a special reason. This hole is to be enlarged to .093". At the same time you are to discard the five load release springs from the 3-4 clutch stack of the input drum. You'll see what we are talking about later. 3-4 clutch pack failure has been noted in as little as 200 miles in some '88 to '92 units due to insufficient clamping force on the 3-4 clutches due to the load release spring assemblies. You'll also get a much firmer 2-3 shift feel. One other thing you will have to look for is the holes in your valve body and case gaskets. Put them over your separator plate and make sure NONE of your holes are blocked. Very important. The kit that I bought from a reputable dealer had the gaskets for '87 and prior for some reason. Multiple holes were blocked. Be cautious no matter WHO you buy from.



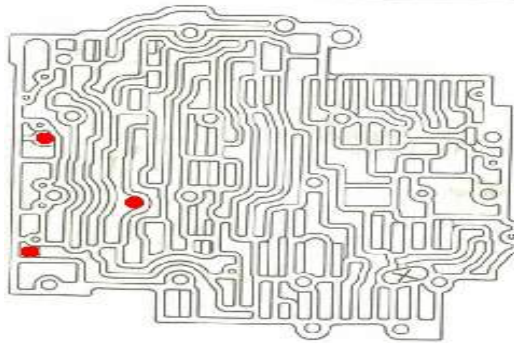
Here's the main difference between the 92 and 93 case and valve body gaskets. The case gasket will have a "C" clearly cut into it and the valve body side gasket will clearly have a "V" cut into it. Just hold them up to the light and you'll see it.



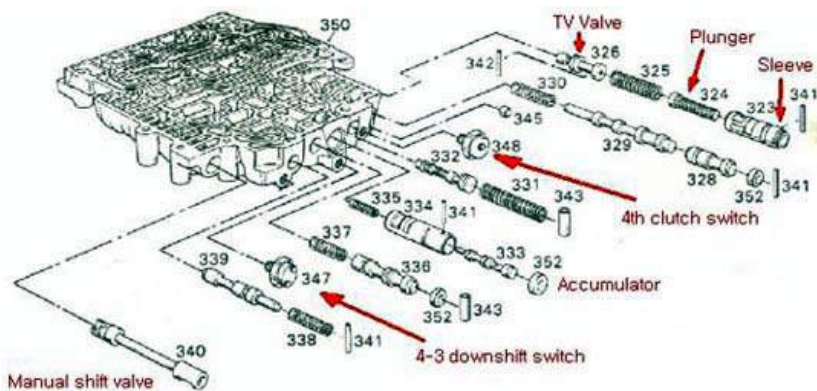
Here's the two possible VB check ball locations. You can reference these for later. Remember to closely identify for sure which one you use based on the above information. The red is the check ball.



LATE 1987 THRU 1992 ONLY!  
VALVE BODY CHECKBALL LOCATIONS  
(WITH AUXILIARY VALVE BODY)



1993 MODELS ONLY!  
VALVE BODY CHECKBALL LOCATIONS  
(WITH AUXILIARY VALVE BODY)



Take all the two or three check balls, depending on which type of transmission you had and put them in a Styrofoam cup. Look at the picture below. See the manual shift valve? It will try to fall out if you tip the valve body. Be careful. Here's where we will use some carb cleaner. Set your self up an area where it is well ventilated, you have plenty of light, and you have plenty of lint free shop rags to lay the valve body and it's components out on.





You will find two kinds of pins. The top is the fat roll pin. Used because a bolt runs through it. The bottom is the thinner roll pin.

You'll need a pair of needle nose pliers. A very small flat head screwdriver and a large screwdriver with a plastic handle. A wire cutter, safety glasses and a magnetic telescoping shaft about 1/4" diameter on the end for fishing out valves from the valve body. A 5 gallon bucket to catch excess carb cleaner in. A small set of picks like the ones pictured below are mandatory.

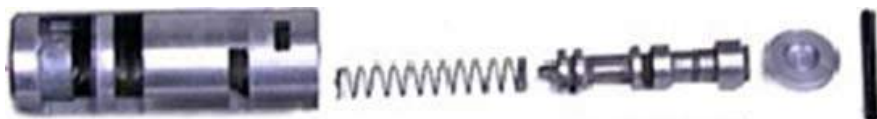
Slide the manual valve link out and place it on your work area for safe keeping. Put on your safety glasses. Really, put them ON!! Use some chemical resistant gloves for this part. If you get carb cleaner on your hands, it will feel extremely cold because it is evaporating so quickly and it is pulling skin oils off of your hands. Your cuticles will peel back and hurt. Now take the whole valve body, being very careful because it is so heavy, and thoroughly spray that sucker off with carb cleaner over your five gallon bucket and watch the black crud start to run off. Do it thoroughly and let it air dry.



Use your small screwdriver and picks to work out each component. Lay them out on your work area in the EXACT order they came out. If your SyTy wasn't up shifting at WOT and you have a replacement tranny, you probably don't have the correct TV plunger and sleeve in there. This can burn up a 3-4 clutch pack. Here's some info on a replacement setup from Sonnax. The 77966-94MK will be the one you want. It is a kit with the sleeve matched to the plunger. The Fairbanks part that fixes this is only a sleeve. I felt better with a matched set (no chance of leakage).

Spray each part off with carb cleaner as it comes out, lay it in order and let it air dry. I had long 1/4" wood dowels I laid out so lineups could not roll around and mingle with each other. The toughest roll pin you will encounter will be the one retaining the TV valve (#326) itself. Note that there is only about 1/8" or so exposed and it is level with the mating surface of the valve body. I tried using my needle nose and it pinched the tip of the pin and pushed it farther down into the valve body. I ended up using a 1/16" or 3/32" drill bit and slowly ran it in until the bit caught tight and then I just pulled up on the drill. The pin and all came out. Clean it off and lay it in place. Keep their roll pins in their appropriate place in relation to the lineups. After you empty the valve body of everything, take it out over the 5 gallon bucket and THOROUGHLY clean it out with the carb cleaner. Use the extension tip that comes with the carb cleaner, stick it up in the valve bores and spray them out. The little shoot that feeds the pressure switches will be full as well. CLEAN, CLEAN, CLEAN. You can accelerate the drying process by spraying brake cleaner on it but it will rust quickly if you do.

The rest will be much easier. The pressure switches are regular GM oil sending unit socket size or you can use an open ended wrench if you are VERY careful. The sleeves may take a little effort to get out. It is ok to gently pry these out. If a valve doesn't want to come out after the roll pin is removed, take the larger screwdriver with the plastic handle and wrap on one side of the valve body with the plastic handle and then flip it over and do the other side until it comes out. Don't try to PRY a valve out if it feels stuck. When you are wrapping on the valve body with the plastic handle, it is actually knocking down small burs that are sticking up on the valve making it stick. If you are patient, and work at it this way, the valve will fall out onto your shop rags (do NOT let it fall to the floor, it will be ruined). When you come across a valve lineup that has a plug on the end of it, be ready for it to pop when the roll pin gets removed. Reinstallation of these merely requires you to take the small screwdriver and push in on the plug so you can get the roll pin past it. The little indented circle always faces the outside. The fat roll pins like in the above picture require you to slightly pinch them with your needle nose pliers as you push up on them. This releases the friction fit slightly so you can get them out.



The other valve you will run across that is SyTy specific is the accumulator valve pictured below. This is number 333, 334, and 335.

This is your accumulator lineup. SyTys will have a "B" stamped on the aluminum sleeve. GM made 7 different types: B,A,N,M,L,K, & F. Range runs from "B" being the firmest to "F" being the softest.



**Secondary Complaint:**

- Shortened band life

**Cause**

Accumulator control incorrect for vehicle application

**Correction**

Using one of these three assemblies will maintain holding power and proper shift feel. The sleeve is made from high quality aluminum and each kit contains three springs of varying spring rates.

**Part No. 77777M-K**  
(.341")

**Part No. 77777L-K**  
(.330")

**Part No. 77777K-K**  
(.315")

Each includes the following:

- 1 Accumulator Valve
- 1 Accumulator Sleeve
- 1 Accumulator Plug
- 3 Accumulator Springs

**Note:** The Sonnax sleeves are not stamped with the letter I.D. The diameter listed with the part numbers above is of the smallest land on the valve.

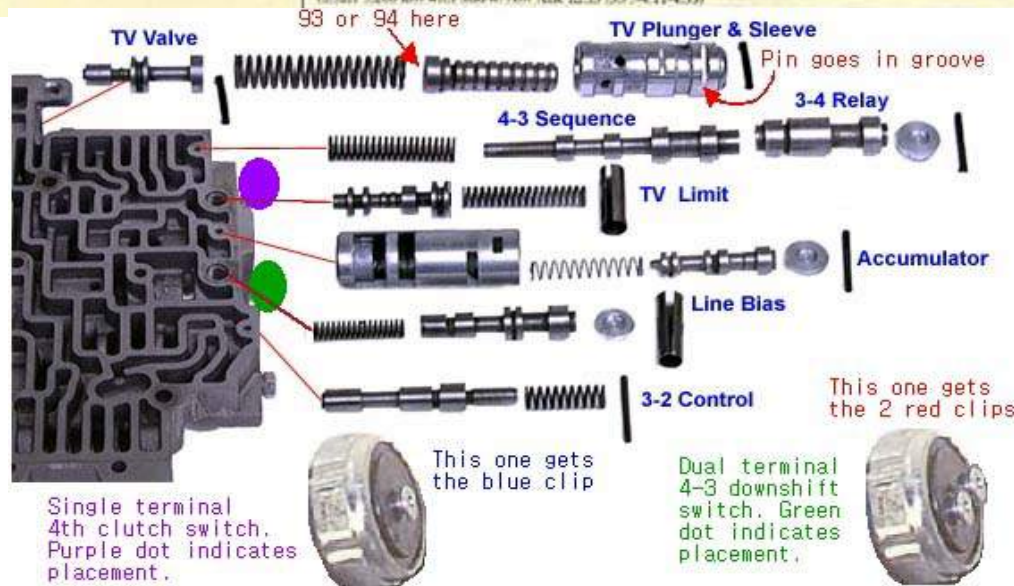


**SONNAX PART SUMMARY**

Vehicles with 200-4R or 4L60 & E transmissions can experience 1-2 light throttle abrupt or "bang" shifts, or a slide-bump on the 1-2 shift, based on a mismatch of accumulator control valve for the application. This valve train has 7 different OEM size variations: B, A, N, M, L, K, and F. They range from the largest valve diameter giving the firmest shift (B) to the smallest valve diameter giving the softest shift (F), respectively. The size variations are clearly stamped with the letter on the aluminum sleeve. Most vehicles, depending upon the transmission/engine combination, can use either the M, L, or K version. However, these are not available unless scavenged from other valve bodies.

Sonnax has designed a replacement accumulator valve train assembly for the M (.341" valve diameter) 77777M-K, L (.330" valve diameter) 77777L-K and K (.315" valve diameter) 77777K-K versions. Using one of these three assemblies will maintain proper shift feel. The sleeve is manufactured from high quality aluminum that is designed to prevent excessive wear due to the reciprocating motion of the steel valve. Each accumulator valve kit contains three springs of varying spring rates to choose from.

Vehicle Type	Accumulator	Yellow 3 lb.	White 5 lb.	Pink 7 lb.
Heavy Cars & Trucks "M" Version with High Axle Ratio (3.09-3.23-3.42)		Light Shift	Medium Shift	Firm Shift
Medium Weight Cars "L" Version (such as Camaro & Firebird) with Mid Axle Ratio (3.02-3.55-3.73)		Light Shift	Medium Shift	Firm Shift
Lighter Weight Cars "K" Version (under 3,200 lbs with Mid to Low Axle Ratio (3.73-4.11-4.33))		Light Shift	Medium Shift	Firm Shift



When you pull yours, it should have a "B" on the sleeve. If not, it is not an original SyTy valve body. The sleeve, valve, and spring are matched for a firm shift.

Sonnax has a kit for this also. However, it will not be as firm as a SyTy. Maybe as firm as a Camaro or Firebird, but not a SyTy. See below.

Here's another lineup shot with a small explanation of the switches.

The switches are very important. Each switch comes in two varieties, normally closed and normally open. You have to make sure you use the original type that came in your tranny. Screw the end off of your rubber tip blow nozzle and screw the switch onto it. Use about 60 psi of air. Make sure the switch does not leak. If it does, it will have to be replaced. According to the schematic at the end, ours are NORMALLY CLOSED, but should be checked for sure. Here's how you check them:

**SWITCH TYPE:** Single terminal normally open

**PART#:** 8642473

**TEST:** Connect one ohmmeter lead to the terminal of the switch and the other lead to the body of the switch. Ohmmeter should read infinite. Apply 60 psi of air to the switch and the ohmmeter should read 0.

