



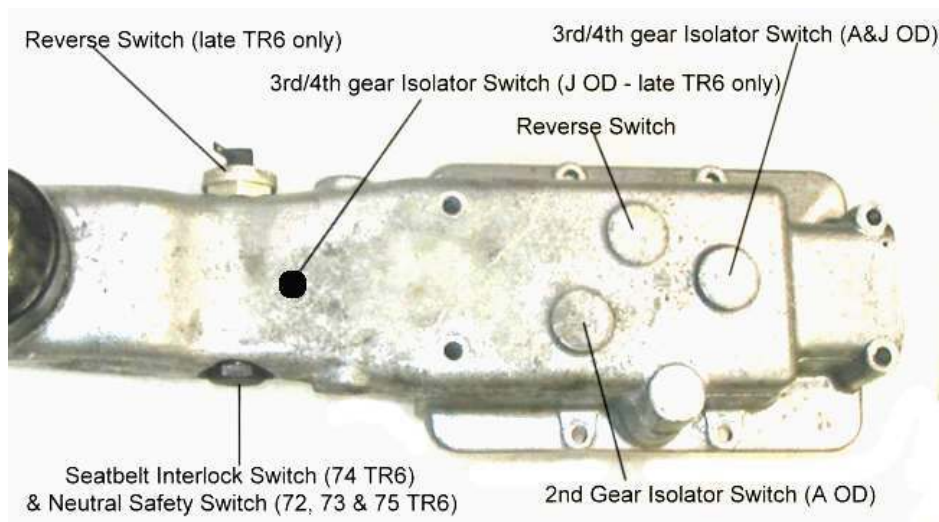
Gearbox Cover Overhaul

The cover for my '76 TR6 gearbox was overhauled a few months ago before putting the engine & gearbox back in the car after new paint. I took a few photos planning to complete the series on overhauling the gearbox. I recently overhauled a TR3 gearbox cover and also took some photos. Now it's time to do a little documentation.

The primary reason I did the '76TR6 cover was to replace the selector shaft seals at the rear of the cover in the futile pursuit of a clean garage floor. The TR3 gearbox had spent many years in a junkyard and we had already found numerous broken parts in the gearbox and associated OD so we wanted to make sure that everything inside was OK.

Gearshift: The gear shift cap and shift lever were removed before long before the covers were overhauled. Gearshift installation and removal is discussed at the end.

Top Cover Variations: There are probably 15 to 20 variations in gearbox covers used on the TR3 through TR6 gearboxes. One variation involved changes associated with the addition of synchronizer for 1st gear (I believe TR4 era) that are discussed later. The other major variations involve the number and location of the switches. The following photo shows the various switch locations



Reverse Switch: The reverse switch is linked to the left most selector shaft that controls the reverse gear. The reverse switch operates when the gearbox is shifted into reverse to turn on the backup lamps. The switch is located on the top left side near the front of the cover in pre '74 gearboxes. The switch is on the left side near the rear on the '74 and later gearboxes.

2nd Gear Isolator Switch (A Type OD): This switch is located on the top right side near the front. The switch is operated by the right side selector shaft when the gearbox is shifted into 2nd gear. The switch is part of the circuitry that controls the the A Type Overdrive unit.

3rd & 4th Gear Isolator Switch (A & J Type OD): This switch is located on the top middle near the front on the pre '74 gearboxes. The switch is on the top middle near the rear on the '74 and later gearboxes. The switch is operated by the middle selector shaft when the gearbox is shifted into 3rd or 4th gear. The switch is part of the circuitry that controls the the A and J Type Overdrive units.

Seatbelt Interlock & Neutral Safety Switch (72-75 TR6): This switch is located on the right side of the top cover and is operated when the gearbox is shifted out of neutral. The switch is connected to the seatbelt module. For the '72, '73 and '75, this switch is used in connection with the seatbelt and door switches to sound the seatbelt warning. The '74 uses a more intrusive arrangement, preventing the starter relay from operating unless the gearbox is in neutral and the seatbelts are fastened.

The button on each switch is positioned adjacent to a selector shafts as noted above. In the neutral position, there is a cutout part of the shaft under the switch allowing the switch button to be in the extended (off) position. When a selector is moved to engage the gearbox, a higher part of the shaft slides under the switch forcing the button in operating the switch. The operation of the seatbelt interlock and neutral safety switch is discussed later.

