

MUNCIE 4 SPEED TRANSMISSION DISASSEMBLY AND REASSEMBLY

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dba Gary's Gearbox – since 1982

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The following article is intended to help the owner of a Muncie 4 speed transmission to disassemble, checkout, repair, and properly reassemble his transmission at home. While some of the procedures listed herein require special machining tools and access to specialized parts, this article is intended for the experienced home hobbyist.

My special thanks to the Classic Chevy Club of Tucson for editing my notes of 25 years, and for publishing this article on their website with my permission.

PREPARE: Prior to actually tearing down your Muncie four speed transmission, get a notebook that will be used to keep track of the important information you will accumulate during this process.

Remember the adage, cleanliness is next to Godliness. Throughout this extensive process, work with clean hands, a good workbench and excellent lighting. As always, pay heed to safety and safety procedures which includes, but is not limited to, adequate protection for your hands and eyes. You can always buy replacement parts, but the loss of an eye or hand is not as easy. Do what the pro's do. WORK SMART!

Begin my listing the General Motors casting numbers as well as the stamped, and dated number that appears on the top or the side of the front case. If your transmission is original to your car, it will have your car's serial number stamped on it either on the top, or the passenger side of the front case, toward the rear.

If you are trying to keep your car as an original, numbers matching car, you will need to keep this trans case at all costs. However, there are no stamped numbers on the tail housings.

There are two different styles of tail housings for the small output shaft with several different General Motors casting numbers. One has the speedometer hole on the driver's side, and the other has the hole on the passenger side. We will sort this out later.

All tail housings for the large output shaft have speedometer holes on the passenger side. The visual inspection that you need to perform at this point is important because it can offer you some insight as to how this transmission has been treated in the past, as well as answering the question of whether or not this transmission been apart before. If it has been apart, was it assembled correctly with all of the correct parts? Plus, exactly which problems are obvious to the naked eye?

Over the years, I have probably opened more than **2,000 transmissions**. It is always an experience opening one of these boxes. Sometimes, I find the front bearing nut on backwards, or shims where there should be no shims. I have seen shift forks *welded up* to take out the slop where they fit onto the slider. Of course, this takes away from the hardness of the product. You name it and I have probably seen it.

Your inspection now should focus on the exterior, the front and rear case. Check the front case in the area of the “ears” for hairline cracks either on the front or the side of the front case. Whatever you find, write it down in your notebook.

Examine the side cover closely for cracks on the rib where the rib meets the boss that holds the shift cam. Then, turn your attention to the tail housing and check the rear mount, bolt holes. It is very common for the threads inside these bolt holes to be stripped.

Last, you want to look at the reverse shift cam boss where the tapered steel pin is fitted to keep the reverse shift cam in place. This is an area for problems. On occasion, someone will install this tapered pin upside down. More often than not, you will have to discard this tail housing simply because you will inflict too much damage to the tail housing when you try to remove the tapered pin (assuming you are able to get it out).

This pin is installed from the top down, small end first. Again, it is installed vertically, small end down and large end up. Then, just a slight tap from your plastic hammer will set it in place.

You are now ready to tear down your Muncie, so a review of necessary tools is in order. You will need the following tools:

- an eight inch crescent wrench
- a medium size pipe wrench
- several chisels
- a set of steel drift pin removers
- a ratchet and socket set
- a large machine hammer
- a large plastic hammer
- a brass drift that measures 5/8 inch in diameter X 8 inches
- a tap and die set.

A large clean area will be helpful to take your unit apart and to spread out.

The first item on the list is the tapered pin that runs through the reverse shift cam boss. Turn your transmission upside down and get a drift that matches the hole and try to drive it out from the bottom to the top. Be careful not to “bugger” the aluminum case. That can happen and it looks *ugly*. If it won't go, get a large, 10”

chisel, about 5/8 inch in diameter. Grind the tip of the chisel to a point that matches the drift hole and will actually fit into the hole about 1/2 to 3/4 of an inch. With this additional horsepower a couple of good whacks should remove the rascal.

As I said earlier, if the pin has been installed upside down, you may as well get another tail housing.

In order to lock the transmission into two gears at the same time, take your crescent wrench and turn one of the shift cams one notch and then turn another (any) shift cam one notch. Now the transmission is locked up for your next procedure.

Move to the front of the transmission and remove the four 9/16 bolts that hold the front bearing retainer onto the transmission. When you remove this piece it will expose the nut that holds the front bearing in place. Take your pipe wrench and remove this nut by taking it off. Note that it has left hand threads. This nut fits onto the threaded area, flat side to the bearing. Check to make sure it was not put on backwards to begin with.

Next, you will want to remove the 7 bolts that hold the side cover on the case. Remove the cover as well as both shift forks and the two shift cams. I usually take a carbide scribe and mark the 1-2 slider "1-2", and mark the 3-4 slider for final assembly.

Finally, remove the 6 bolts that hold the tail housing to the main case. I usually take a large plastic hammer and strike the tail housing on the rear mount area in a direction that takes the tail housing away from the main case. Try not to pry it apart as the aluminum will mark easily and perhaps cause the unit to leak oil later. Now, pull the tail housing back, as far as it will go. Sometimes, it will come all of the way off. Sometimes, it gets hung up on reverse gear. If it does, you will need to pull the reverse cam toward you, it will actually come toward you about 3/8 of an inch, which will allow the reverse gear to clear. You can actually help yourself here by reaching your hand inside the tail housing and pushing the reverse cam as well as pulling on it to get it to move. Now, the housing will come off.

There is a small reverse gear that fits through the bottom of the front case. You can remove this simply by taking it out, by hand.

The center bearing support may be stuck to the front case so it may take some effort to get it off, without inflicting any damage. When you get this loose, take two screwdrivers and reach under the snap ring on the front bearing and pop the front bearing from the main drive gear. Then, moving toward the rear of the transmission, grab the bare main shaft and pull backward, wiggling it at the same time, and the entire shaft full of gears will come out the back of the transmission.