**SWITCH TYPE:** Signal terminal normally closed

**PART#:** 8642569, 8634475

**TEST:** Connect one ohmmeter lead to the terminal of the switch and the other lead to the body of the switch. Ohmmeter should read 0. Apply 60 psi of air to the switch and the ohmmeter should read infinite.

**SWITCH TYPE:** Two terminal normally open

**PART#:** 8643710

**TEST:** Connect one ohmmeter lead to one terminal of the switch and the other lead to the other terminal. Ohmmeter should read infinite. Apply 60 psi of air to the switch and the ohmmeter should read 0.

**SWITCH TYPE:** Two terminal normally closed

**PART#:** 8642346

**TEST:** Connect one ohmmeter lead to one terminal of the switch and the other lead to the other terminal. Ohmmeter should read 0. Apply 60 psi of air to the switch and the ohmmeter should read infinite.



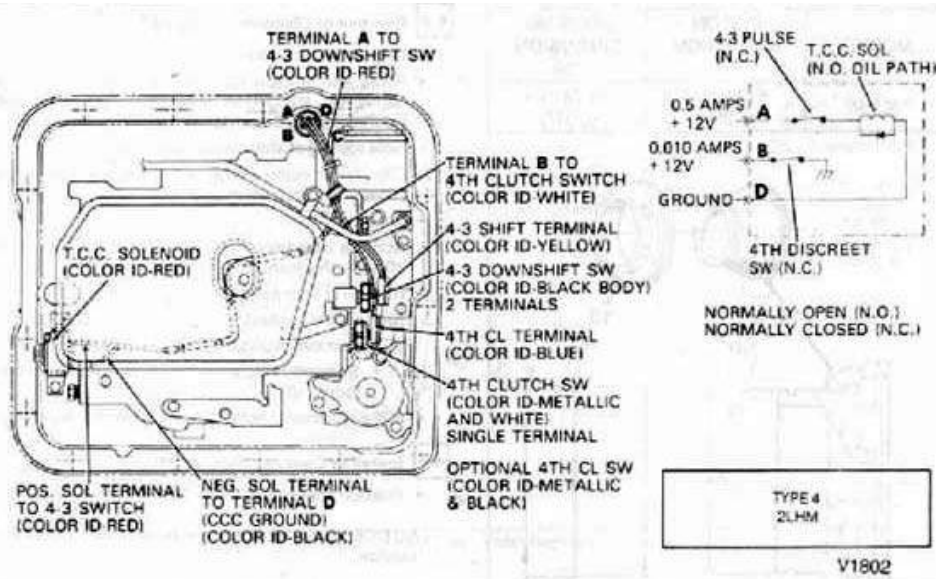
Here's the other side of the valve body:

You will find this side much easier to deal with. After you get the valve body thoroughly cleaned out and all the valves and sleeves and springs are cleaned, you are ready to start putting them back in. Gently drop the valves into their bores and check for freedom of movement. If the valve sticks or doesn't move, do the screwdriver handle wrap deal again. The valves should also move freely in their sleeves. If it sticks in the sleeve, take the sleeve and gently tap it on each side(not the end) on the shop rags that are laying on the work bench until the valve moves. If the valve is still stingy, when you get it out, take your thumbnail and go over the lands and edges of the valves. If you find a bur, take a small fine file and rub in one direction to just take the bur off. You can also use the green scotchbrite cleaning pads that come in bundles of three at the supermarket and clean the valve and spray it off again and try it. Don't forget that you can use your magnet and pull them out too if they are not stuck. Be gentle.



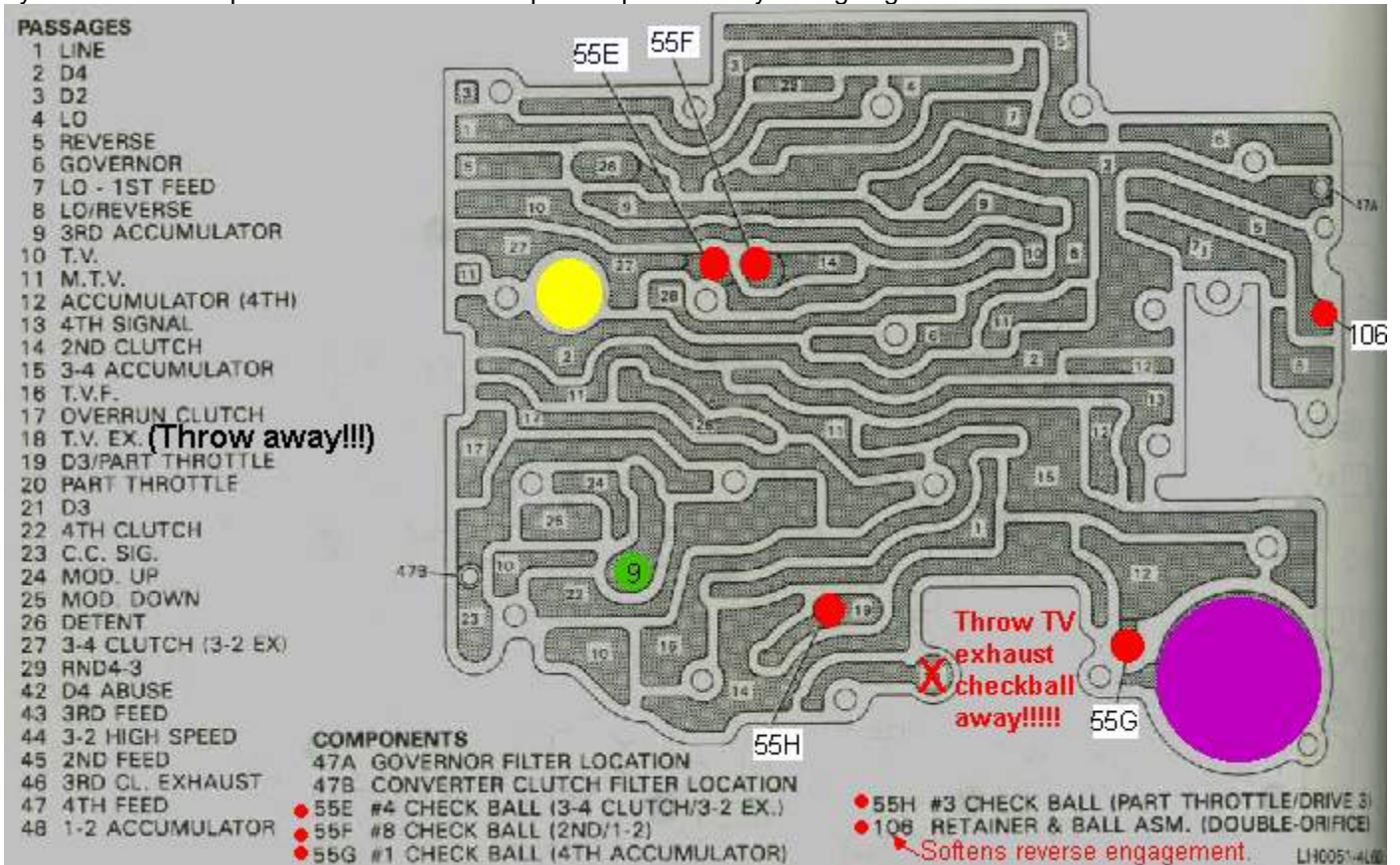
Here another shot of the auxiliary valve body. Same rule applies for these valve as well. NEVER use a hammer on the roll pins. They should only be pushed in by hand. Once they are almost all the way in, take the screwdriver handle and tap them in until they are flush with the valve body sealing surface. You'll notice the pins stick out more on these two. That's ok. Remember, must be flush with the sealing surface.





Here's a schematic of the wiring for the SyTy (Type 4)

On to the case. Now, if you had it sitting level, you've got your check balls that were sitting on the separator plate and put them in a Styrofoam coffee cup. You've removed the separator plate. Now you're going to see this:



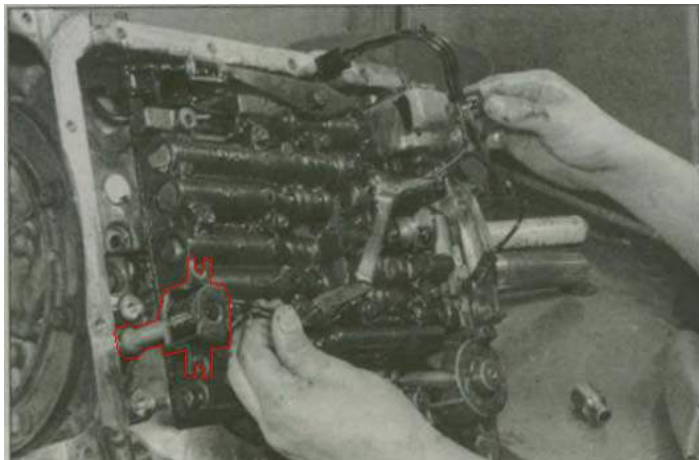
Use your magnetic pickup tool and reach down in there #106 which is the check ball that softens reverse engagement. This check ball helps eliminate the "clunk" when you put it in reverse. You have to get this out or it will fall out and disappear during cleaning or movement of the case. The retainer will not hold it in there.



Here's a pic of Jesse's when his fell out:

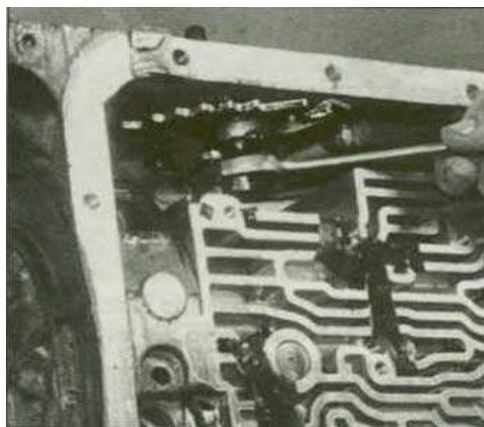
Grab all the other 4 check balls and put them in the cup. Use this chart for reference when you put them back in later. See that red "X"? That is the infamous TV exhaust check ball. This gets thrown away on all rebuilds. If this check ball fails and sticks, your line pressures will max out and quickly destroy the clutches in your transmission. It is 3/8" in diameter. Larger than the rest so it is easy to identify. The large purple dot is the 3-4 accumulator. We'll talk more about this later. The green dot with the #9 in it is the often talked about 3<sup>rd</sup> accumulator. More on this later as well. The discussion later is really important if you enlarge the 3<sup>rd</sup> feed orifice in the separator plate. The yellow dot signifies the 2-4 band anchor pin.

Pull the spring out of the 3-4 accumulator bore. It will be white or black (no color). Reach down in there with your big needle nose pliers or snap ring pliers and pull out the piston. The pin may come out also. Set the spring and piston (maybe even the pin) in a cup off to the side (mark the side of the cup so you'll know what it is later).



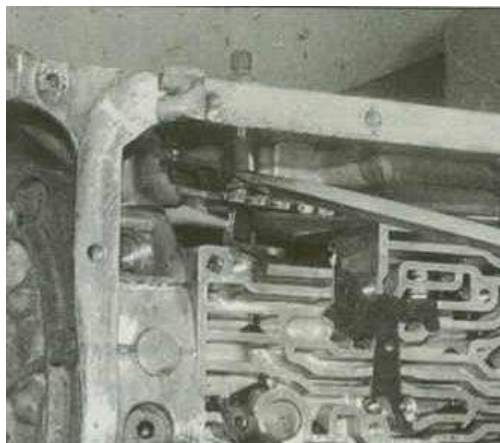
Make sure you've got that TCC solenoid pulled out of the case. Here's a pic with it highlighted in red.

You MUST have that removed before you can pull the pump.



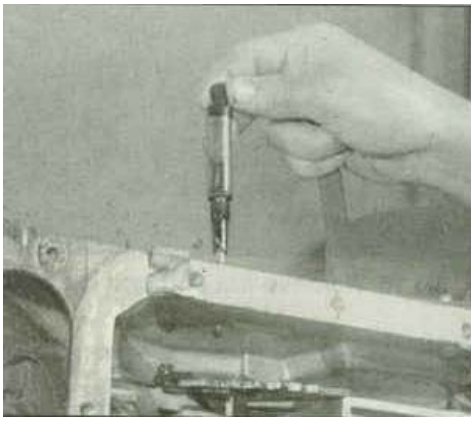
Now, if you haven't already, we're going to remove the manual shaft assembly.