The switches in the photo below are Overdrive Isolator Switches on the TR3 cover. The switches screw in to threaded holes in the cover. These switches have a hex section near the surface of the cover that requires a large thin open-end wrench (spanner) that I don't have. However, a small pipe wrench works well (don't ever let a real mechanic see you working on an auto with a pipe wrench). Later switches have a larger hex section that matches well with are crescent wrench.



Selector Shaft Detents: There are detents on the selector shafts, one for each stable position. The photo on the right shows the detents or notches on the reverse selector. One detent is for neutral and the other for reverse engaged. The other two selector shafts have three detents (1st-N-2nd and 3rd-N-4th). There are spring-loaded balls or plugs in the underside of the cover that fit into the detents. The springs and balls/plungers were held in place by threaded plugs on the TR3 through the mid TR6s. The later TR6s, starting in about '73, had pressed-in plugs.



The pressed-in plugs for my '76 were removed by drilling small holes in the plugs and the screwing in sheet metal screws and then prying up on the screw head as shown in left photo below. The spring under the first plug removed flew halfway across the workshop. The other two plugs were covered with a rag before they were pried out. The detent parts for the '76 TR6 are in the middle photo and those from the TR3 in the right photo below. The two forward speed selectors use the large spring and ball and the reverse selector has a plunger, a smaller spring and a thick spacer called a distance piece. It looks like I drilled through the distance piece in the middle photo. (Update 2/02: I took apart a TR250 cover and found that a pointed plunger with smaller spring and distance piece rather than a ball on the 3rd/4th detent. The Moss catalogues indicates that they changed from the ball to the plunger in the TR4 after gearbox CT9899 and changed back to a ball after TR6 gearbox CD 22039).



I was unable to get replacement pressed- in plugs for the '76 but was able to get the older threaded style from TRF, which were used. After the selectors were removed, the three holes were tapped 7/16-20. The existing holes were the correct size so all I had to do was find the tap and use it. The photo below shows a hole being tapped. This occurred much later in the process but I thought it better to show here to wrap up this subject.

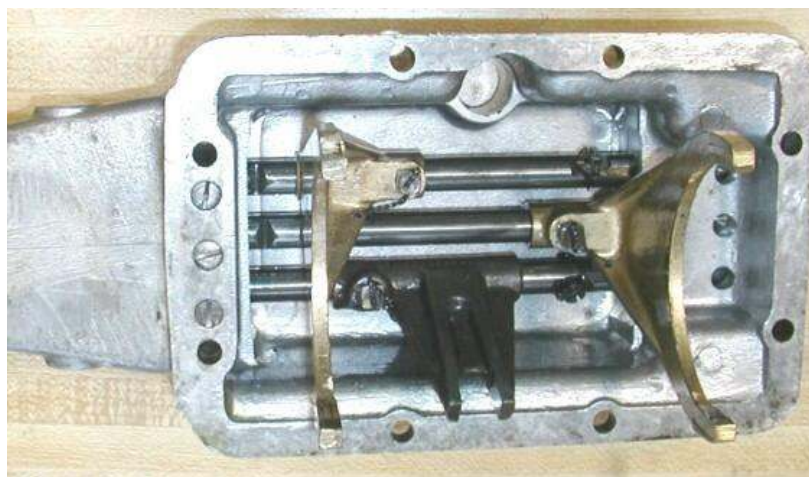


Selectors: The next photo shows the '76TR6 cover. The brass forks are on the forward speed selectors and the cast steel one, called an actuator, is on the reverse selector shaft. Note that the movement of each selector shaft is limited by the fork or actuator at one end and a sleeve at the other. The upper selector (the one with a socket wrench on the tapered screw securing the fork) is for 1st and 2nd gears. The fork goes to the rear on that shaft and the sleeve to the front. The middle shaft for 3rd & 4th speeds has the fork at the front and the sleeve to the rear. The two forks are different, no way could I remember which was which but they are easily identified when compared with the photo; the part with the bolt sticks out further on the 3rd/4th speed fork. The reverse selector shaft has the sleeve to the front. Note that the forks and actuator are oriented so that the tapered screw in each is toward the middle of the cover. The sleeves are all of different length; the approximate lengths shown in the table below. The reverse sleeve is shortest and the 3rd/4th the longest. I try to record these type of data because I frequently mix up the parts, and when I don't, I think I might have.