As you do this, some parts will fall to the bottom of the case. Don't worry about this because all of the parts have to come out anyway. After you have the main shaft of gears on your bench, remove any and all loose gears and parts from your transmission.

Next, take your brass drift and carefully drive out the steel pin that runs through the cluster gear. Remove the pin by driving it out from the front to the rear. When you drive this steel pin out, all of the loose bearings and brass, as well as the thrust washers, will fall to the bottom of the case.

Remove the steel pin and the cluster gear from the floor of case. You should make a careful note here about how much force was needed to drive this pin out. As long as I can remember, the standard amount of force is "10 whacks" with a large brass hammer. If the pin required significantly less than this amount of force, your pinhole is worn and will need to be repaired. More about this will be provided later.

Make notes in your notebook about the pin removal. You should now have a bare case. We will now begin the process of stripping the main shaft of all gears and synchro's.

Chuck the main shaft into your vice by clamping your vice onto the main shaft where the drive shaft yoke fits onto it. If you are concerned about "buggering" the main shaft, simply place two pieces of something soft in the jaws of your vice, like aluminum or brass, to absorb the force of the jaws.

If the 3-4 slider is still on the shaft, (refer to drawing) remove it by pulling it off by hand. Then, take your snap ring pliers and remove the snap ring that holds the "3-4 hub" onto the shaft. Once that is done, the hub should be removed. Sometimes, they have to be *coaxed* off.

Under my workbench I keep a large piece of aluminum that measures 8 inches by 8 inches by 1 ½ inches thick. I simply reach down with my foot and pull this piece out from under the bench and take the shaft from the jaws of the vice and drop it from a distance of about 30 inches so that the shaft hits on its end where the hub is stuck. This force generally removes the hub and third gear at the same time. You can use a piece of oak or hickory as well.

Chuck the shaft back into the vice by putting the opposite end of the shaft into the jaws of the vice so you can work on the other end.

The first thing to tackle here is the speedometer gear. Your unit could have a plastic gear or a metal gear. We will address both types.

If your unit has the plastic gear, simply push down on the spring clip and, using your plastic hammer, gently tap the plastic gear toward the rear of the shaft until it clears the spring.

If your unit has the steel pressed on gear, you will need to either use a bearing separator and a puller, or use a chisel and a machine hammer. Use care to drive the gear from the shaft if you are not handy with a chisel and hammer. My advice is to use the puller.

Then, moving forward on the shaft, remove the reverse main shaft gear as well as the snap ring that holds the rear bearing in place. The entire rear bearing and center support will now come off.

First gear is next to leave the shaft, as well as the brass-blocking ring. This will expose the 1-2 gear synchro hub and slider. The slider should come off by hand and the hub can be removed the same way we removed the front hub, by dropping it onto a firm but soft surface.

If this procedure is not satisfactory, chuck the whole affair into your press and press it off by placing the entire shaft onto a press and press the shaft through the hub and everything will come off of the shaft.

Congratulations, you have now torn down your transmission. There are still a few things to do. For instance, take your side cover in hand and with a screwdriver, pry the two seals from the shift cam holes. Remove the rear bearing from the center support (also called mid-plate or bearing housing). The last item is the tail housing. Push the shift cam into the housing and it will release the spring and ball (detent) and all three pieces will come out. The next thing is to remove the rear bushing and seal from the tail housing. You can use a big screwdriver or a seal remover on the seal and drive out the bushing with a bushing driver or something home made. Be careful not to damage/score the case.

Everything should go to your parts cleaner for a good scrubbing. Spare no elbow grease, get into all of the nooks and crannies to get this thing clean.

CLEAN YOUR WORKBENCH, put everything onto clean paper, and put everything in order. Put all of the brass parts together, put all of the aluminum together, put all of the bolts together, and so on. This is so we can divide the various jobs into different categories.

For example: the first thing you want to do is to check all of the gears. I will step you through the process of evaluating a gear and the same process is used for each gear. There are four areas of the gear that you will need to look closely at. The first area is the helical teeth (the large teeth). If any of these teeth are nicked, chipped, or broken, the part should be discarded. Further, if there are

signs of burned (discolored) teeth or other signs that the teeth are anything but shiny, it will need to be discarded.

Next, examine the 36 small (engagement) teeth. These are the teeth that hold your transmission into gear. If these teeth are worn down more than 20% and you use this gear, the transmission might pop out of gear. Also, you will need to examine the inside of the gear where it rides on main shaft. If it is galled, it should be discarded. If it is galled, the main shaft will be (most likely) galled and need to be replaced.

Examine first gear, second gear, third gear, and the cluster gear the same way. The problem with the cluster gear is that if it has any of these imperfections, it will have to be discarded. It cannot be fixed.

The main drive gear has a few more areas to be checked. Inside the pocket area a bearing rides, so you will need to check this area to make sure it has not been compromised in any way. Again, if it has been compromised, you must replace it. The area on this gear where the pilot bearing rides, should also be in good shape. If you have a perfectly good main drive gear, except for the pilot point of the gear, this can be repaired. More about this will come later.

(See Cottage Industries) By now you have determined which gears are keepers and which ones need to be replaced. Next, we will move on to the synchronizers.

Look at the inside of the slider for wear at the edges of the teeth where they meet the 36 energizer teeth of each gear. If there is any wear or rounding off of these items, they should be replaced. A new type slider is being reproduced called a locking slider. It is designed to reduce popping out of gear. More about this step will follow later.

Next, check your hubs for wear along the splines and replace as necessary. Do not worry about the brass blocking rings as they come with the master rebuild kit. Now, closely examine the main shaft. Start at the front and examine the bearing surface for wear or pitted areas. Check each and every surface area where each gear rides. Remember, this is a planetary transmission and the surface area should be perfect.

I'd like to make a "point" here! Years ago, the notion was, regarding cars and car parts, that a good mechanic should make the parts work. With transmissions, you should almost look for a reason to get rid of questionable parts so that they do not come back to haunt you later. The bearing retainer is very important. Each and every time you press the clutch in, the throw out bearing moves across this piece. Any wear **at all** is **unacceptable**. Replacement is cheap insurance.