Use an opened end wrench and break the nut loose to get it off. It will be TIGHT!  
Use a small box to put all of these small parts into so none get lost.

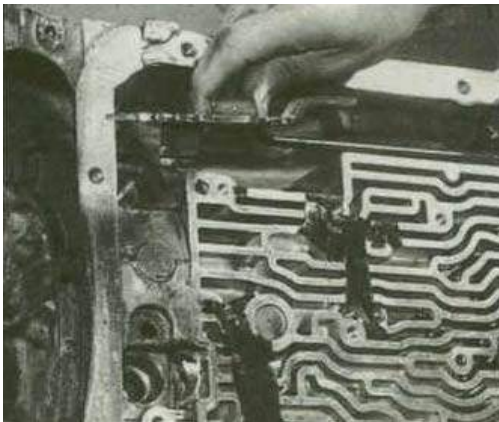


Use a large flathead screwdriver and pry the clip off. Keep a finger on it so it doesn't shoot off or fall down into the case.

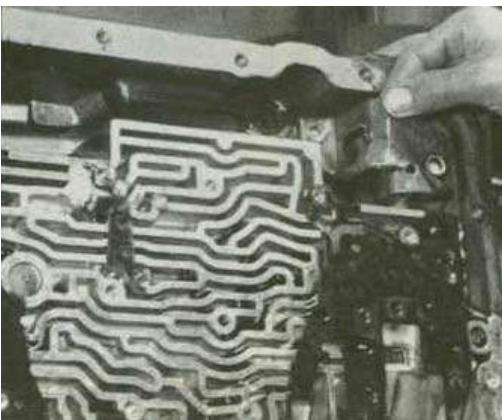




Now just wiggle/slide the manual shaft out of the case. There will be a new seal for it in your kit. Make sure you replace it. It goes into the bore of the case. If you are having your case hot tanked, wait until you get it back before you put in the seal. Use an appropriate socket to push the seal in to place.

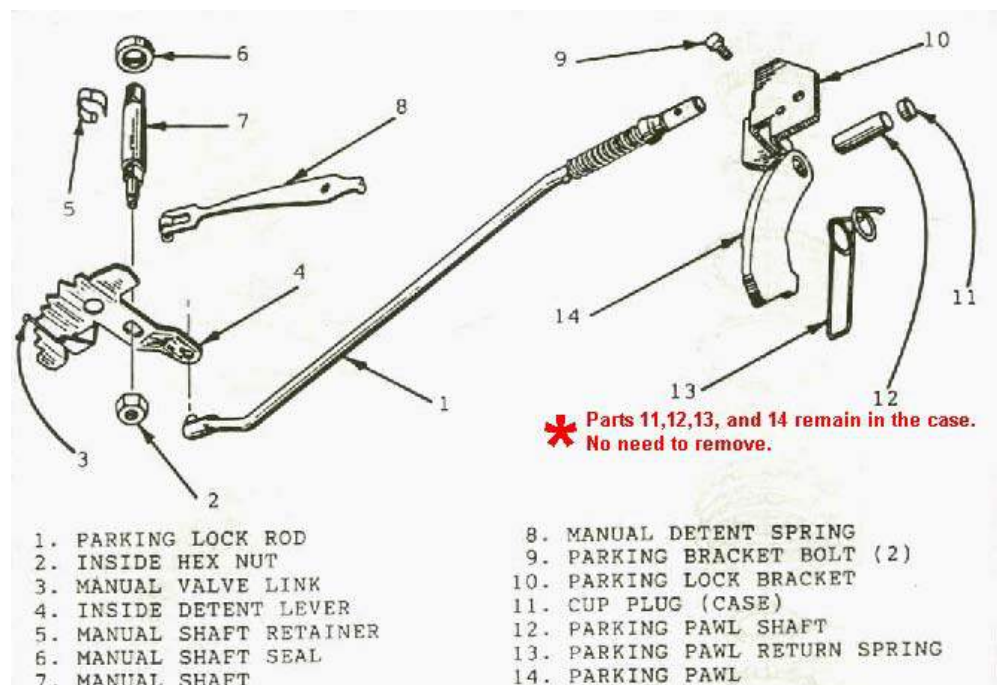


Grab the detent arch and rod assembly and pull it out. The far end of the arm will slide right out of the park/lock bracket that is still bolted to case.

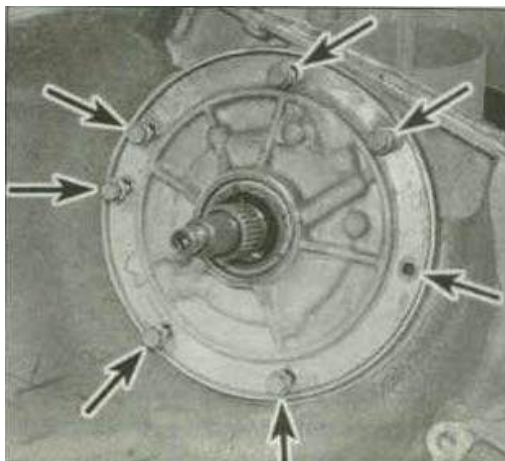


Remove the two bolts that retain the parking bracket assembly and lift it out. There is a hardened "finger" that pushes over into rear reaction gear support. This finger is what prevents the output shaft from turning. Your truck will still roll, however, if your front propshaft is out of the truck. This is due to the design of the Borg Warner AWD 4472 transfer case. Rolling in park is normal if you have the front prop out.

Here's another exploded view to see all the parts you will remove:

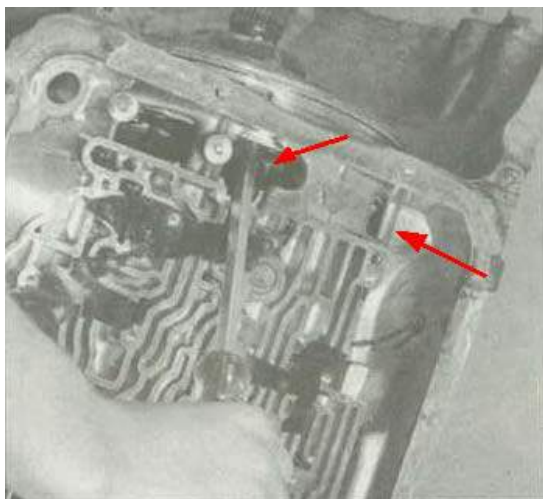






Now let's get the pump out. Remove these 7 bolts.

These are special bolts and have seals on the back side of them. The seals are rubber O-rings. If your kit has little black washers also, don't use them. They are for older versions.

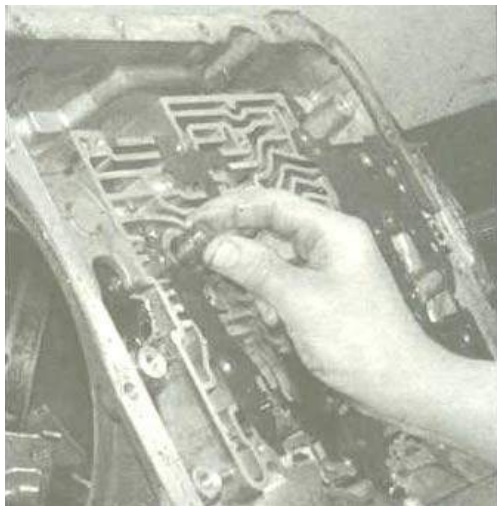


Now we just pry out the pump. Take two flat head screw drivers and place them between the aluminum housing of the pump and the shiny steel surface of the reverse input drum. It will be seen as a small crevice between the two. The red arrows indicate points where the screwdrivers need to be inserted. The arrow on the right points to a window in the casing. Just pry simultaneously with both a little at a time and then move your purchase point a little until you get the pump loose. Once it pops loose, just grab a hold and set the whole thing to the side. Be prepared, it may explosively try to come out once the seal clears the case if you are prying too hard.



#### **On to the input drum.**

This thing is heavy. Firmly grab it with two hands if you have to and slowly remove it from the case. It is very heavy and may hang up on the 2-4 band so take your time and slowly get it out. It will want to drop and bang on the inside of the bell housing. Just be ready. Set it to the side.



Now just pull out the anchor pin and band. If you can't get it off the 2-4 band, take one of your dental picks and reach down inside and push the anchor pin out from the inside to release some of the tension of the band. Sometimes it kind of cocks in the case and hangs on the input drum.

If your input drum came out easily and the anchor pin is still in the case, take the finger of one hand and reach inside the case and push it out while grabbing it with the other hand. Put it in with the check balls so you don't lose it. Then just reach in and pull out the band.



Things are coming apart quick now. Make sure you have everything organized so nothing gets lost.

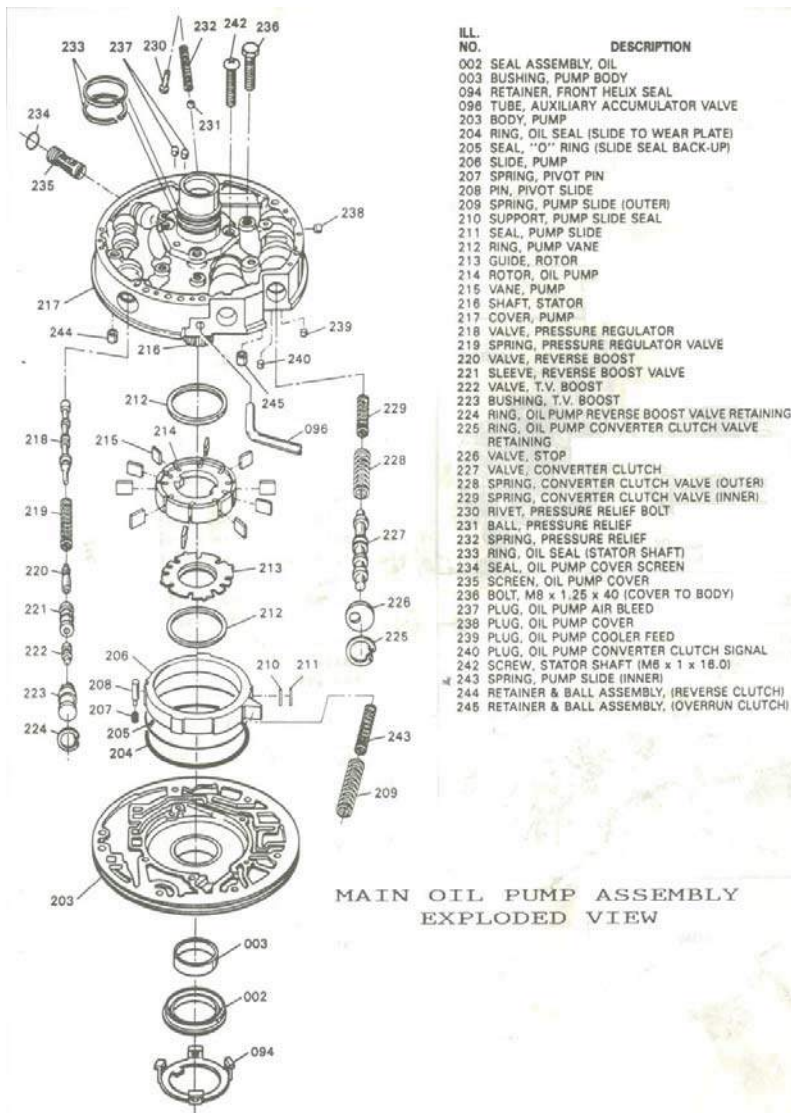
Here's a pic of the front sun gear being removed. Just reach in and pull it out.

Do yourself a favor on this. It is a genuine pain in the backside to remove the bushings if you don't have special bushing removal tool. Then you have to put the new ones in to proper depth, which in itself isn't a difficult thing but you need a proper sized bushing driver. Then there is the issue of getting them installed perfectly straight. Very important. If you get a new one, it will have new bushings already pressed into it. There are two. You also won't have to worry about hairline cracks in your old one.

DACCO part #77824A. The money you have saved doing this yourself is worth the \$13-\$20 you spend on this part.

Now we're going to stop taking parts out of the case for a bit and focus on rebuilding some of the sub assemblies you just removed. One is the pump and the other is the input drum/reverse input drum assembly. There are many mods we will do to each in this tutorial.

