

Refurbishing the 1965-69 Manual Transmission Shift Assembly
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The following is about repairing the LM (1965-69) shifter assembly. Comments from Corvair owners suggest the LM floor shifter experiences greater wear vs. the EM floor shifter. The different EM (1960-64) shifter will not be discussed.

The following is about the floor shifter and the shift tube to the transaxle. Refer to the 1965 Corvair Chassis Shop Manual for shifter assembly removal and installation procedures. From GM's perspective the shifter and shift tube were items to be replaced if they were no longer serviceable. Now, except for new old stock (NOS), new parts are not available. A malfunctioning shifter assembly must be repaired. This article will cover how to dismantle and make repairs to the floor shifter and shift tube assembly.

NOTE: The procedures herein require skills that you may not have. It is suggested this entire document be read to determine if you have the skills and tools to execute refurbishment of the floor shifter and shifter tube assembly.

Why was the LM Corvair shifter design changed compared to the unit in EM model year Corvairs? The EM floor shifter is firmly mounted to the floor. The LM shifter bolts to the shift tube assembly that is connected to the transmission support and slides fore and aft in the floor in unison with the transaxle and engine assembly (powertrain) during acceleration or deceleration of the vehicle. This design minimizes shift lever movement at the shifter knob as the powertrain moves. The LM design functions like the floor shifters of front engine cars that are bolted to the manual transmission instead of to the floor.

The following will discuss refurbishing the floor shifter and then the shift tube assembly that connects the shifter to the transmission. Modifications or adapters to the shifter assembly to shorten shift lever throws will not be discussed here.

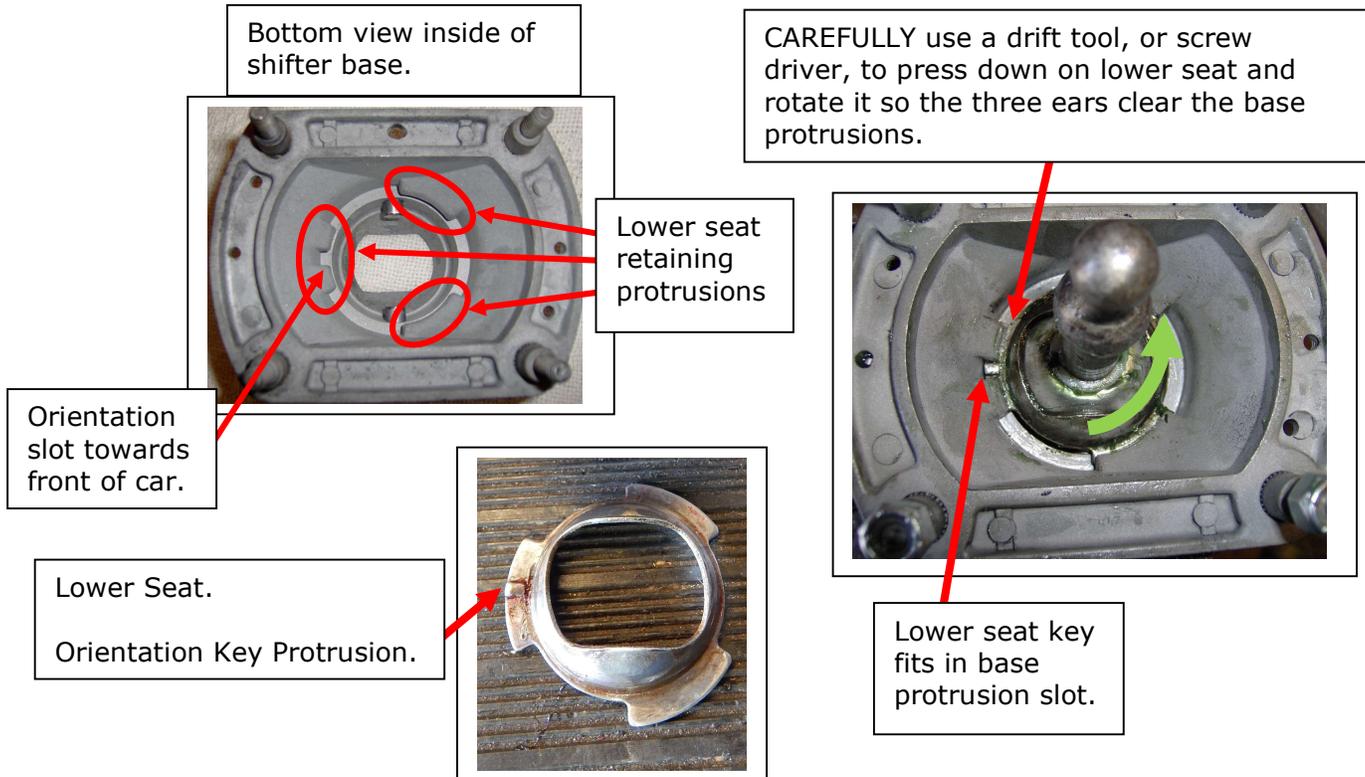
The 1965 Corvair Chassis Shop Manual Section 7 describes the "Service Operations" to remove the shifter and shift tube assemblies. The 1966 Corvair Chassis Shop Manual Supplement Section 7 describes the changes made for the 1966 model year and newer gear selection assembly components.