BEARINGS AND SMALL PARTS: Discard them. All of these parts come in your new master rebuild kit.

The aluminum front case should be slowly/carefully examined under a strong light. Each and every ear should be checked, front and back, for cracks. All thrust surfaces should be examined for signs that a thrust washer has spun out and ruined the surface. At this time, all bolt holes should be tapped with the best tap money can buy. I purchased a special tap set for aluminum that are .005 thousand undersize so they won't take out metal, only straighten out threads and remove dirt.

Remember, your transmission may only see service once or twice in its lifetime. Remember how difficult it is to R & R the thing, so let's do it right the first time. If any of the bolt holes are stripped, now is the time to repair them. Helicoil kits are available at your local parts stores. Does your front case need aluminum repair/welding? The important thing to make sure of, is that there are no cracks in this case and that the pinhole is not wallowed out. This would allow gear oil to leak from the front of the case onto the clutch assembly, and also would permit the cluster gear to move about in the case when in fact it should not move at all. **Zero movement!**

If the pin that came out of this pinhole is in excellent shape and reusable, then the pinhole in the aluminum case should be fitted to this pin. If you have measuring equipment, a good measurement on the front of the pin is .0953. Remember, you can't go oversize because your pin will not pass through the bearings in the cluster gear. This pin should fit tightly into the case.

When the transmission was torn down, notes should be made as to how many whacks (with a large hammer and a brass drift) it took to remove the pin. For example, if, after a couple of whacks with the hammer, you could push the pin out with your finger, **this is unacceptable**. On the other hand, if it took ten hard whacks with the hammer to get the pin out, then you have a good case. The *fly in the ointment* here is, if you have a good case, and need to use a new pin.

If you need to use a new pin, you will have to check the new pin size so that it is at least as large as the one that was in there. These pins vary in diameter as much as 1/2 of a thousandth of an inch and this is enough to allow the cluster gear to move about, which is **unacceptable**. The fix is to either; get another used case, have yours repaired, or buy a new case.

If you are building a transmission for your classic and need this transmission because of the correct serial number on the case, then you must have your original case repaired.

The tail housing needs to be examined where the tapered pin fits the hole. This hole should be in good shape, and if the hole is enlarged on the top or bottom, the tail housing could leak oil and should be replaced. Or, using black silicone, completely sealed.

The rear-bushing hole should be able to tightly hold the new bushing. ALL bolt holes need to be tapped and/or repaired by helicoil, or welding and re-tapped, both on the side of the case, and on the bottom, two motor-mount holes.

Check your rear bearing center support (middle plate) for wear and cracks as well as the side cover for cracks. The side cover and shift forks will need to be examined together. The scissors wear at a point where the shift fork fits into the half round slots and sometimes are worn between the half rounded slots from the fork by continually rubbing across them. Instead of being a small hump between the slots, this area will be worn flat. If this is the case, you will want to discard the scissors. Also, the matching area on the shift fork should be round and mostly smooth. They become **unacceptable** when they are worn deeply here, 1/16 inch or more.

At this time, examine the entire side cover as an assembly, with lube on all parts, forks included. Look at any point where metal rubs against metal and determine if wear is significant enough to produce slop. Replace as necessary.

Check the shift cams to determine if they are too loose in the aluminum side cover. If they are too loose, there will be instructions for this later under "Aluminum Repair".

There are 3 shift cams, one for 1-2 gears, one for 3-4 gears, and one for reverse. Replace these parts if they are worn. Reverse wears more than the other two, especially where the spring-loaded ball rides against the cam.

In review, we have checked all of the aluminum, all of the gears, the main shaft, the bearing retainer, and the synchronizer assemblies.

Since we have been logging all information, we now know what we need to order to build a good transmission. To rebuild this transmission, we will need to order a master rebuild kit and any of the parts that failed to pass our visual inspection. A master rebuild kit comes with the following:

- 1) new front and rear bearings
- 2) four new brass blockings rings
- 3) A new gasket kit
- 4) rear bushing and seal
- 5) a new steel pin
- 6) new side cover seals (3)
- 7) a new front nut.

It also comes with a package of needle bearings (112) and a package of cage bearings for the main shaft to the main drive gear. It also comes with new spacers for the cluster gear needle bearing, as well as new O-rings. There are new thrust washers for the cluster gear and the reverse gear (2).

We will now look into the possibility of repairing other areas of the transmission. For example, if your front case was crucial to matching the numbers on your car and the front case had a broken ear, you would need to send this case out to a specialist for repair. Suppose your main shaft had pits on the front bearing surface or the main drive was perfect except for a bad tip from a spun pilot bearing. These items would need to be repaired.

COTTAGE INDUSTRIES: Over the past few years, four speed transmission parts have been in short supply. General Motors is making very few parts and, each year, they make even less. Cases, shafts, and gears are no longer available from your local dealer, so now we have to rely on “after market” products by American Companies as well as from other, foreign countries, like Spain and Italy.

These products are remarkably well made although nothing equals the quality of original GM Delco. Purchasing gears from some companies offering discounted gears has taught me several difficult and expensive lessons. Suffice to say:

What is the point of embarking on a rebuild if you install inferior parts that do not hold up?

Fortunately, we are now able to find quality suppliers across the USA who deal in quality “after market” parts to keep our transmissions going. Also, there is a man in New York who specializes in repairing Muncie aluminum cases. He has been featured in Super Chevy Magazine that described his craftsmanship as “Art Work”.

Some of the aluminum repairs he has made are remarkable. He has kept the transmission case within **one half of one thousandth of an inch!** There is virtually nothing he cannot do to either a front or a rear Muncie case. I have used his services frequently and highly recommend him.

Also, with shafts and main drive gears in short supply, I have sent about two dozen parts to a competent machine shop for repair of main drive gear tips, and front bearing surface on the Muncie main shafts. I have checked the hardness of the work he performed, and **it is as hard as the original**, which is very important.