Here's an exploded view to see what we're getting into:



## We'll start with the pump. The heart of your transmission.

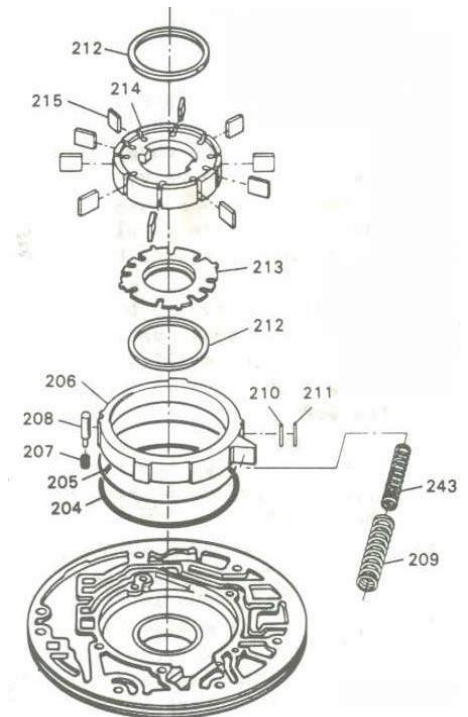
Start by sliding the tan thrust washer off of the large diameter stator end of the pump.



Now, take out the bolts that hold the two halves of the pump together. There will be 5 of them. Be cautious, the halves will separate easily and there is no gasket between them. Make certain you position just as pictured so the pump rotor and other small parts stay in the pocket.



Here's an exploded view of the pump internals again.



Lift off the top pump ring, all of the pump vanes, and lift out the rotor. Set them all on clean lint free shop towel. There will be one more pump ring on the bottom. Take a look at your pump rings.



Make sure you cup your hand over the springs so they don't shoot out!!!



Early models used brittle rings that would crack and ruin the pump casing. Your SyTy, unless the tranny was replaced by a pre 1987 unit, will have these in it. Make sure yours has the yellow markings on it. Taking out the pump springs is dangerous. They WILL shoot out and bounce around the room if you don't cup your hand over them before you pry them out. Just take the flathead screwdriver, position it as shown, cup your hand over the dual spring assembly and pry it out.



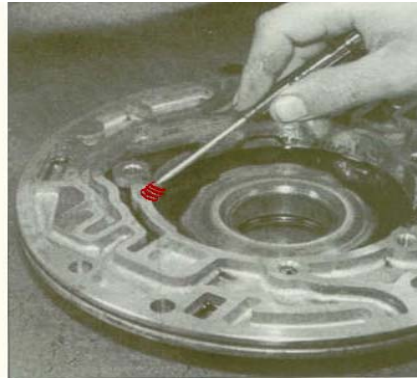
Rubber slide seal is down in the groove.

Metal ring just sits on top of the rubber slide seal.

Lift out the slide. There will be the following items stuck to it or they will still be in the pocket.



Rubber seal goes against slide 1st than Teflon.



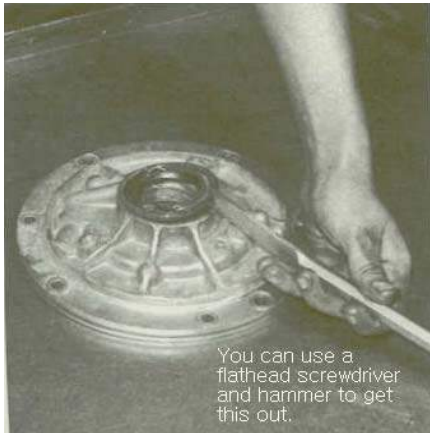
Reach in with your fingers and remove the pivot pin(#208) and then take a very small pocket screwdriver and stick it down in the hole and remove the pivot pin spring. It will have a red color to it. Do NOT lose it. Keep it with the pivot pin.

Have another large lint free shop towel ready and flip the pump over with the smooth surface down and place it onto the towel. You can use a screwdriver and pry off the front seal retainer (#094).

I used a flathead screwdriver and hammer and then knocked off the metal clad seal.

It will be red with a black rubber seal in the center of it. This is being replaced so don't worry about damaging it. Just do NOT damage the aluminum pump case while you are getting it out. It is difficult to get started but once you do, just work your way around the circumference of the seal. If you want to make it easier, you can get a bushing cutter/seal removal tool from here:

<http://www.bulkpart.com/>

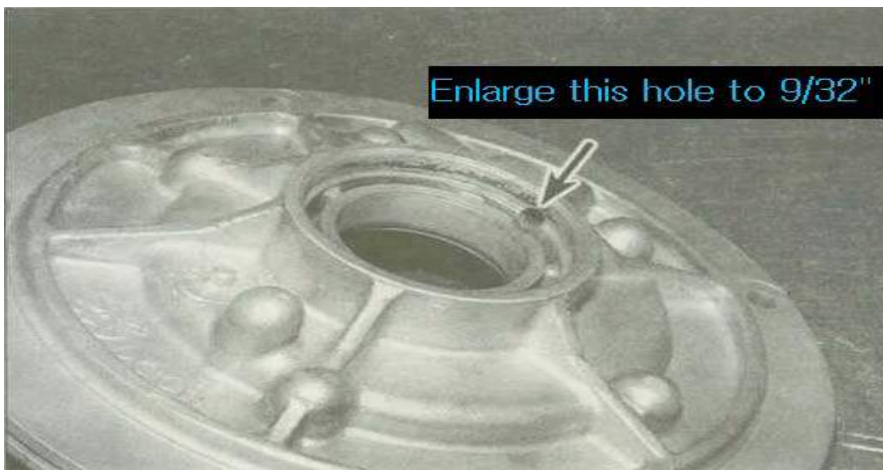


You can use a flathead screwdriver and hammer to get this out.



The picture is showing the correct way to remove the pump bushing. There is a lip that is cast into the pump to keep the bushing from walking forward. If you try to drive the bushing out the wrong way, you will ruin the pump. Don't use the bushing cutter for this bushing or you can ruin that lip. The best way is to use a bushing driver kit.

If you don't want to spend the money, take it to a local shop and let them knock the bushing out for you. Only takes a second. Don't put the new one in yet.



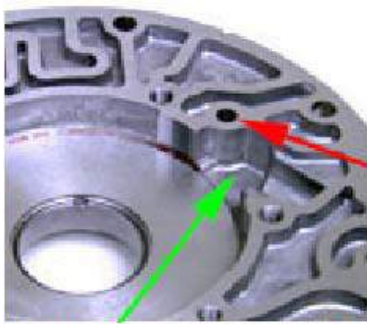
Enlarge this hole to 9/32"

Here's why. The pumps in the 700s were notorious for blowing out the front seal because the drain back hole wasn't large enough.

Here's what you do. Once you get the front seal and the bushing out, hold it up like this:

Take a long 9/32" drill bit and slowly work your way using the original hole as the guide. Don't drill all the way through the side of the pump. If you flip the housing over, you will be able to see where this passage intersects another passage at almost a right angle. Just drill until you can watch the drill bit just make contact with the wall of the intersecting passage.

Here are all the different aspects of drilling the pump.



Drill this out to 5/16"  
This is the same passage  
you look down into to see  
when to stop when drilling  
the intersecting passage.

If the drillbit breaks through this surface while you  
are drilling the front seal passage, the pump will still  
work just fine.



The max on this passage will be 9/32"  
Only drill until you see your bit bottom  
out. No further.

This last shot is the stator side  
of the pump. Drill this out to  
5/16" as well. Go slow and  
use the original as your guide  
so you don't crossdrill into  
another passage.



Interlocking Finger Style



Butt Style



I like the "babbit" or "interlocking finger"  
style of pump bushing because it is VERY  
resistant to cocking in the bore. Here's a  
picture comparing the babbit style to the  
type you will find in your pump if you have  
a Typhoon.

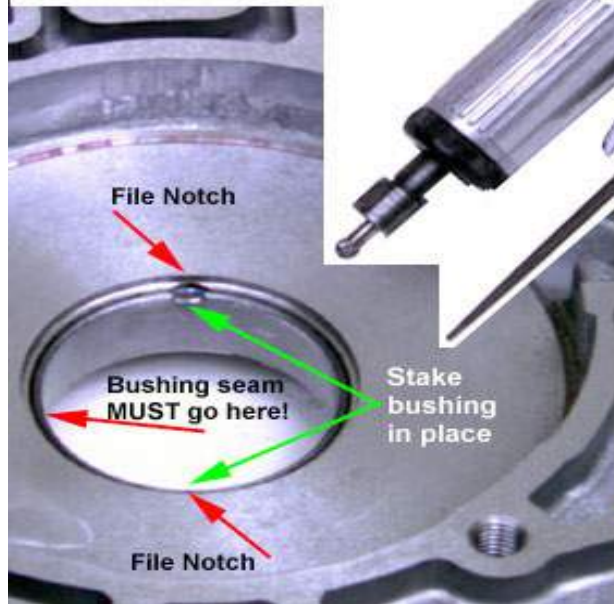
**Important**

700R4's & 4L60E's use a Teflon coated pump bushing  
that has a butt style seam instead of interlocking fingers.  
This bushing loves to collapse inward than spin out &  
sometimes even wears out the bushing bore. When the  
bore is worn out you can pull the bushing out with your  
fingers. Always replace Teflon Butt with the babbit style  
700R4 pump bushing.



4. Stake bushing in place. Scrape excess babbitt off with pocket knife. Resize on TC hub.

3. Apply a coating of Red colored LockTite to bushing & pump bore. Install bushing.



**Important**  
Always LockTite & Stake bushing in place to prevent spinout!

1. Use a grinder or a 3 sided file to make a notch on each side of body.
2. Brake Clean pump bushing & bore in body. Blow dry with compressed air.

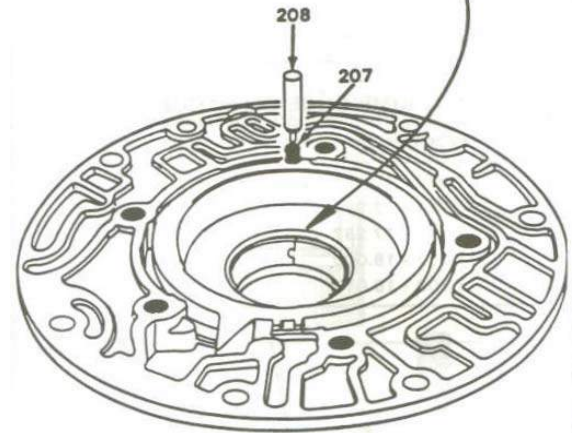
A way to keep the pump bushing from spinning in its bore is to stake it in place.

Here's a really good description:

After you make the two little notches (very little, doesn't take much) debur the notches just a bit and clean with carb cleaner and let dry. See the red arrow in the center that describes where the bushing seam goes?

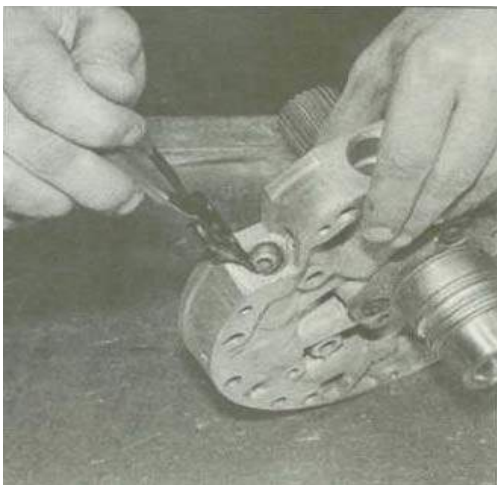
Here's another pic showing what they're talking about:

WHEN REPLACING THE FRONT PUMP BUSHING, ORIENT THE SEAM OF THE NEW BUSHING SO IT IS POINTED AT THE BOLT HOLE NEXT TO THE PIVOT PIN AS SHOWN BELOW.



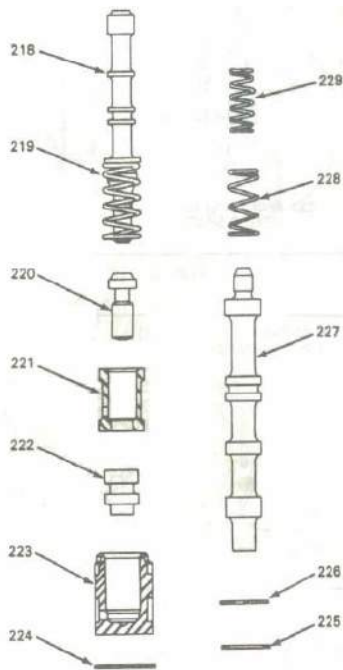
That arrow is pointing this out for you. Don't install it yet, just look first. That seam must be inline with the pivot pin. Now use a "babbitt" style bushing and put RED loctite on the bushing and the surface of the bore. Now install the bushing. Only install it until it touches the lip that we talked about earlier. If you drive it past the lip, you'll ruin the pump and the bushing. Once the bushing is in perfectly straight and at the proper depth, use flat punch and just tap the spots of the bushing directly inline with the notches you made. Take a pocket knife and scrape the raised material from where you staked the bushing. Whenever you stake something, the area immediately surrounding the point of impact will raise ever so slightly. You need to scrape this down as close as possible to the original surface as you can. It only takes a little scraping. Don't go crazy.