Per the Chassis Shop Manual or supplement, the floor shifter can be removed without removing the shifter tube assembly, but care must be taken to support the shifter tube assembly. If either end drops down before BOTH ends are fully disconnected it could bend parts of the shifter tube assembly.

NOTE: Before dismantling the floor shifter, it is recommended the complete shifter repair process herein be read. Take pictures for later reference!!

Dismantling the floor shifter assembly. - Refer to Figure 7a-2 of the 1965 Corvair Chassis Shop manual. Different techniques can be used to support the shifter base upside down while the following are parts are removed:

- **Lower Seat** - A circular plate has three extensions. The “seat” is retained under three protrusions in the base. **NOTE: the shifter lever assembly seat is under tension from a spring between the parts below the retainer. Exercise caution while dismantling the assembly.** The seat must be rotated until the three extensions are clear of the base protrusions. Refer to illustrations.

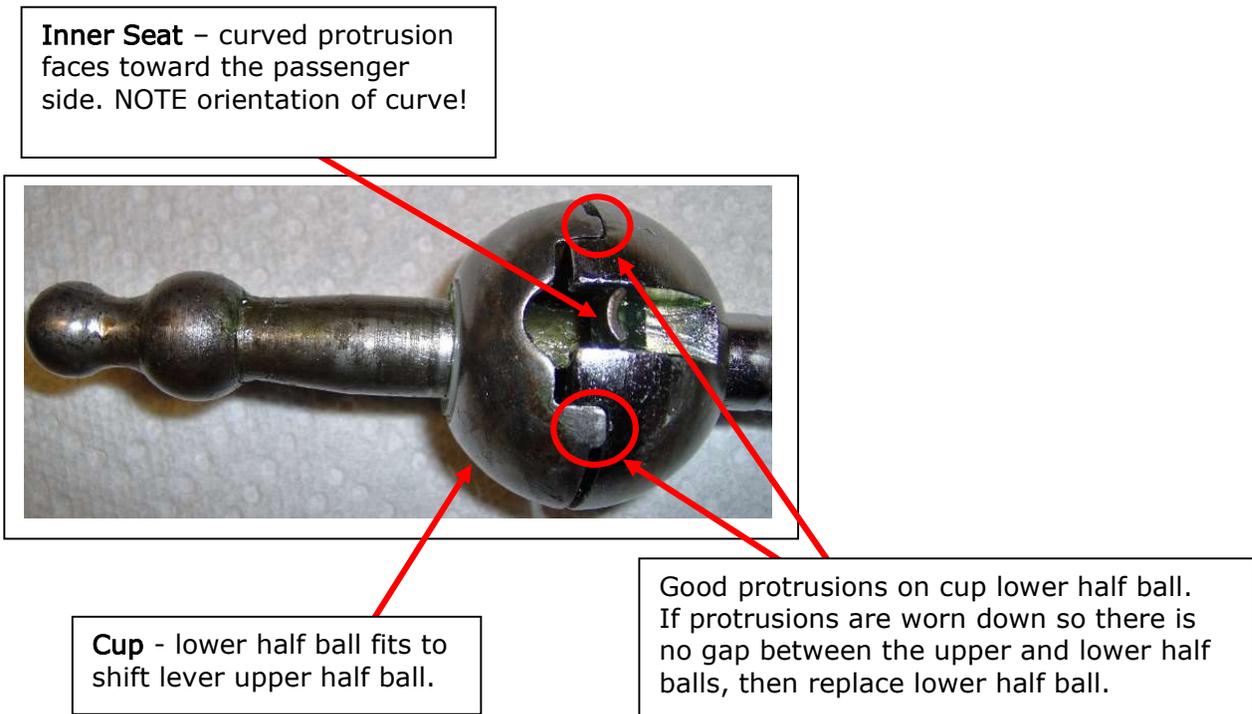


- **Cup** - The “cup” is a stamped steel half ball that mates to the shifter lever upper ball. The “cup” is sometimes badly worn. A good used cup can be purchased or the cup can be repaired by welding or brazing. The “cup” contains a plastic bushing.