I have written this instruction manual for myself (Gary's Gearbox), and my customers. Note, that I am also sharing this info with at least one other company that I greatly respect and admire. I highly recommend **D & L Transmissions** of Huntington Station, New York, for all your parts. I have used D & L as a supplier since the mid 1980's, and they have given me 100% satisfaction on all orders and parts, plus extremely fair pricing.

ALUMINUM REPAIR MACHINE SHOP WORK I recommend:

Steve Bechtold
306 Ocean
Huntington Station, New York 11746

FOR TRANSMISSION PARTS / TECH INFO, I recommend:

D& L TRANSMISSIONS; LARRY FISCHER
180 West 19th Street
Huntington Station, New York 11746
631-351-4837
www.dandltransmission.com

When you have received all of the new parts that you ordered, the master rebuild kit, and your parts have returned from the various **cottage industry suppliers**, it is now time to reassemble your Muncie 4 speed trans.

ASSEMBLY: We will start by putting all of your clean and new parts on clean paper on your workbench. Organize the parts, all brass together, all aluminum together, and bearings, etc. All of the aluminum case work should have been completed by this time, and all of the parts should be clean and ready for assembly.

I highly recommend that you use Pennzoil 90 weight gear oil for your assembly work, except in the area of packing the needle bearings. For the needle bearings, you will want to use wheel bearing grease. If you are doing this job in the summer time, you might want to consider **freezing the cluster gear, as well as the grease**, for an hour or so.

We will divide this job into various tasks, loading the cluster gear, loading the main shaft and installing the reverse gears, installing the cluster gear, and final assembly. By this time, I assume that you have familiarized yourself with the various gears and their names by the use of your product sheet at the end of this article. If you have not, go to your diagram and, using a yellow marker, mark each and every part, ex: third gear, cluster gear, etc.

Now we will begin by chucking the main shaft into the vice in a vertical position. **Protect your parts here.** I have aluminum jaws in my vice. The front of the shaft should point towards the ceiling, and the rear of the shaft should be in the jaws of the vice. I use an acid brush and a plastic cup full of Pennzoil gear oil. I brush some oil onto the shaft where each gear rides, and an equal amount inside third gear. Then, I place third gear onto the shaft with the surface for the brass, blocking ring, facing the ceiling. A little more oil onto the surface of the gear that holds the brass ring, an equal amount onto the brass ring, and then fit the brass ring to the gear by twisting it to see if it fits without rocking. If it rocks and does not fit the gear squarely, replace it and use another ring.

Next, you will want to install the 3-4-synchro hub. Put one of the new wires onto the bottom of the hub and dab some oil on the inside where it rides on the shaft. Dab an equal amount onto the shaft and install it with the cone of the hub facing the ceiling. If it is a tight fit, use a brass drift and punch it on by tapping and moving the drift until you go in a circle and complete the installation of the hub.

Then take a small dab of wheel bearing grease and place it in the three slots where the "KEYS" ride. This grease will hold them in place.

Next, take your collar (or slider as it is called) and install it over the hub with the three keys in it. Of course, the hub has a front and rear. It gets installed with the half rounded side up. Just put it on the hub, and just over the keys a little, and come down on it with the two heels of your hand. Or, with one hand hold a couple keys in while you work the collar down over the keys. Then, put the other wire on the top of the hub so that it puts pressure against the three keys. This is kind of a busy time and you will want to make sure that the area where the three keys fit into the brass, blocking ring is lined up ahead of time. Otherwise, the keys will bottom out onto the blocking ring and you will not be able to get the third gear snap ring on.

Now, install the snap ring that holds the synchro hub and third gear on the shaft. Check the thickness of your snap rings and always use the one that fits the tightest. Also, there is a front and back to the snap rings. The ends that fit into the snap ring pliers are beveled. If you put one on backwards, it is difficult to grab with the snap ring pliers. Try one and you will see!

At this time, take the main drive gear and put three fingers full of wheel bearing grease into it. Then, take the cage that holds the cage bearing, and stuff it full of grease. Carefully put the individual bearing into the cage and, with your fingers, smooth the grease around the bearings so that they won't fall out. Take a pair of needle nose pliers and grab the caged bearing by the edge and lower it into the back of the main drive gear. Once it is in, use your finger to push it in all the way, and wipe the grease over it so that it stays in place.

Install the 4th gear brass, blocking ring by laying it onto the top of the 3-4 hub. Then, turn the main drive gear upside down, and fit it onto the end of the shaft in a twisting motion so that it fits onto the brass and the keys fit into the slots of the brass. Notice that when you look at the slider, you see brass on each side of the slider. This indicates that this synchronizer is in the **neutral** position.

Congratulations, this end of the shaft is complete.

Take the shaft from the vice.... *very carefully*... and turn it upside down. Place the main drive gear into the vice and clamp down on it. This is in order to load the other side of the shaft.

Now, we dab some oil on the mating surfaces of second gear and the shaft, and install second gear with the synchro side facing the ceiling. Next, oil a brass ring and the mating surface on second gear, and install the ring.

The one remaining synchro assembly will now need to be installed. Oil the inside of the synchro hub, and the mating surface on the shaft, and put on a new wire on the bottom side of the hub and install it. This is a press fit. You have your choice here to use your press so that it can be pressed on, or you can take a heavy brass punch and CAREFULLY drive it on.

The problem here is when you drive it on, the shock from pounding may knock the wire out of the synchro. I have developed a feel for this, and even if I do knock it out, I just put it back. I like **driving it on** as opposed to the press. The hub goes on with the side of the hub with the extension facing down, and the flat side of the hub facing up. But, you have your choice. You can also install the first gear bushing along with the hub. Get them started and, using a long brass drift and hammer, pound on the bushing that forces the hub down. Keep an eye on the wire, and stop and push it back on as you proceed.

Once this is on, you will hear it bottom out as you drive it with the hammer and the drift. Then, you can repeat the process of finishing the synchro by filling the synchro slots with wheel bearing grease and three new keys.