Once the Red Loctite has set up, take the TC you are going to use and clean the hub with green Scotchbrite and wipe it down CLEAN. Take transmission fluid and lubricate the TC hub and the bushing surface you just did all that work on. Set the TC so the hub is sticking up and gently slide the pump half onto it. All we're doing is checking that the fit is snug but NOT too tight. You should be able to rotate the pump half on the TC hub without any restriction.



Now more on the other half of the pump. This half of the pump is where ALL of the valve lineups are. Take a pair of snap ring pliers and remove the snap ring slowly so it doesn't shoot off and land in the floor.





ILL. NO.	DESCRIPTION
218	VALVE, PRESSURE REGULATOR
219	SPRING, PRESSURE REGULATOR VALVE
220	VALVE, REVERSE BOOST
221	SLEEVE, REVERSE BOOST VALVE
222	VALVE, T.V. BOOST
223	BUSHING, T.V. BOOST
224	RING, OIL PUMP REVERSE BOOST VALVE RETAINING
225	RING, OIL PUMP CONVERTER CLUTCH VALVE RETAINING
226	VALVE, STOP
227	VALVE, CONVERTER CLUTCH
228	SPRING, CONVERTER CLUTCH VALVE (OUTER)
229	SPRING, CONVERTER CLUTCH VALVE (INNER)

These lineups are spring loaded so be careful. When you get ready to clean your valve lineups, do them exactly like you did the ones for the valve body.

Here's what they'll look like:

Spring #219 will be green. Transtar sells a diesel tranny pump spring that is pink. The pink spring will add anywhere from 3 to 5 psi to your pressure at idle. The pressure regulator valve needs to be modified. If you have a 93 Ty, it will already have the new style valve in it. If you want to buy the new valve, the GM part number for the valve is #8684048. Or you can just do this:



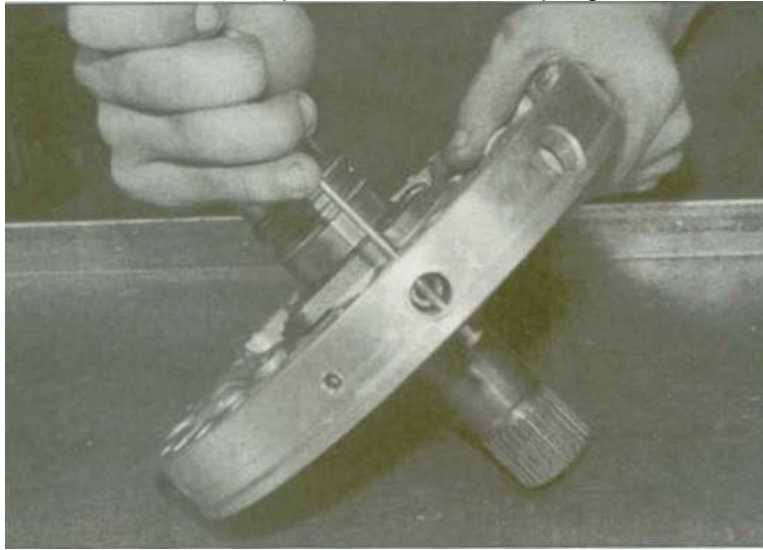
When you do this, your line pressure will drop by about 50 psi. It is worth it. The systems using the previous valve would allow little to no fluid flow during lockup condition. This makes the tranny/torque converter run very hot. When you do this mod, fluid will flow continuously, even during lockup. To compensate for this, we need to install a larger TV boost valve. #222 and #223 in the diagram.



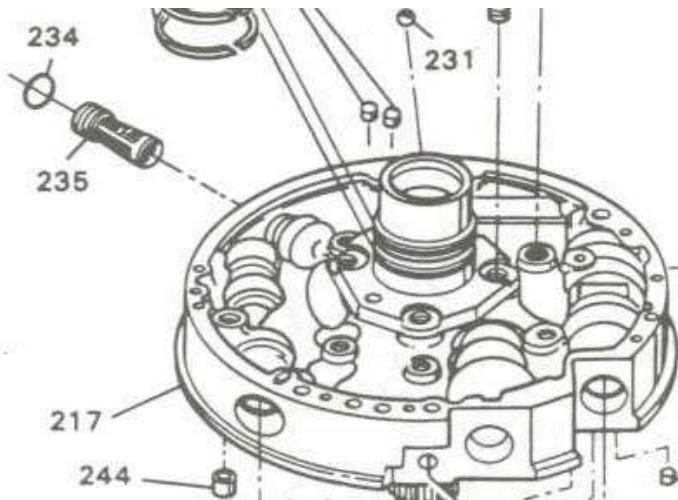
Stock is .471" Common aftermarket is .500" and run about \$12 to \$15 each. The largest readily available is .570"  
Here's a comparison:

I use a .500" and George used a .570 and is very happy with it. They are available from <http://www.2004rperformancecenter.com/> for about \$50 each. Look under "Xtreme Parts" for the 2004R. The TV boost valve for the 700r4 and the 2004r are interchangeable. If you plan on shifting manually, you may wish to install a larger REVERSE boost valve as well. This is designated as item #220 and #221 above. This will not raise your line pressures unless you are in REVERSE or LOW. "Xtreme" also has them up to .400" (this is almost 25% larger than the largest available size from GM. They run about \$40 each.

Onto the pressure relief valve spring.



Take an appropriate sized drill bit or center punch and push the “nail like” retainer out while you keep your thumb over the opening. There is a red spring and check ball that will come out. Keep them together with the retaining pin. Reach in with a pair of needle nose pliers and remove the pump filter. There may be a replacement in your kit. If not, your kit will have an “O” ring for it. You can see it on the left as #234 and #235.



Here's another shot of where they are at and how they look.

**If either of these is missing you'll have very low line pressure!**

**Important**

Don't forget to install thimble filter & O-Ring into stator bore. If pump came from parts supplier make sure press. blow off ball & spring isn't missing.



Installing the bushings straight and true in the stator of the pump is critical to proper operation of the transmission. You may wish to take them to a shop and have them pressed in for you. Any good machine shop can remove and install these for you. If your bushing kit has two that look like they will fit in the small end of the stator, you want to use the one that is taller and has a larger internal diameter. The smaller one won't fit over the splined shaft on the input drum. Once you get your pump back from the shop, here's a trick you can do to make sure the bushings are not cocked in the bore. Take your input drum and set it up so the splined shaft is sticking up. Now lube the shaft up with petroleum jelly or transgel and carefully slide the stator down over it. It should install EASILY and spin FREELY. If it doesn't do just as this says, the bushings are cocked in the bore. Take it back and make them do it again.

Spray it down thoroughly with carb cleaner and let it air dry. Use transgel or petroleum jelly and lube the lineups and install them just like you took them out. Use the pics above as reference. When you install the pump filter (don't forget the o-ring) it will snap into place. Reinstall the check ball, the red spring and the large “nail like” retainer in the pressure relief assembly.

When you install the lineup with the TV boost valve and reverse boost valve, the snap ring must be installed in the second groove as shown below.

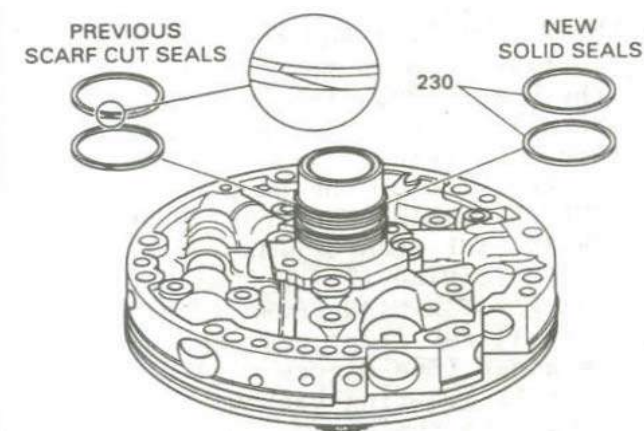


2nd Groove  
Snap ring  
MUST go  
here!

Installed in  
1st Groove  
= Low Press

Press. Regulator Bore

You should replace the 2 large scarf cut Teflon o-rings (blue) on the large end of the stator with the new one piece rings.



Here's what I do to install them. Take an aluminum pop can and cut the top and bottom off and cut a slit down the side. Now rub your hands together to warm them up and grab one of the rings. Rub it around in your hands. This makes them very pliable. Now take the cut up pop can and set it over the large end of the stator somewhat like a cone. Now slide the Teflon o-ring down the aluminum and into the bottom groove. Then just move up and do the next one. Much easier than you think. Now, to resize them, take a radiator hose clamp of an appropriate size and put it down over the lowest ring and tighten it up very slowly with the smooth area of the clamp over the ring so the grooves don't cut the Teflon. Just tighten it down until the clamp hits the metal shoulder above and below the groove the O-ring is in. Do the same for the next one up and then just leave them on there until just before you reinstall the pump into the tranny later on.

230 RING, OIL SEAL (STATOR SHAFT)

Now back onto rotor side of the pump with the pocket in it. Let's put the front seal back onto the pump as shown below. Put red loctite on it and use a flat block of wood and hammer and reinstall it evenly back into the pump.



Reinstall that little red spring that was under the pivot pin. Now take the slide and clean it up thoroughly. Take some transgel or petroleum jelly and lube the new rubber o-ring out of your kit, and reinstall it in the groove. The use some more jell to hold the metal ring on top of it so it doesn't fall apart. Use the pic below for reference.

Rubber slide seal is down in the groove.

Metal ring just sits on top of the rubber slide seal.



Here's a trick on the springs you can do to keep the pump in the HIGH VOLUME position. Very important when using bigger boost valves and doing the pressure regulator valve mode. Your stock springs look something like this:

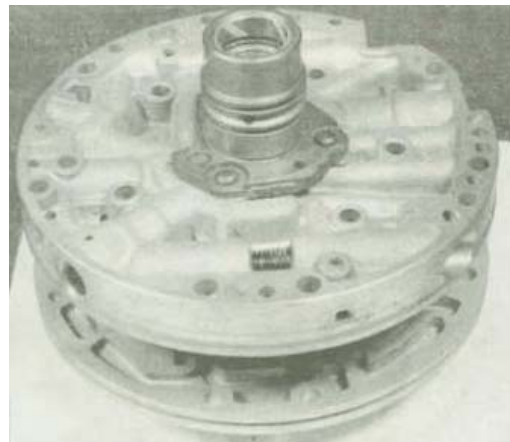
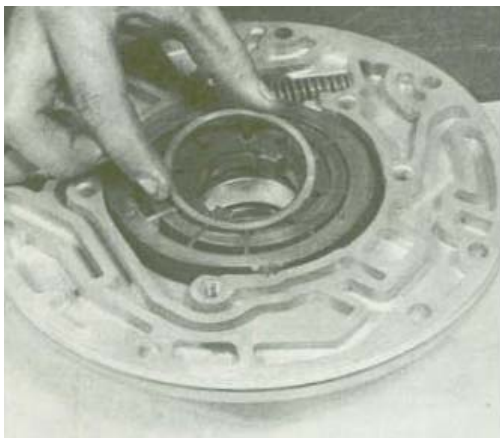


Now Sonnax sells a very heavy duty pump slide spring. The pic doesn't show it well but it will be purple in color. Info on it is <http://www.powerglide.com/parts/parts/77722-01.htm>

Take your stock INTERNAL spring and screw it into the HD Sonnax pump slide spring. This will be a damn stout spring and will hold the slide in the max volume position no matter how high you rev it. It will be a bear to reinstall. Put one end against the steel slide and then use a thin flathead screwdriver set against the aluminum wall and slide the spring assembly down into the pump cavity for it. It is tight. Your thumbs will be SORE once you get this in. It is NOT easy but it is worth it.