 - **Bushing** - the “cup” has a plastic bushing inside it that the “spring” seats on. The “bushing” is sometimes broken. Corvair vendors sell a replacement bushing.
- **Spring** - The “spring” removes play between the shifter lever assembly and its housing. The tension is considerable and makes installing the lower “seat” difficult. **NOTE: The spring should push against the internal seat so the shift lever moves toward the passenger side.**
- **Internal Seat** - The internal seat sits between the upper shift lever half ball and the lower stamped steel half ball. **This part MUST BE orientated correctly during re-assembly!** Its purpose is to provide a spring-loaded motion that pushes the shift lever to the passenger side of the car (3 - 4 shift side).
- **Shift lever and half ball** - The shift lever with its affixed half ball assembly can now be removed via the bottom of the shifter base.

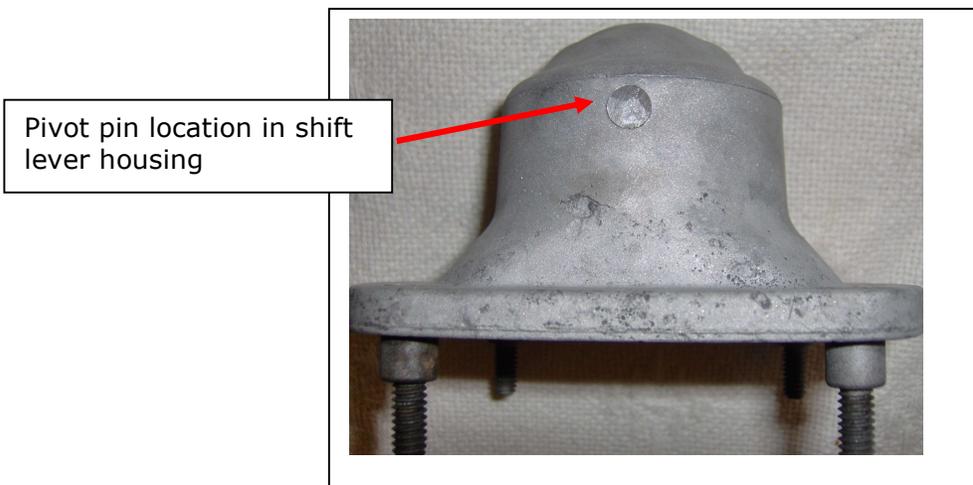
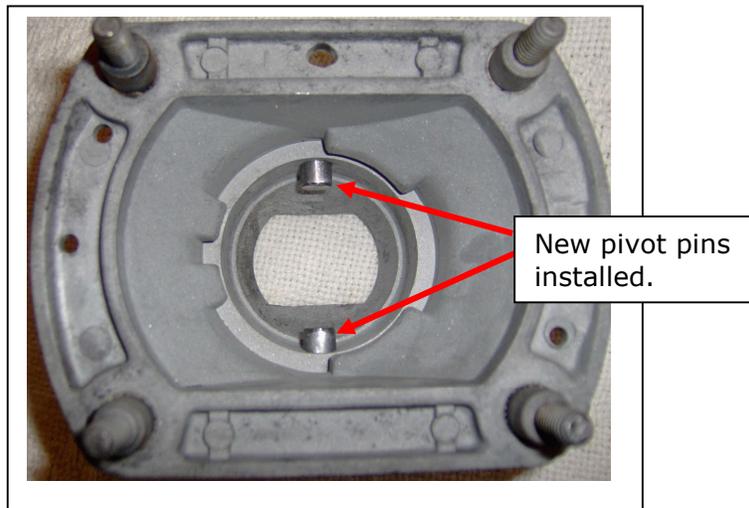
Floor shifter repairs - Depending on model, the shifter lever is either painted or chrome plated and may need to be re-plated. The shifter lever has a half ball with slots in the ball that is part of the pivot mechanism. The slots in the half ball fit over, and rotate on, pins in the shifter lever base. Refer to illustration -