You are now ready to put the new slider, or the old one, back onto the hub. If you use the old one, make sure you line up the three worn smooth slots on the inside of the slider with the three new keys. This way it will give you the best possible shift. Make sure that you put the slider on correctly, it goes on exactly opposite of the other one. **Got that? Exactly the opposite of the other one.** It will resemble a hamburger bun once both collars are installed.

After this, install the top wire.

Next, install the first gear brass and then first gear, oiling all parts as previously mentioned. Make sure to fit the keys into the brass slots as you assemble the keys and the slider together.

We now need to install the new large retaining ring and new bearing into the center support and then install this onto the main shaft. There is a part of the center support that protrudes forward in order to fit into the rear of the front case. Install the center support with this protrusion facing the front case. You might have to lightly tap the bearing in order to get the whole unit to drop down onto the shaft. If you do have to **pound on it**, use a brass drift and tap on the interior race next to the shaft. **Do not tap or beat on the bearings or the outer race.**

Just prior to doing this, it is a good idea to look over your work. One of the two things that commonly go wrong with this job is that the keys are not correctly

fitted into the brass slots. Once this center support is down in place, put the thickest snap ring onto the shaft to lock the bearing in place. Again, put the snap ring on correctly so that you can get a grip on it if it needs to be removed.

What you should now have is a shaft with first, second, third, and fourth. First, second, and third should rotate freely on the shaft. If they do not, don't panic. Take a very small slotted screwdriver and place it between the fourth gear brass and the gear it is fitted against. Pry **very gently** to see if it is binding. Work the screwdriver all the way around, 360 degrees around the gear to make sure it is free. Do this procedure to all of the four brass blocking rings and then try to rotate your gears. Remember, the job of the brass is to **bind the gear**, so if it is binding, it is doing its job. However, we don't want it binding at this time.

We will install the main shaft reverse gear at this time by placing some oil on the splines of reverse as well as the splines of the main shaft and installing the reverse gear with the collar for the shift fork to the rear of the transmission. We will finish the main shaft by installing the speedometer gear on the main shaft. Try to use the old marks to line it up. Because it is a steel gear, you should see the old marks. If there are no marks, measure the tail housing from the forward end of the housing, to the center the speedometer hole. Then, take a measurement from the rear of the center support to the center of the speedometer gear on the main shaft. The two figures should be the same with the figure to the center of the speedometer hole in the case being primary.

The main shaft is now complete.

CLUSTER GEAR: Next, we will load the cluster gear with new needle bearings. Clear a small area and keep it clean. Lay out **only those parts** you are going to use, which includes your new needle bearings, 6 new spacer washers, your tube spacer, and your grease. I keep paper towels handy to keep my hands clean while doing this.

Take your cluster gear in one hand and insert a couple of "fingers full" of heavy duty wheel bearing grease. Liberally coat the inside of the cluster gear and do the same to the tube spacer. Then, take two spacer washers and put one on each end on the tube and put the tube into the cluster gear. Add some extra grease to hold it in place. Cool grease will work better than hot grease. Use your refrigerator as required to cool the grease.

Take a moment to think carefully about what you are doing and clean your hands. Make sure that you have a liberal coating of grease just inside the cluster gear where the bearings go, and then **feed the bearings** into the cluster so that you have a circle of **28 bearings**. If you lose count, don't worry. Just keep installing the bearings until you can no longer get another one in. Smooth them out and make sure a layer of thick grease is over the entire row.

During this time, keep the cluster gear horizontal to the work bench, otherwise everything will come out the other end. Now, add another spacer washer to the row of bearings and, using the washer, shove the row of bearings into the cluster gear to make room for the next row of 28 bearings. Add another row of bearings into the cluster gear and then add another washer. Turn the cluster gear around, keeping it horizontal to the bench, and add your grease, another row of 28 bearings, another spacer, more grease, another row of 28 bearings, and the final spacer.

Using your finger, go inside the cluster gear to make sure that no bearing has raised up. They all need to be laying down. At the same time, you can carefully remove any excess grease without disturbing any of the bearings in the cluster gear. Now, the cluster gear is ready for installation.

INSTALL THE GEAR: I have seen people use dummy pins and various tricks to install this gear, but I have yet to see anyone do it faster, and with more consistency, than the method I will explain at this time.

The key ingredient for this task is that the grease **MUST be stiff** inside the cluster gear. On hot days, 90 degrees or higher, the grease will get soft and you will either have to use special transmission assembly grease from a transmission supply shop, or you should place the cluster into your wife's freezer for an hour.

This gets messy because when you bring it out of the freezer, the gear wants to sweat water like crazy. Therefore, as you may have already guessed, I use the special assembly lube. It's only about \$3 and well worth it. If you read these directions, and it is even close to 90 degrees outside, you would be well advised to get some of this assembly lube.

Proceed to take the transmission case, turn it on its end, so that the front of the main case is resting on the table surface with the ass end of the box in the air. Dab some grease onto both thrust surfaces and install the proper size thrust washer onto the thrust surface at the front of the case, the part of the case that is resting against the table surface.

Just prior to doing this, notice the tab on the thrust washer. Chuck the washer into your soft jawed vice, tab up. Lock it down, take a small drift that fits the tab, and peen it over until the tab forms almost a 45-degree angle to the washer. This is so the washer will not spin inside the box and wear out the thrust surface.

Next, put a small amount of grease on the thrust washer and put it onto the thrust surface in the case. If you have access to a "CHEVY POWER" factory book, there is an illustration inside about this procedure.

Make sure both hands are clean. Take the cluster gear in your right hand by grabbing it and holding it by the small end (as you might hold the knob of a

baseball bat) with your fingers, and lower it into the case. At the same time, hold the case with your left hand.

As the cluster gear starts to hit bottom, take your other (left) hand, grab the cluster gear, and guide it toward the thrust surface. You should then take your right hand and pull the case toward you so that the edge of the case with the one inch pin hole is just off the table top and can be penetrated by reaching under the case with your right hand.