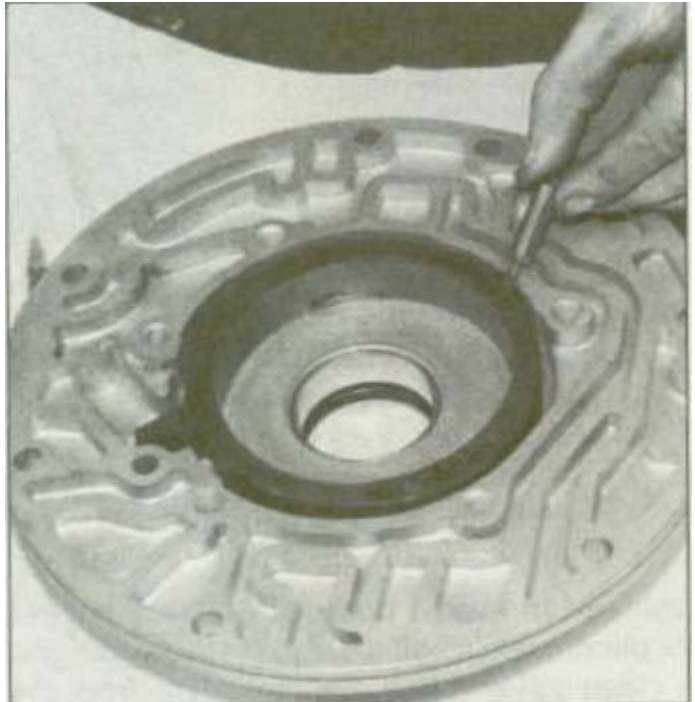
The rest of the pump reassembly is easy. Take some tranny fluid and pour it into the pocket to lube it up. Set one of hardened pump ring down into the pocket. Take the plastic pump guide and use some transgel and stick it to the rotor. It will only go on one way. Carefully set the rotor down into the slide on top of the hardened ring. Now take your 10 vanes one at a time and slide them down into the slots of the rotor. You will know they are fully seated when the top of the vane is FLUSH with the rotor and slide surface. The only difficult part you will run into is getting the hardened ring underneath fully centered. As you install a vane, the inner edge toward the bottom will set against the hardened ring. The outer edge will ride against the pump side inner wall. Just take your time. You'll get it. Don't forget to install the other hardened pump ring on top of the assembly as shown below. It will sit just inside all the vanes.

Now take both halves of the pump and line them up as shown below.

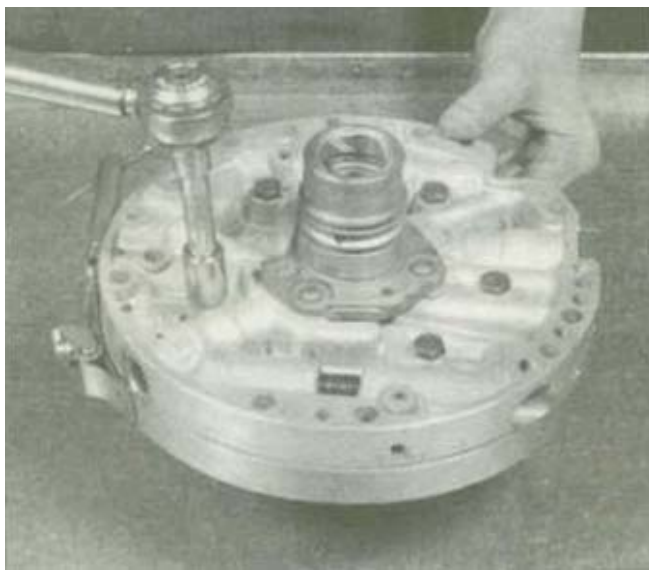


Sit the slide assembly down into the pocket with the o-ring/metal ring side down. Will only go in correctly. Pretty much idiot proof. With the slide in place take the NEW rubber stick and Teflon piece out of your kit and lube them with jell. I kind of hold them together and slide them both in at once so the rubber is against the slide and the Teflon is against the aluminum pocket wall. The tops of the seals will be flush with the top of the slide when installed correctly.

Now install the pivot pin. Push down on it until the top is flush with the slide.





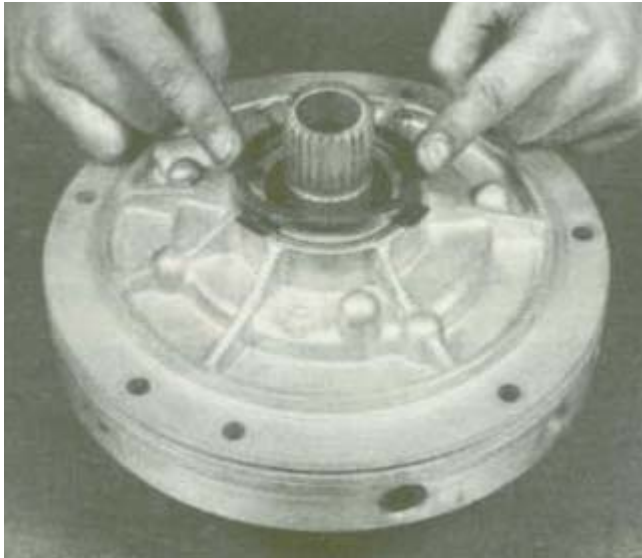


I'm really particular. I install the bolts on opposite sides just loose enough that I can rotate the halves for alignment. I line up the bolt holes PERFECTLY. This way you know all of the other passages will also be PERFECT. Now tighten them finger tight and install the other 3 finger tight. Use two LARGE hose clamps like come on rubber large diameter drain adaptors at home improvement stores and hook them up inline so that they make one large circle. Slide the assembly down over the pump centering on the joint where the two halves meet. Now cinch the clamp assembly down.

**USE A TORQUE WRENCH and tighten to 18 ft. lbs.**

Remove your clamp assembly, flip the pump over and install a new front seal retaining ring. Some retaining rings have a small tab that stick out on the internal diameter of them.

You can just barely see it under the gentleman's right hand index finger in the picture. Position the pump so that the valve lineups are pointed directly at you. Now put the little tab at just about the 5 O'clock position and take a hammer and gently tap around the top edge of the retainer until it is fully seated.



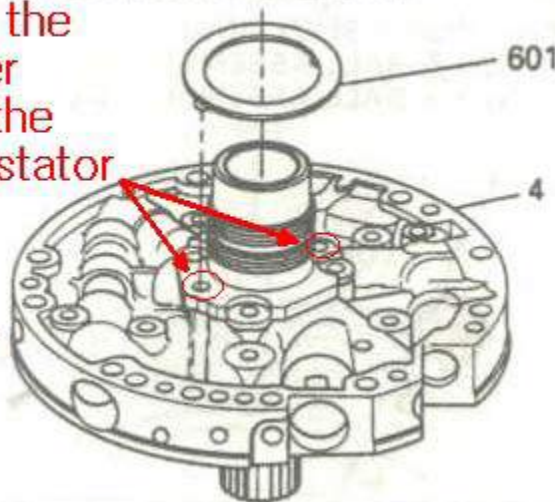
Go ahead and take some transgel and install the tan plastic thrust washer on the stator side of the pump as shown below. The gel, of course, makes the plastic washer stick in place.

Don't install the large diameter rubber seal with the red stripe on it that goes around the circumference yet. We'll do that later.

#### 4 PUMP ASSEMBLY, OIL 601 WASHER, THRUST (PUMP TO DRUM)

The tabs on the thrust washer line up with the holes in the stator

Stick the washer to the pump with transgel.



There have been a few questions regarding 13 vane pumps. There are two reasons that make me not want to use them. But, they have been used successfully in the past.

#1 If you order a 13vane pump from most places, you won't know if it is a PWM unit for the 4L60E. This is a completely different design from what our trannys need.

#2 This is the biggie in my opinion. Your rotor and slide was matched to your pump housing. The tolerances are so close that it is required to mic the rotor and slide for replacement so you can get the EXACT replacement. Look at how *close* those tolerances are before you fall into a different thickness for matching your rotor and slide. There are 5 for each one obviously. If you get a 13 vane pump and it works, consider yourself very lucky. If you get one and it is thicker than your stocker, you can have them honed until they are the correct thickness. If you don't have it honed, either the slide will stick in a low flow position or the rotor and vanes will dig into the pump. If they are too thin, you won't be able to use them because pressures will be low.

Here's how you check if you are unsure of your clearance.

OIL PUMP ROTOR SELECTION CHART	
THICKNESS (mm)	THICKNESS (in.)
17.948 - 17.961	0.7066 - 0.7071
17.961 - 17.974	0.7071 - 0.7076
17.974 - 17.987	0.7076 - 0.7081
17.987 - 18.000	0.7081 - 0.7086
18.000 - 18.013	0.7086 - 0.7091

OIL PUMP SLIDE SELECTION CHART	
THICKNESS (mm)	THICKNESS (in.)
17.948 - 17.961	0.7066 - 0.7071
17.961 - 17.974	0.7071 - 0.7076
17.974 - 17.987	0.7076 - 0.7081
17.987 - 18.000	0.7081 - 0.7086
18.000 - 18.013	0.7086 - 0.7091

### Important

Always check pump clearance. Rebuilds are usually TOO TIGHT or TOO LOOSE

### Slide, Rotor & Vanes Clearance .0005" to .002 MAX.



### Here's A Quick Check For Rebuilt Pumps

1. Install bare slide into body
2. Bolt stator to body
3. Take & shake pump assemble. You should here slide rattle back & forth. If not it's TOO TIGHT.
4. Do same test with rotor.



If you are too tight but close, take a fine honing stone or a block and 320 grit emery paper and work surface until clearance is uniform and correct. If you don't have a honing stone, take it to a machine shop and tell them exactly how much to take off and which side to take it off of. If you have any material removed, it must be taken off the top side. For example, in the picture above, if the clearance was too tight or negative clearance (slide thicker than pocket is deep) the material will be removed from the side that the feeler gauge is touching. You can see that is a whole lot easier just to

reuse your stock 10 vane pump.

### CUSTOM TOOL TIME!!!!

We're now moving onto the input drum and reverse input drum sub assemblies. Before we do anything else with these, we're gonna build a tool to compress the spring assemblies to pop out the snap rings so we can clean everything up properly and replace the seals.

We have Barry Tisdale to thank for the original design. We changed just a couple of things but it is still his design. Instead of buying an \$80 to \$140 tool, we can now fab up a unit for less than \$20.

Here's what you need to get:

Plastic milk crate

15"x15"x 3/4" thick plywood (NOT OSB)

15" long piece of 2"x2"

A 60" piece of 3/8" all thread

8 nuts that are the same thread pitch as your all thread

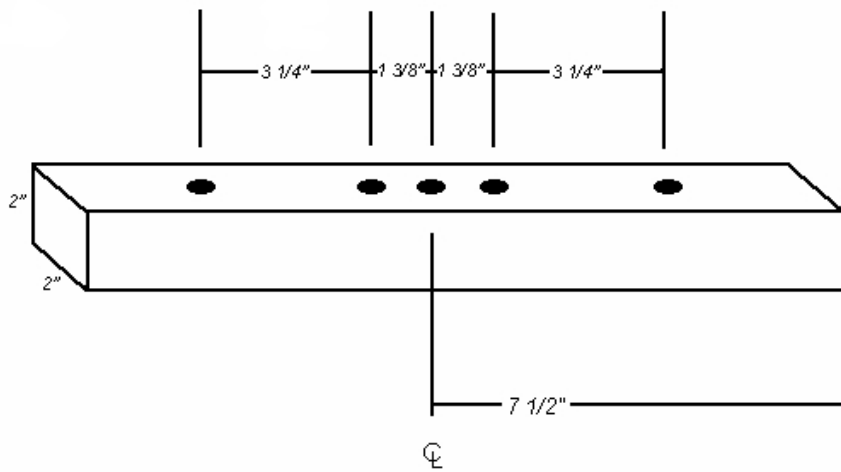
8 washers with a 1" outer diameter and a 1/2" inner diameter for the all thread

Two 5/16" 'screw eyes' with matching nuts and washers

Here's what we're going to do with all this stuff.

Take that 15" long piece of 2"x2" and drill five 7/16" holes in it just like in the picture below:





Now take the 15"x15"x3/4" thick piece of plywood and lay the 2x2 you just drilled and lay it right across the middle of the plywood and mark the centers of the two outer holes and the hole in the very center. Drill the two outer holes with a 7/16" drill bit. Use a hole saw or jigsaw and, using the center marking as a reference, drill/cut a 2" diameter hole in the very center.

Take the milk crate and flip it upside down. Take some wire cutters and cut a hole in the very center of the bottom out about 2" in diameter.

Take the 60" piece of "all thread" and cut it into 4 equal pieces. Grind all the ends smooth so the nuts thread on easily.