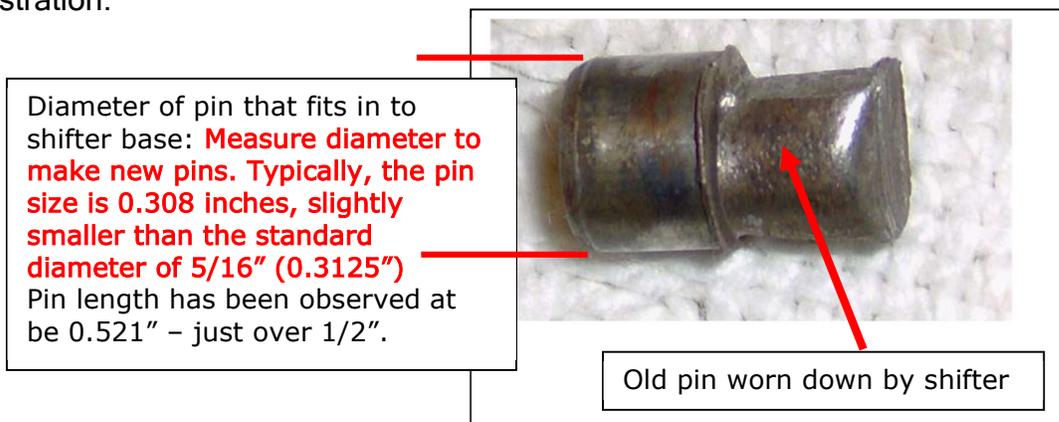
Internal seat and lower cup - Refer to the following illustration. The lower cup can be worn in areas indicated. A worn cup should be replaced with a good used part. NOTE: The cup can be repaired by welding on new material and machining it, but it requires skilled workmanship and a good part to use as a measuring reference.



Shifter lever base --- The shift lever fits into an aluminum housing that contains two pins for the shift lever to pivot on. See illustration.



Worn shift lever pins can be pressed out of the aluminum base and replaced. See illustration.



NOTE: The shifter pins metal alloy is softer than the shift lever ball metal. **DO NOT INSTALL HARDENED STEEL PINS** since they will cause the shifter lever ball slots to wear. The shifter ball slots are difficult to repair without damaging the shift lever.

Several used pivot pins were examined. The typical diameter is 0.308" that is smaller than the standard rod 5/16" diameter of 0.3125". A soft metal 5/16" rod can be purchased to make new pins. Very little metal will need to be removed from the rod diameter to make a pin that fits snugly in the base housing. New pins SHOULD NOT REQUIRE EXCESS FORCE TO INSTALL. Excessive force can deform or crack the aluminum housing. The 5/16" metal rod diameter can be reduced using a lathe, but many use a simpler method of rotating the rod in sandpaper. Some use a hand drill; others rotate the rod on a work bench while applying an orbital sander to the rod. Once the rod diameter is reduced to allow the rod to snugly fit in the shifter housing hole, then cut the rod to produce a pin length of 0.521 +/- 0.003", just over 1/2" long. Press pins into the base housing without using excessive force.

NOTE: It is strongly suggested the shifter base holes NOT be opened to 5/16" to accommodate the standard rod diameter. Every time the pins are replaced the pin hole diameter in the aluminum base may increase slightly due to broaching from pressing in the pin. Once the hole gets larger than 5/16" a custom pin will need to be machined on a lathe to fit snugly.

Lower Seat - When the shifter is used for long periods without being lubricated, the lower retaining seat can be worn. Inspect it and remove minor ridges and corrosion so the inner surface is smooth. If badly worn or corroded, then replace lower seat.

Remove corrosion and wear burrs from inside lower seat.

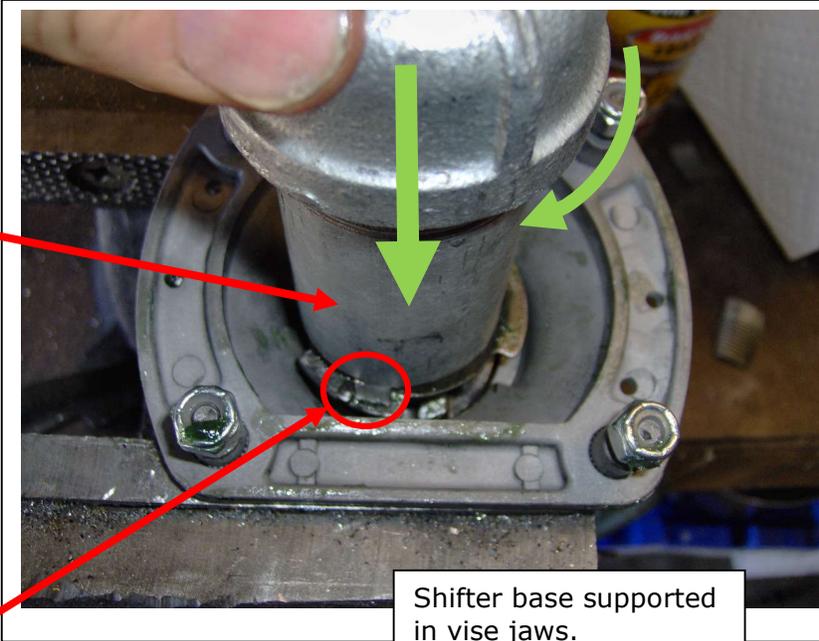


Assembling the shift lever and base - Refer to Figure 7a-2 of the Corvair Chassis Shop manual. Note the indicated relief in the housing (shown in the previous dismantling procedure herein) that must face toward the front of the car. Select an appropriate grease and lubricate the areas of the base and shift lever and associated parts. Support the base upside down and assemble as follows:

- **Shift lever and half ball** - The shift lever and half ball assembly are installed so the shift lever is properly orientated in the base. NOTE: The base protrusion with the slot faces toward the front of the car. Use this as a reference to install the shift lever.
- **Internal Seat** - Install the internal seat that sits between the upper shift lever half ball and the lower stamped steel half ball. **Orient this part correctly during re-assembly! The curved protrusion goes toward the passenger side of the shifter. The curved section will rest on the shifter base pivot pin.**
- **Spring** - Install the "spring" which will be compressed after the cup and lower seat are installed

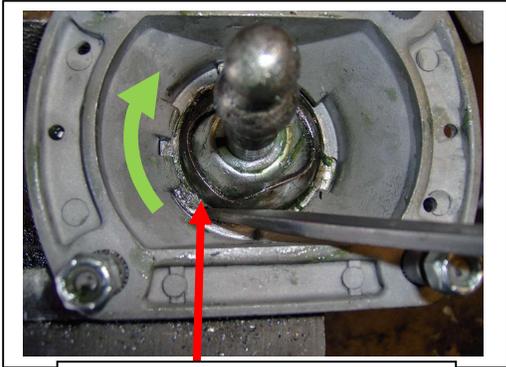
- **Cup** - Install the stamped steel half ball “cup” that mates to the shifter lever upper ball. Verify the plastic bushing is in place for the spring to seat against.
- **Lower Seat** - Before installing the lower seat, make sure the shifter, internal seat, and cup are properly oriented!!!! The lower seat circular plate has three extensions that fit between the base protrusions. **NOTE: the lower seat must compress the cup against the spring so all three extensions fit between the three base protrusions. Depress the lower seat down to the base. Rotate the seat so the three extensions slide partially under the base protrusions. It is recommended that a tool is fabricated to do this. Refer to illustration. Once the lower seat is partially rotated under the base protrusions a drift or screw driver is used to rotate the seat until its tab is centered in the base protrusion slot. See illustration.**

Select pipe (metal or plastic) that fits inside the base protrusions so the lower seat can be pressed DOWN against the spring tension and rotate the pipe and lower seat so the three extensions slide under the base protrusions. **NOTE: pipe is modified so it has a tab to push against the lower seat raised key to rotate the lower seat**



Rotate lower seat to push raised key under base protrusion.

Shifter base supported in vise jaws.



Complete rotation of lower seat to push raised key under base protrusion until key is in slot.



Lower seat raised key in base protrusion slot.

Shimming the shifter base to the floor. - If you plan to refurbish the shifter tube assembly, postpone this process until afterwards. The instructions for selecting the shim sizes are in the Corvair factory Assembly Manual, but an alternative method in the following produces better results.

Assemble the shifter lever and base onto the plastic seal and metal shim on top of the floor shifter opening as follows:

Floor opening.



Thin steel shim on top of floor. It is often corroded. Replacement shim from vendors is plastic.