Put your index finger in the hole, and move your finger around to help keep the thrust washer in line with the pin hole. With the index finger on your right hand inside the pin hole, and the case resting against your body so it does not fall from the workbench, work your index finger to help line up the washer. Your left hand should maneuver the cluster gear so everything lines up.

If you are confident that everything is lined up correctly, then put your index finger inside the bottom hole and check for any bearings have gotten loose. If so, manipulate them back into place. Then, take the other thrust washer and peen over the tab and install it by sliding it between the cluster gear and the rear of the aluminum case on the thrust surface. All of this is performed as the case sits in the **exact same position as you started**, front down and rear of the case up in the air.

We do not want to move this case as yet. Make sure that there is some grease in the hole inside the case where the pin fits. Again, with the edge of the case over the edge of the table being restrained by your body, insert the pin in a slow twisting motion. You can help yourself here by putting your left hand index finger in the bottom pin hole to help hold the cluster gear and the thrust washer in place. Keep pushing the pin down and, if you run into resistance, try twisting the pin and slightly moving the cluster gear to see if you can get the pin moving down again.

BE PATIENT! IF IT WAS EASY, EVERYONE WOULD DO IT.

After you have determined that the pin will not go any further, you will have to remove the pin, and then the top thrust washer with a screwdriver, and then the cluster gear. By feel, put your finger into the needle bearing area and feel for a raised bearing, or any such problem and fix it. **DO NOT FORCE THE PIN!!**

Not always do you need to remove the pin, and even if you do, this is not the end of the world, just a minor setback. Sometimes, you can look and see a raised needle bearing. Just manipulate it back in place and go on. We will again consider that you are going down with the pin and holding your finger in the bottom hole. Keep going down with the pin until you come to the edge of the aluminum hole. Two things to remember here are:

- 1) Make sure that the thrust washer is clear of the pin
- 2) Then, go to the other end of the pin, and rotate the pin until the rear of the pin is positioned at a 8:00 o'clock / 2:00 o'clock position in the hole (related to the case itself) and the raised portion of the pin is at the top, with the cut out portion at the bottom, so it will clear the gasket.

You are now ready to drive the pin home. I strongly recommend a large brass hammer. You can use a steel hammer and a brass drift, but you lose some control if the pin is really tight. Drive the pin into the case so that the recessed part of the pin is flush or slightly below the hole (for the sake of the gasket). If, on your first try, you have the pin almost in and it shoves out one or more needle bearings, just repeat your steps.

After you do a few of these, your batting average will quickly go up. For those of you who would like to do it differently and are willing to spend time and resources, round up a dummy pin that is several thousandths of an inch smaller in diameter than the largest part of the pin (the largest part is the rear of the pin), so that it clears the front hole in the case. Then, place the pin in the cluster gear, install it, and then work your pin through the cluster gear as previously described. Turn your case so that it is right side up or sitting on your bench with the bottom of the case resting on the work bench surface.

REVERSE THRUST WASHER: Next, you will want to install the tri-metal reverse thrust washer onto the reverse boss in the transmission case. Make sure to put grease on both surfaces so that it stays put. Install the small reverse idle gear with the thrust side of the idler toward the thrust washer.

There is some controversy about using gasket sealer PLUS a gasket. Some folks say that silicone sealers attack the gasket. I say it stops the Muncie from leaking fluid, one drop at a time. I put 1/8 to 1/4 inch bead of black silicone all around the gasket surface on the rear of your main case. Then I put another bead all around the front gasket surface on the mid plate, and place a fresh gasket on the mid-plate.

3-4 SLIDER: So that your next step goes easily, you will need to move the 3-4 slider into the fourth gear position. Carefully grab the slider and move it toward the front of the box so that it locks onto the engagement teeth of the main drive gear (it will then clear the teeth on the slider). Cradle the entire main shaft with gears by placing the front main drive gear in your left hand. Place your right hand under the rear of the shaft back at the area of the place where the drive shaft yoke fits. Then, move the entire assembly towards the rear of the case carefully.

Keep pressure on the main drive gear so that it does not separate from the rest of the shaft and make a big mess. As you place the end of the main drive gear into the back of the case, slide it into the back of the case and rest it on the bottom of the round hole where the mid plate goes. Then, reach through the side

of the case (side cover hole) with your left hand, and grab the main drive gear. Raise it up slightly and, at the same time, lift with your right hand and bring the entire shaft slowly towards the front of the case.

If necessary, stop along the way and get a new grip on it, but continue to bring it to the front. The obstacles here, as you move the shaft to the front of the box, are getting the sliders over the top of the gears on the cluster gear in the bottom of the box. It will clear and go forward, but you will have to raise it up and bring it forward.

As you clear the various gears and get to the point where your mid plate makes contact with your main case, go slowly here and line up the mid plate so that the gasket stays in place and the dowel pin in the mid plate lines up with the dowel hole in the main case. Then, force the entire shaft in all the way in so that the dowel slides into the case. For temporary support, I place a bolt into one of the holes to keep the mid plate from backing out. At this point, if you are going to stop for awhile before installing the tail housing, I suggest installing the proper size bolts into the mid-plate and into the main case, in order to hold the mid-plate in place tightly enough to spread your sealant and get a proper seal. Later on you can remove these bolts when you install the tail housing.

CHECK YOUR WORK: Carefully move the 1-2 slider one click in either direction so that the transmission is locked up. Next, is the front bearing. Oil your bearing and slide it onto your main drive gear. If it will not go on all the way, use a small brass drift and a hammer. Or, you can use a pipe that has the same OD as the inner race of the bearing. If you use a pipe, be careful so that when the bearing steps up over the threads, that your pipe **does not bugger or chip off the threads**. Be sure **not to hit your bearings**, and be on the lookout for brass chips. Keep your work clean.