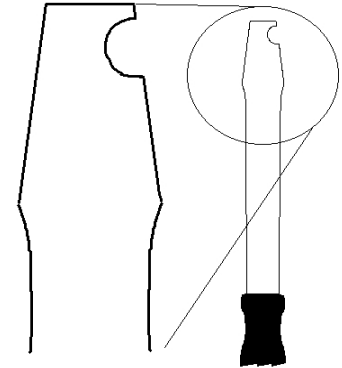
Now take a medium to medium/large size flat head screwdriver and grind a little notch in the side of it just like this:



Here's how you make a lip seal tool:

Get some 1/4" diameter copper tubing about 8" long. Get a small paper clip.

Straighten out the ends of the paper clip and stick the free ends down into the copper tubing until there is 3/4" to 1" sticking out. Then just take some vise grips or a large vise and SECURELY crimp the cross hatched area in the picture. This will obviously hold the paperclip in place and leave you plenty of handle area.



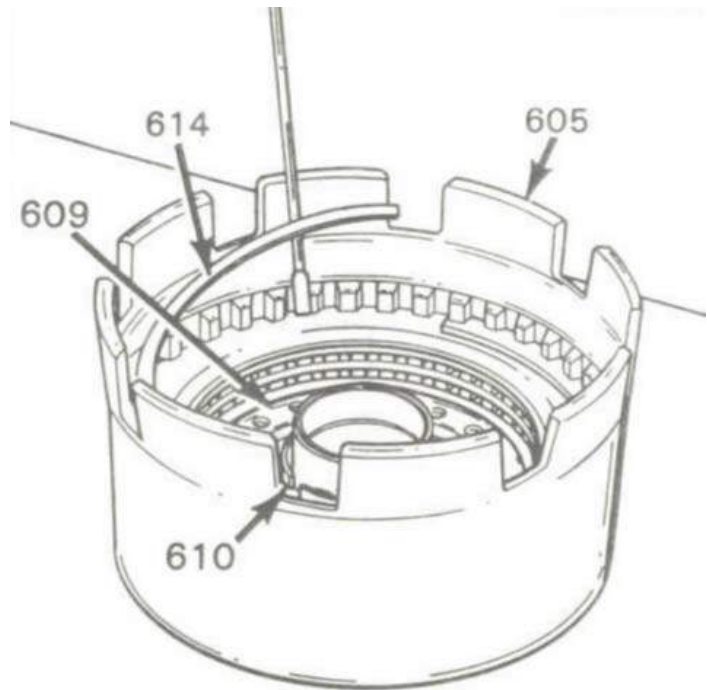
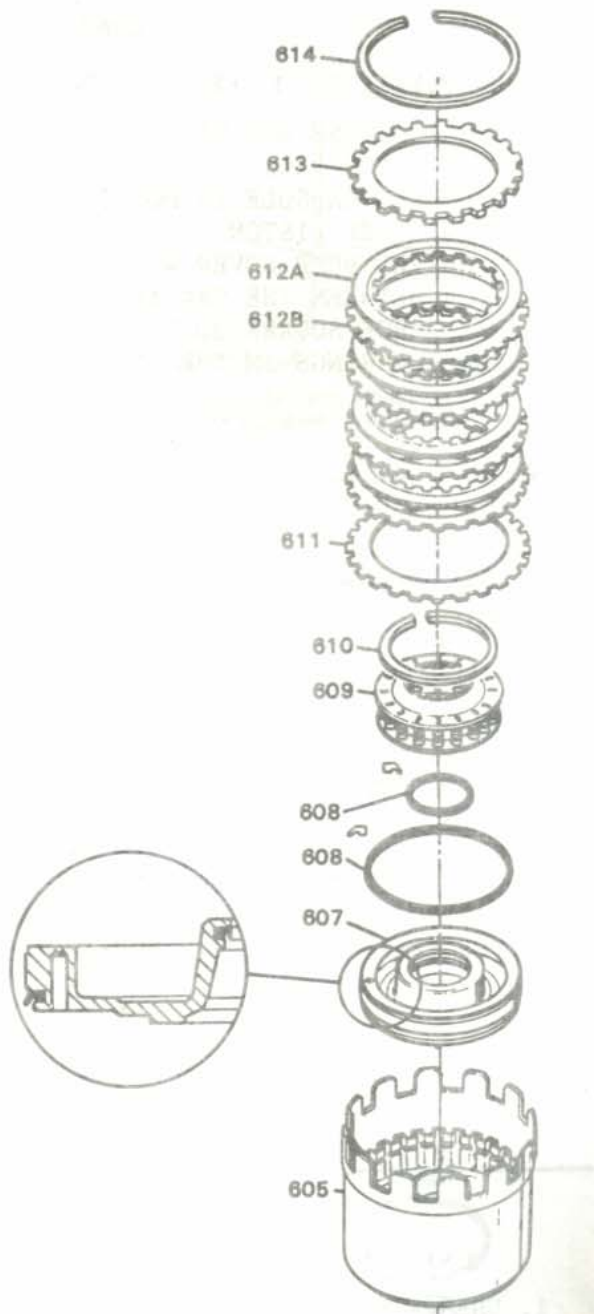
### The reverse input drum.

Make sure you've got all your new frictions soaking in a clean bucket full of ATF while you are doing the rest of this so they'll be ready when you want to put them in. Must soak for about an hour at least to prevent burn up on initial apply. Now just lift it off the input drum.



Here's the exploded view of what your getting into.

Now just take that screwdriver you notched and slip it down between the snap ring and the inner wall and slightly rotate the screwdriver, grabbing the snap ring with the notch and getting it started. Then just work your way around the circumference.



Now just reach in and grab the backing plate, frictions, steels, and the bellevells and lift them all out at once.

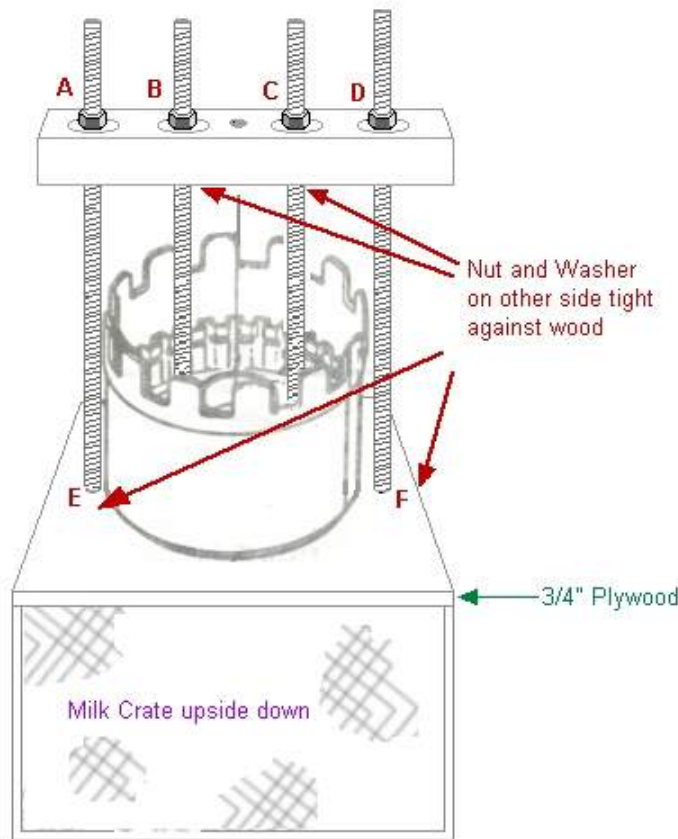


ILL. NO.	DESCRIPTION
605	HOUSING & DRUM ASSEMBLY, REVERSE INPUT CLUTCH
607	PISTON ASM., REVERSE INPUT CLUTCH
608	SEALS, REVERSE INPUT CLUTCH (INNER & OUTER)
609	SPRING ASM., REVERSE INPUT CLUTCH
610	RING, REVERSE INPUT CLUTCH SPRING RETAINER
611	PLATE, REVERSE INPUT CL. (BELLEVILLE)
612A	PLATE ASM., REVERSE INPUT CLUTCH (FIBER)
612B	PLATE, REVERSE INPUT CLUTCH (STEEL)
613	PLATE, REVERSE INPUT CLUTCH BACKING
614	RING, REVERSE INPUT CL. RETAINING

Now we're gonna use that labor intensive tool you made. Set up up like this:



Tighten Nuts "A" and "D"  
to compress reverse input  
clutch spring assembly  
ATSG #609 and then  
remove snap ring #610



Don't compress it so much that you damage #609. Any kind of compressor will damage it if you compress it too much(it can bend). You want to compress it just enough to where you can get your snap ring pliers in there and pop out snap ring #610. Once you get the snap ring out, just start loosening "A" and "D" until the springs of #609 have completely extended and you can feel the load has released from your compressor.

You want the ends of the 2  
center all threads to engage  
here and here

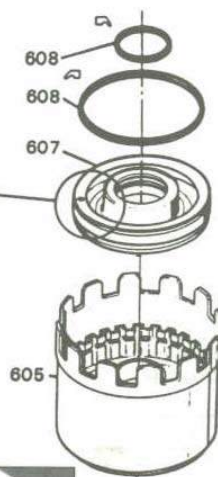


All right! Lift out #607, reverse input clutch piston.



Now we will have to update this while it is out. This is known throughout the industry as # 77761C orifice cup plug. Just use a 3/32" roll pin punch to drive it in from the back side of the piston as referenced in the illustration here. Drive it in until it is flush. The cup is knurled to keep it from falling out.

## REVERSE INPUT PISTON MODIFICATION



Pull off the seals and clean the piston up with carb cleaner. Let it dry and install the new seals exactly like the exploded view references them (the profiles). Coat them with petroleum jelly and set it off to the side.

Couple quick things to check and do.

First check the flat surface that the 2-4 band rides on for flatness.

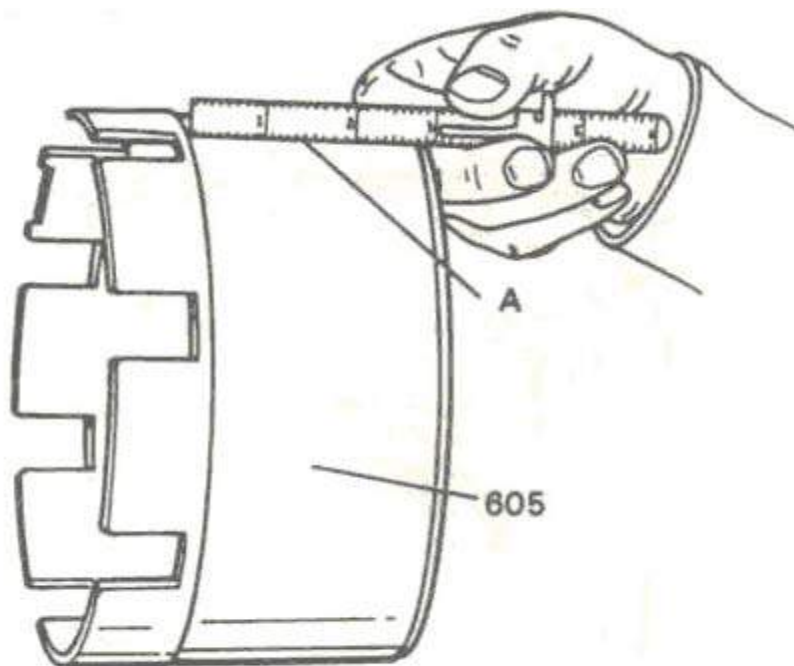
Also look at the tangs. If they are flared out, your input sprag is not holding and allowing high rpms on deceleration. This flares out the ears on the sun gear shell as well. We'll check both of these.

If you found with your straightedge that the band surface isn't dished (dishing is rare) then go ahead and take 320 or 400 grit sand paper and thoroughly remove all shininess from the surface until it is uniform and clean. You want a nice uniform surface for that new band to grab. Follow that up with a THOROUGH flushing with carb cleaner and let it dry.

Now we're gonna stack it back up. Any kit you buy whether it is a full red friction with kolene coated steels set or a standard set, you'll stack it up the same way in a 1988 and up transmission.