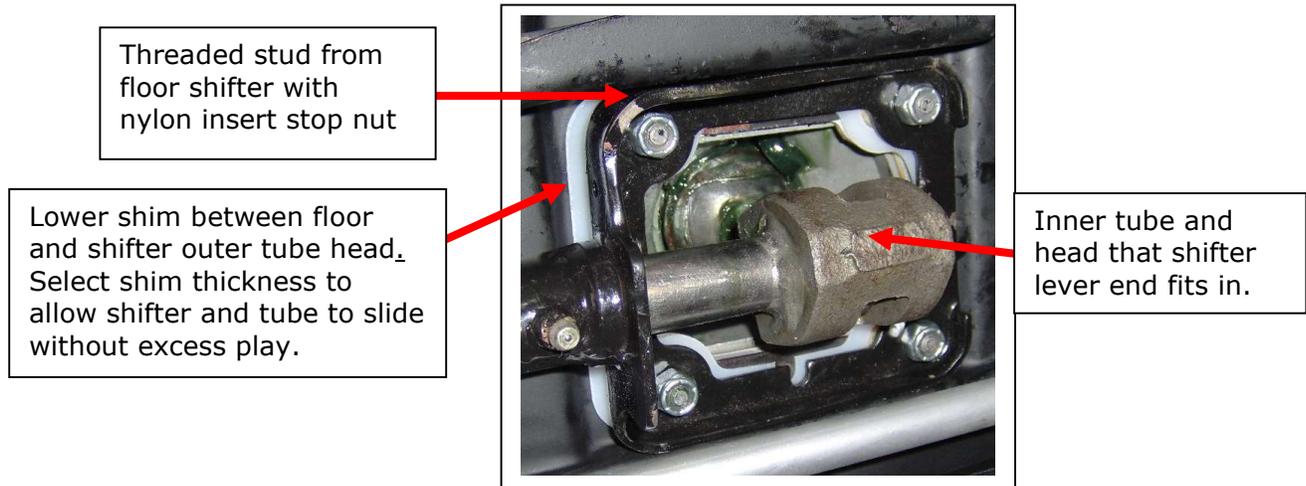


Plastic seal that sits on top of thin steel shim. Shifter lever and base sit on top of seal.

Note the elongated slots the shifter base fits into allow the base to slide fore and aft with the drivetrain movement.



Four threaded studs protruding from the shifter base go through elongated holes in the plastic upper seal and thin shim, through the floor, into the shifter rod housing head. From below the floor, four nuts are installed on the four shifter threaded studs. Only part of the stud is threaded so the nuts will stop at the unthreaded stud shoulder.



- **Selecting the shims per the Assembly Manual** - This process relies on a clean and flat (like new) floor. Precise measurements are made to select the shim thickness (different thicknesses are available from vendors). It was meant to be a quick process at the factory, but it sometimes resulted in the shifter being too loose or too tight in the floor. A shim is selected to go between the underside of the floor and the shifter tube bracket. Unfortunately, after decades the floor area under the shifter may be uneven from abuse or corrosion making the measurement process in the assembly manual impractical.
- **Alternate shim selections process** - The shifter base shimming should allow the shifter to slide fore and aft in the floor with minor resistance, but not so loose as to tip from side to side. Corvair vendors sell different size shims to go below the floor.
 - The previous statement requires the shifter and tube assembly to be slid fore and aft to determine how tight it is to the floor. This requires the rear of the shifter tube assembly to be free from transmission support, but level. **DO NOT LET THE REAR OF SHIFTER TUBE HANG DOWN** while the front is bolted to the shifter base to prevent bending the shifter bracket at the shifter. Support the rear of the shifter tube to allow it to move fore and aft.
 - **When you cannot get the shims to work!** - Sometimes the floor area is uneven so one corner of the shifter base is tighter to the floor than the other corners when you tighten down all four nuts on the shifter base threaded studs. Making the floor area level may not be attainable for the best fit. When this happens the “tight” corner area nut on the threaded stud can be loosened. If this results in a good “fit” then replace the nut with a “stop” nut (has a nylon insert to keep the nut from spinning loose) and adjust it so the shifter fits snugly, but moves fore and aft. Even though the stop nut is not tight against the threaded stud shoulder, it will not come loose.

Refurbishing the shifter tube assembly. - Refer to Section 7 of the 1965 Corvair Chassis Shop manual for removal and installation of the shifter tube assembly. Support both ends of the shifter tube during removal to prevent bending the assembly. **CAUTION - The shifter tube assembly may have already been removed previously and not in the factory configuration.**

The shifter tube assembly consists of the following:

- An outer and inner steel tube.
 - The outer tube has a bracket on the front that attaches to the floor shifter. Another bracket on the rear that attaches to a rod and bracket that bolts to the transmission support. The brackets on each end support the outer tube and allow it to move fore and aft.
 - The inner tube slides in plastic bushing (factory) on each end of the outer tube. The front of the inner tube has a stamped steel or cast iron receiver the floor shifter lower lever fits into. The inner tube is hollow. The rear has a split and a tab to receive the rod of a coupler that attaches to the transmission shift coupler.
- Outer tube rear support.
 - The rear support has rubber bushing (available from vendors) that hold a rod. The rod attaches to a bracket that attaches to the transmission mount.
 - The 1965 model year support rod must be CAREFULLY bent to align the inner shifter tube and coupler with the transmission gear selector shaft.
 - The 1966 to 1969 model year support rod is adjustable to align the inner shifter tube and coupler with the transmission gear selector shaft.
- Coupler from the inner tube to transmission selector shaft
 - The purpose is to connect the shifter and inner tube to the transmission gear selector shaft and allow adjustment of the shift lever fore and aft position (loosen clamp and slide coupler shaft inside inner tube to adjust).
 - The coupler rubber insert can fail. A pin fits through the coupler into the transmission gear selector shaft hole.