Make sure you have installed the retaining ring around your bearing prior to installation. Put your left hand nut onto the shaft and tighten it with your special Muncie wrench that can be purchased from D& L Transmissions (or use a pipe wrench). Make sure that the left hand nut goes on straight and is extremely tight. **EXTREMELY TIGHT!** This is important! Take a pointed punch type chisel and dimple the NUT at a point close to the threads. This is called **staking it!** If you look at your old nut from the factory, you can see how they did it. Staking keeps the nut from backing off.

THE FRONT BEARING RETAINER: Put a small amount of black silicone on the retainer and the gasket, and install them together. If your master rebuild kit supplies a set of clips to keep the 4 bolts from backing out, **use them**. If not, use your favorite product on the bolts to keep them from backing out. Tighten the bolts according to aluminum specs for 3/8" bolts. Do not over tighten these bolts. **They will strip!**

TAIL HOUSING: Move to the rear of your transmission and prepare to put the tail housing on. There are only two problems to overcome here. The first one is the area of the reverse shift cam. Put your new seal in the cam boss and then get your reverse cam, spring, and ball, ready to install. Since this next procedure requires 6 hands, I made a special tool to eliminate the need for 4 of those hands you probably don't have.

Obtain a small putty knife with a $\frac{3}{4}$ " wide blade (approximately). If you can get a putty knife with a $\frac{1}{2}$ inch blade, use that one. When I made my tool, I chucked it in the vise by the wood handle, and got a set of wide mouth vise grips ready. I took a torch, heated the end of the knife, grabbed about $\frac{3}{4}$ " inch of the blade, and bent it so that it formed a 45 to 55 degree angle to the rest of the blade. After it cool a little, make sure that the new part that you have formed is no longer than $\frac{5}{8}$ " of an inch. You can reduce any excess by grinding.

Next, we are going to "**DIMPLE**" this new end. As you hold the tool in your hand, the new part of the blade that you just formed, should lay flat against the work bench. The bottom side of this tool gets dimpled. This is so that when you install the reverse shift cam, you can use this tool to reach under the shift cam to depress the steel ball and the spring under it. In this manner, as you depress the ball and spring, and, at the same time push the shift cam all the way into the shift cam boss, you will be able **RETRACT THE TOOL**.

TO REPEAT THE PROCESS: This tool will enable you to push down on the ball and spring, push the shift cam in, and as it slides in, retract your tool. When you try it, you will see that it happens very quickly. The first time it works successfully, you will hardly believe it. Over the years, I have tried everything including screwdrivers, Popsicle sticks, my wife's knives, you name it. This special tool will work **GREAT** if you concentrate on building it.

DIMPLING THE TOOL: Warm the end of the putty knife with a torch. Quickly, take a hammer and a steel ball. On a steel plate, while the knife is **red hot**, place the knife on the ball and smack it once so that a dimple of slight proportion is formed. This does need not be a large dimple, a small one will do. Then, allow the knife to cool off by dipping it in cool water that will harden the surfaces.

If you have read these instructions ahead of time, you will have some understanding of what we are doing and what we need to do to accomplish our goals.

Finally, buff the knife on a buffing wheel so there are no sharp spots. I do not know of anyone who sells these tools nor do I know another way to install this shift cam any better than this. If you try to install this cam without the tool, be careful to not "bugger" the case.

Before final installation, I test fit the shift cam to make sure it fits and rotates properly in the hole. I have found that it is a good idea to take all three shift cams and, one by one, chuck them into your vise and polish the round surface that fits in the aluminum case by using 400 to 600 grit sandpaper. If you have something finer, use it. If it "test fits" OK, clean it, and apply some oil to it & the aluminum case. Place the spring in the hole, apply some grease to the ball, and lay it on the spring. Then, move the shift cam into the shift cam boss hole, and move it slowly toward the ball and spring. Just before it makes contact with the ball and spring, take your new knife tool and depress the ball fairly hard, exercising some balance to your force. As you get it balanced, then shove the shift cam over the ball and through the hole, retracting your tool at the same time.

You have your choice of placing the tail housing in the vise or doing this on the workbench. I use the workbench and sometimes will use the upper part of my body to help balancing the unit. Now, you will need to be careful to not push these parts back out. You cannot install the tapered pin yet because the shift cam will need to be adjusted in and out to install the tail housing. **Be careful.**

TAIL HOUSING INSTALL: We have already covered the installation of the rear bushing and rear seal, so you are now ready to install the tail housing.

First, remove the bolts that you put in to hold the mid-plate and install the "LONG" reverse gear into the small hole at the bottom of the rear of the case. Then, run a bead of black silicone around the rear of the mid-plate (which is now on the transmission) and attach the proper gasket. Run a bead of black silicone around the gasket area of the tail housing. Turn the tail housing so you can look inside and apply some grease to the hole in the reverse shift cam where the selector goes. Apply some grease on the selector and install the selector into the shift cam.

With a small crescent wrench, place it on the outside of the shift cam where the shifter ear bolts on and proceed to move (shift) the cam counter clockwise, one notch. If the transmission was completely assembled, that would place the transmission in reverse. We are doing this to simplify the installation.

Next, take the 5 or 6 inch polished steel shaft with the drift pin through it, and place a new steel thin washer on it. With a little grease on it, install it into the back of the long reverse gear. As you install it, take your left hand and reach into the box and feel inside the hole where this pin goes. With your finger, line up the thrust washer so that the pin can pass it on its way to bottoming out in the case.

In order to put the tail housing on, this drift pin must be in a specific position. Take the tail housing in hand and look at the matching area for the drift pin. Notice that it is not straight up and down, rather, it is slightly to one side and we must adjust the pin in the back of "reverse" to match the tail housing. Using the

face of the clock as a basis to position this pin, I place the pin in about the 12:30 to 6:30 position.

As you can see, it is a small offset that you can test by placing the tail housing on, without engaging your reverse gear, to determine if the tail housing will go all the way on. If it does go on, you can proceed. With the reverse cam set in the reverse position, and the small selector with grease in the reverse shift cam, you are ready to install the tail housing.