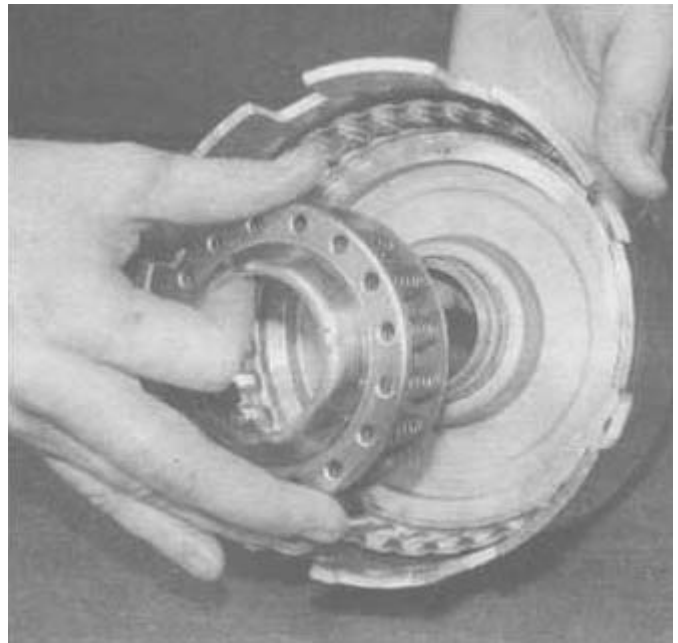
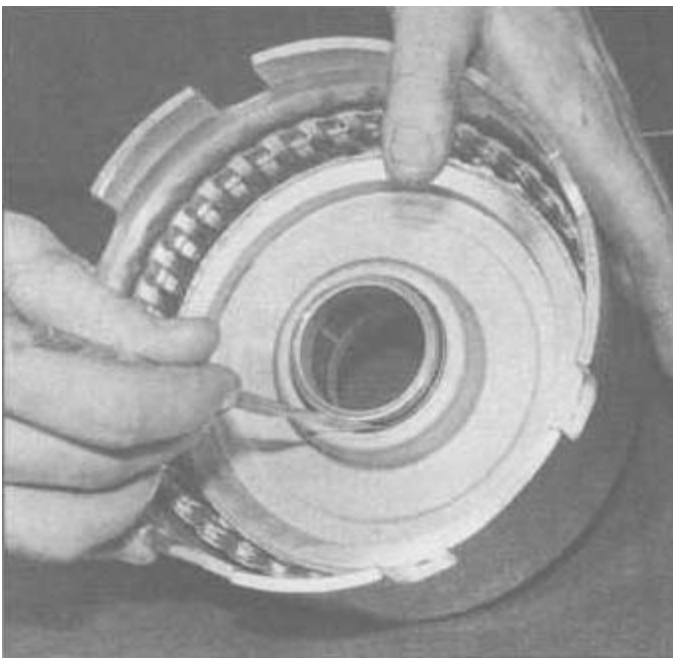
First we put back in the piston. Lube everything up with petroleum jelly and use your lip seal tool and chase the inner and outer seals using a slight downward pressure while rotating it ever so slightly. It likes to cock sideways

when you get about  $\frac{1}{2}$  way around, be ready. Be patient, you seldom get on the first try...or the second for that matter....The piston will be able rotate freely with little resistance and it won't try to cock in the bore when it is installed correctly.



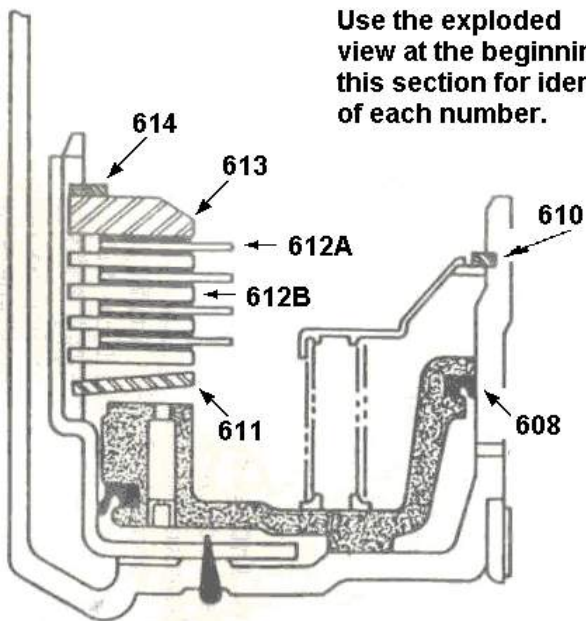
A CHECK FOR DISHING AT THIS POINT  
605 HOUSING & DRUM ASSEMBLY, REVERSE  
INPUT CLUTCH





Now drop back in #609 and find your snap ring #610.

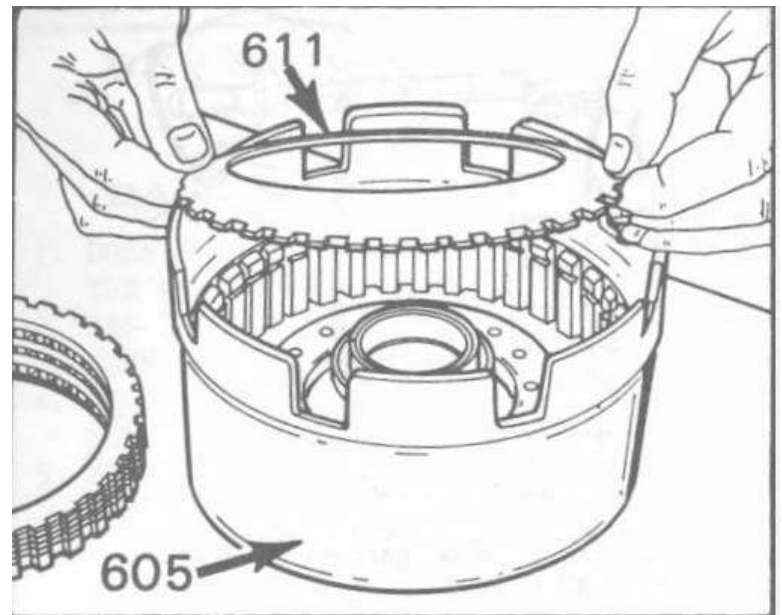
Put the reverse input drum back into your homemade setup just like you did earlier and compress the spring assembly just enough to pop the snap ring back in. Pull it out and we'll fill it back up.  
Here's a quick outline of how it's gonna stack up:

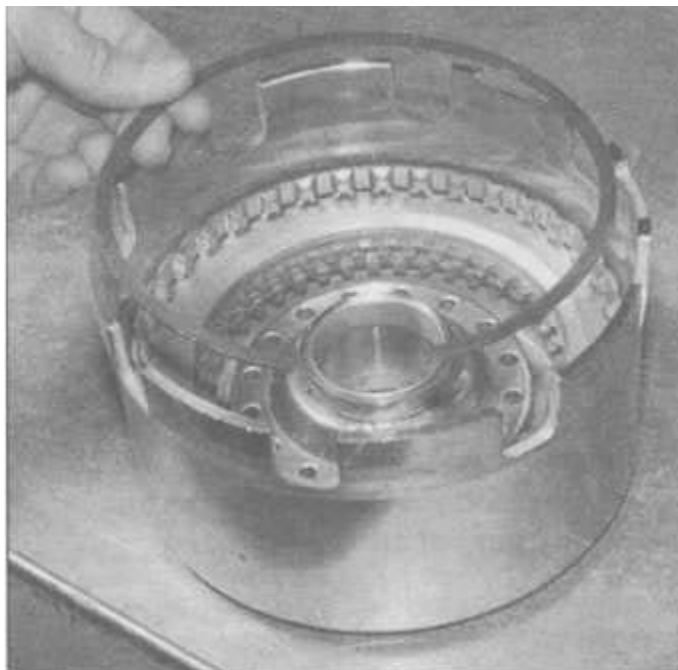
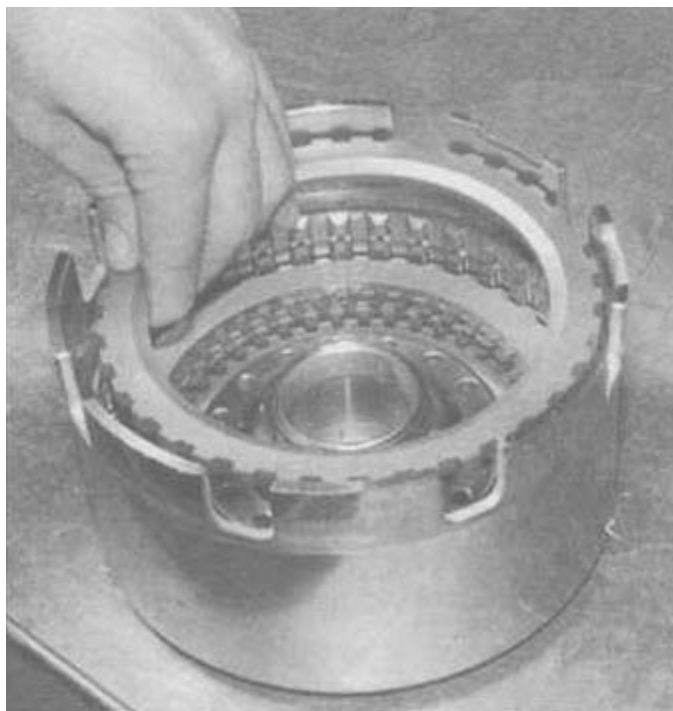


**Use the exploded view at the beginning of this section for identification of each number.**

Drop in the bellevilled plate concave side down:

Then start dropping in your clutches **STARTING WITH A STEEL** right on top of the bellevilled plate then a friction. Alternate steels and frictions until you have installed 4 (four) of each.

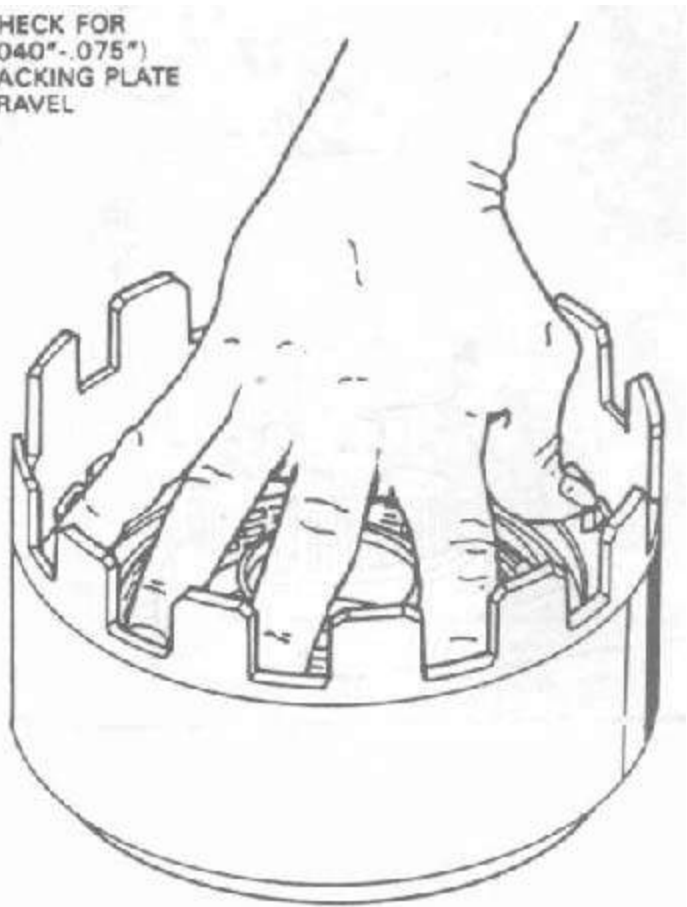




Drop in the reverse input clutch drum backing plate #613. See that chamfer? Make sure it goes up. Then pop in your snap ring.

Now we need to measure clearance. Use your feeler gauges in one hand and use your other hand as illustrated below:

CHECK FOR  
(.040"-.075")  
BACKING PLATE  
TRAVEL



You want to push down with only about 20 pounds of pressure. You don't want to push too hard so you don't warp the bellvelled plate. You want .040" to .075" of travel clearance between the backing plate(#613) and the heavy top snap ring(#614). Here's a chart to help you identify what plate you will need if your clearance isn't where you want it. This chart is referring to ATSG#613.

Once you get this sub assembly done, set it off to the side in a clean spot and cover it up to it doesn't get any dirt or sawdust in it or anything. It is VERY important that you keep everything clean.



## REVERSE INPUT CLUTCH BACKING PLATE SELECTION

### ALL MODELS

BACKING PLATE TRAVEL = 1.02mm - 1.94mm  
(0.40" - .076")

PLATE THICKNESS	IDENTIFICATION
7.60mm - 7.45mm (.299" - .293")	5
6.94mm - 6.79mm (.273" - .267")	6
6.28mm - 6.13mm (.247" - .241")	7
5.62mm - 5.47mm (.221" - .215")	8