Shifter tube bushing failure. - The plastic shifter tube bushings on each end of the outer tube fail resulting in difficulty selecting transmission gears. The inner tube must be removed from the outer tube to replace the bushings. This can be troublesome as follows:

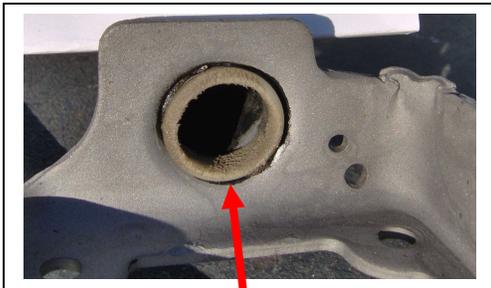
Remove the inner tube from the outer tube. - **WARNING** - Years of accumulated dirt and rust can make this difficult. The inner tube slides forward (rotate the tube to shifter lever head to clear the outer tube bracket), but it may not slide out.

- The inner tube may have a cardboard wrapper, tape, or grime preventing it from sliding forward. Remove the front plastic bushing in the outer tube if needed to remove the inner tube.
- Inspect the inner tube to make sure it is not bent or out of round, especially at the rear portion. It must be straight and the portions that pass through the bushing must be round. Use a caliper to measure diameter and correct if out of round.
NOTE: Very bumpy pavement can cause the inner tube to rattle against the outer tube. A paper tube was used to prevent this, but with age the cardboard deteriorates and causes the inner shift tube to bind in the outer shift tube.

Alternative “fixes” like wrapping a fabric tape around the inner tube or installing a plastic pipe over the inner tube have been observed. These “fixes” may bind the inner shift tube!

RECOMMENDATION - DO NOT install an inner tube liner or tape. Clean both the inside of the outer tube, and the outside of the inner tube. Place a thin film of chassis grease on the outer tube inner surface and to the outside of the inner tube before assembly. This will prevent future corrosion and dampen possible rattling on bumpy roads. DO NOT pack the tube full of grease!

- Remove the worn outer tube plastic bushings. See illustration.

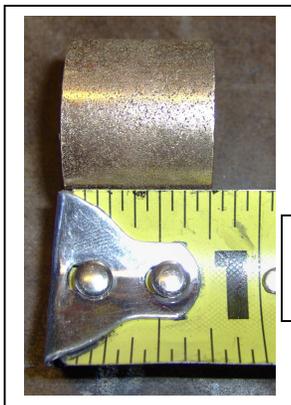


Front plastic bushing



Rear plastic bushing

- Replace the bushing on each end of the outer tube that support the inner tube with either plastic or brass.
 - Plastic bushings are easiest to install and available from Corvair vendors.
 - Brass or bronze bushings are an alternative. Corvair vendors sell them, or they can be purchased from a hardware supplier.
 - Brass/bronze bushing advantages are:
 - Greater durability and less play between bushing and inner tube.
 - Brass/bronze bushing disadvantage:
 - Lubrication required.
 - They often require honing to provide clearance between bushing and inner tube.
 - The brass/bronze bushing must be secured in the outer tube. Securing hardware must not protrude into the inner diameter which would bind the inner shift tube.