Two final adjustments should be performed now. First, pull the main shaft reverse gear (the large round one) back from the splines on which it rides, and then adjust the small selector to line up with the collar on the main shaft reverse gear. Move the tail housing onto the main shaft. I usually place the transmission on the workbench and not in a vise or in a fixture, but do whatever suits you. Move the tail housing up to the reverse gear, fit the selector onto the main shaft reverse gear, move it slowly forward, and then hit the curled splined part of the shaft.

Next, take the tail in your right hand, rotate it in a small circle, and set up a vibration with your same hand keeping pressure forward on the tail. The tail should “pop” up onto the splines and be able to move forward.

IMPORTANT! Before you move it forward, make sure the main shaft reverse is still connected to the selector (look inside). Then, grab the reverse shift cam and slightly move it into the tail in order to take the slack out of the two pieces so that they do not separate in the process of installing the tail.

Now, move the tail forward. If it stops, set up a vibration with your hand keeping pressure on the tail. Again, you may need to move the reverse shift cam into the case a little more. Develop a “feel” for this. The tail should now be ready for your final effort to make contact with the rest of the unit. Guide the dowel so that it matches, as well as the steel pin in your long reverse gear, and the drift pin that is inside of it.

A friend once described this process as a soap opera, and a automotive vocational teacher told me he quit teaching about Muncie’s because he could not seem to teach the kids how to install this tail shaft.

I think that his answer is a “cop out”. If it does not go on, retrace your steps because it *has to go on*. Remember this, they had people of varying skill levels at the Muncie factory doing this job. Are you, the master mechanic, going to quit?

Once it’s on, quickly put two bolts in it, one top and one bottom. Then, carefully adjust your reverse shift cam so that it lines up with the tapered pin, install the pin from the top down, install the small end first, and tap it down gently with a small plastic hammer.

Take a crescent wrench and place it on the reverse shift cam and click it (rotate) one turn clockwise to see if the transmission spins freely (neutral). Click it back and rotate the main drive gear and observe that the output shaft turns in the opposite direction (cause it's in reverse). If you have any problems here, such as no reverse, or the transmission will not turn freely in neutral, retrace your steps.

Sometimes the transmission will not turn freely until all bolts are torqued down evenly. Other times, the unit will not turn freely even after torquing the bolts. Sometimes, this is due to the brass blocking rings doing their job of grabbing the gear. Take a real small slotted screw driver, go inside the transmission, and "ever so easy" pry the brass blocking rings away from their matching gears, and then rotate the unit.

To make sure the transmission is in neutral, the brass blocking ring should be clearly showing on both sides of the slider, all evenly spaced. If one of the sliders is slightly engaging the next gear, it will drag the transmission and make it feel "not right". Then install the rest of the bolts and torque them down to aluminum specs. Not bone crushing, rather, aluminum specs.

INSTALL THE SIDE COVER: The final task is to install the side cover. You should have both new seals installed. If the scissors and spring are on the cover, then install the two shift cams making sure you install them right side up.

There are three half moon slots in each scissor. The middle is for neutral, the shift cam on your right is for 1-2 gears, and the other cam is for 3-4 gears. Looking into the transmission, starting on your right and moving left, the gears will be first and second with a synchro assembly in between, and then you have third and fourth with a synchro assembly in between. Go to the 1-2 synchro assembly and move that slider to your left which should engage second gear. Then, go to your side cover and, with a little grease, install both shift forks. The shift fork for 3-4 should be placed in the neutral position (middle slot) and the fork for 1-2 gears should be placed in the second gear slot. Just match it with your eyes.

Install your gasket, place the side cover on the unit by holding it in your fingers, and manipulate it so that the forks clear the box and goes onto the slider correctly. If the forks fall out in the process, just repeat the process. Install the bolts and torque to spec.

SUMMATION: I am not going to troubleshoot this transmission since I have provided extensive detail concerning the disassembly and reassembly of the unit. Your troubleshooting should take place as you go along. It must be understood that you have read this document thoroughly **before proceeding**. All problems should be taken care of as you do each and every procedure.

If you are halfway through the job and something is not right, it will not correct itself by working past the problem. Having been in this business for many years, this detailed description of tearing down and rebuilding a Muncie 4 Speed transmission is by far the most comprehensive set of notes ever offered. You are being provided notes and many tips that have vanished over the years. As the opportunity presents itself, I may add pictures to this article.

NOTES ABOUT PARTS & SUPPLIERS: Since General Motors long ago gave up on the Muncie, even sold their tooling, we now have to rely on “Specialized Suppliers”. This particular market (like many others) has spawned suppliers who have only one thing in mind. **Making money.** These folks may not have your best interests in mind. My advice is **find yourself a good supplier and stick with him.** After you find a good supplier, trust him to give you good prices and good merchandise and technical information. I have found that, in this business, it’s a good thing for customers to be loyal to their quality suppliers.

This is not one of those businesses that necessarily pays to shop around for the best price. While you might save a few bucks here and there, there is the possibility that your newly found supplier will sell you parts that are not up to the quality that you expect. I strayed from my supplier **one time** and purchased some discount Ford Mustang cluster gears. Turns out they came from some sweatshop in Bangladesh and, you guessed it, every one of the cluster gears failed. This lesson cost me a bundle.

Most competent suppliers will check out the quality of their products beforehand. Any savings you achieve by purchasing from a discount supplier, someone other than your regular, trusted supplier, can be lost in an instant. I learned my lesson the hard way.

Few people in this industry will offer quality information freely, but a quality supplier will keep you informed of new products, ideas, technology, and the availability of rare parts. Every year, I have tried to take care of my local machinist and my transmission parts supplier. This may sound backwards, but think about it for a minute. Your machinist is in a position to either: take that extra step with your cylinder heads to make them really nice, or, he could skip that last, crucial step. Do you want his decision about the quality of YOUR machine work based on price haggling or do you want him to be thinking about you as *that nice guy* who remembered him at Christmas?

Treat your transmission supplier the same way. With loyalty, consideration, and pay his fair price without grumbling.

Gary Howard
Gary’s Gearbox
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