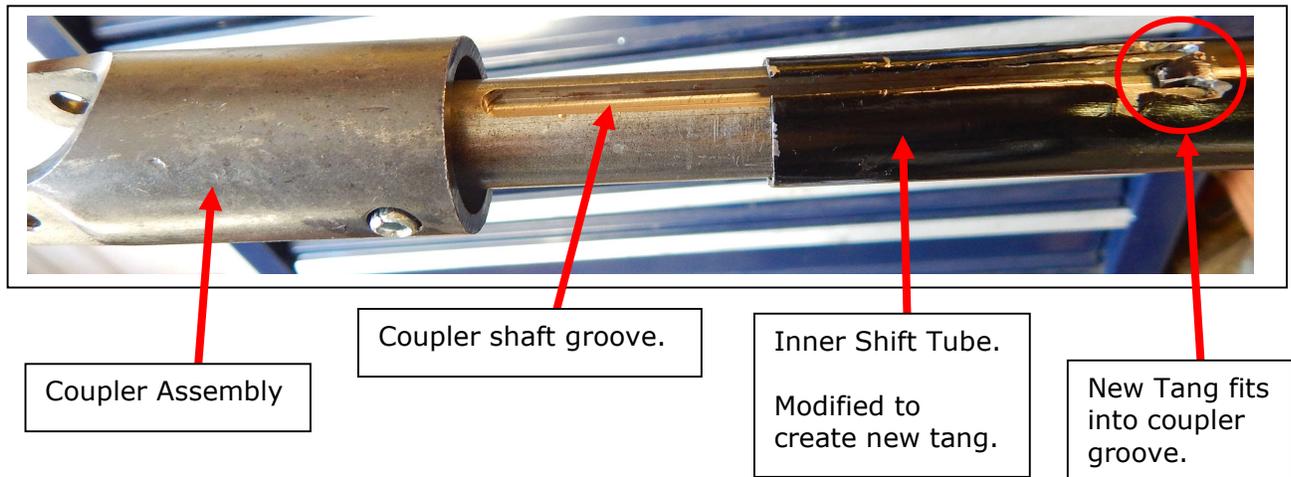


Example of brass or bronze bushing fitted inside outer tube.

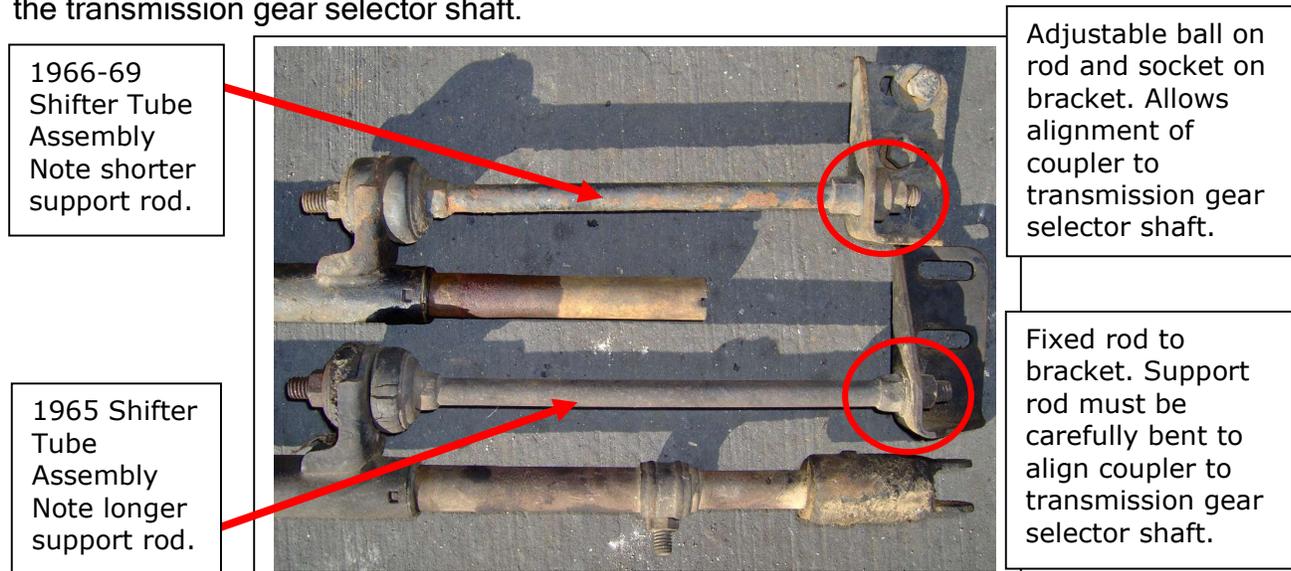
The shift coupler - The tube shift assembly connects the shifter to a coupler that connects to the transmission gear selector shaft. The coupler rubber insert can fail and the coupler pin and holes can become worn causing excessive shifter play when selecting gears. New shift couplers and pins are available from Corvair vendors.

The shift coupler shaft has a groove in its shaft. The coupler shaft fits into inner shift tube that has a corresponding slot and an alignment tang. The tang fits into the coupler groove to align the coupler in the inner shift tube. This prevents the coupler from slipping and rotating out of place that could prevent proper gear selection.

If the tang is broken off the inner shift tube, then cut the tube to make a new tang (width equal to groove width in coupler shaft) and carefully bend it down. See illustration.



The shifter tube assembly rear support - The shifter and shifter tube assembly are connected to the transmission mounting bracket. The 1965 model year shift tube rear support is a one year only design. The revised 1966 - 69 transaxle required a change to the shift tube rear support. The support rod is a different length and is attached to the support bracket via a ball joint that allows the rod to be adjusted to align the coupler with the transmission gear selector shaft.



Centering the shifter and shift tube assembly at rear support - The LM floor shifter slides in the floor as it is connected to the transmission support. One issue is making sure the floor shifter is centered in the slots of the shifter plastic seal so the shifter can move fore and aft without hitting the shifter seal slot ends. Once the shifter and tube assembly are installed, loosen the rear shifter tube rod support that bolts to the transmission support.