Approximate sleeve lengths, inches		
Reverse	1st/2nd	3rd/4th
1.95	2.9	3.25



The TR3 cover is shown below. The plugs for the detent springs haven't been removed yet. It is easy to see that the 1st/2nd gear fork and the reverse actuator are very different than those in the late TR6 cover above. The 3rd/4th fork is also different, but it's not so obvious from the photos. The reason for the big difference in the back of the cover is that the early gearbox had an unsynchronized 1st gear and the same mainshaft gear was used for both 1st and reverse. Note also that set screws rather than sleeves are used on the early cover to limit selector shaft motion. The sets screws are a loose fit and safety wire is used to retain them. Safety wire is also used to retain the tapered screws on this early cover. Safety wire is not used on the later covers such as the TR6 cover above. My view is that if the screw heads have hole, use safety wire; if not, forget about it. Clearly, if one is planning on mixing and matching parts between gearboxes, one should verify that any substituted part is the correct one.



Removing the selectors: The square headed tapered screws securing the forks to the selector shafts were difficult to remove. A good quality 12 point 3/8 socket as shown in an earlier photo was used. That worked for five of the screws. One of the heads had the corners rounded a little and the socket slipped so I had to resort to a 5/16 open-end wrench for that one.

There is an interlock between the selector shafts that prevents the middle shaft from being removed before both outside shafts have been removed. Also, no shaft can be removed unless the other two are in the neutral position.

I started by putting the two forward gear shafts in neutral and then sliding out the reverse selector shaft. After removal, I slid the actuator and sleeve (later gearbox) or set screw (early gearbox) in the correct position on the shaft to ease reassembly later.

The 1st/2nd gear selector shaft is removed next followed by the 3rd/4th gear selector shaft. In each case, the fork and sleeves/setscrew are put back on the shafts in the correct position and orientation. The removed selectors are shown below; the 76 TR6 on the left and TR3 on the right.



Interlock: The interlock consisting of a short pin and two steel balls is located between the detents and the gearshift. There is a hole bored in the casting between the three cylinders housing the selectors at the point of the interlock. The 3rd/4th gear selector shaft has a small hole bored through it to hold the pin. The steel balls are located in the hole in the casting between the shafts, one between reverse and 3rd/4th and the other between 1st/2nd and 3rd/4th. There are also detents bored into the sides of all three shafts. The photo below shows the 3rd/4th gear selector shaft (the

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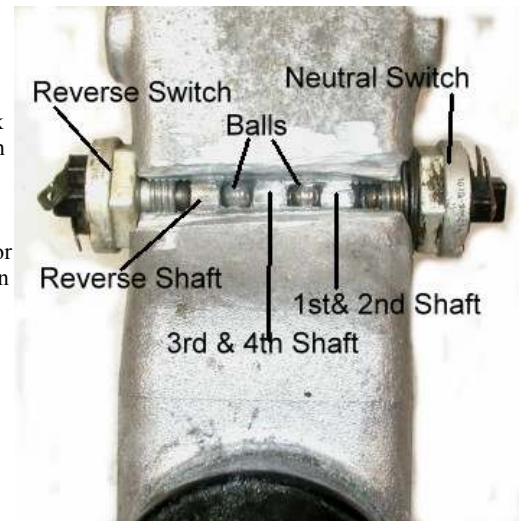
middle shaft) from the TR6. The three notches on the right are the detents that work with the spring and steel ball. The notch to the right of the steel ball is for the overdrive switch in the top of the cover. The two balls and the pin just visible in the recess in the shaft are the interlock.



The photo below is of the reverse selector shaft from the TR3 gearbox. The two notches on the right are for the dents, in this case, the spring and plunger. The recess towards the left side is part of the interlock: one of the steel balls fits into the hole.



The photo on the right is of a late TR6 cover where a slot has been cut to expose the interlock components. The diameter of the steel balls is slightly greater than the distance between each of the two shafts. The recesses are deep enough such that a ball can be pushed into one recess far enough such that the other shaft can slide by. The shaft in which the ball is pushed is prevented from moving by the ball. The pin in the middle shaft is the same length of as the diameter of the shaft less the depth of one of the recesses. For example, if the middle selector shaft is moved out of neutral, the balls on each side of the shaft are pushed into the recesses in the outer shafts preventing them from moving. If one of the outside shafts is moved off neutral, the associated steel ball is pushed into the recess in the center shaft keeping it from moving. This ball also pushes the little pin in the center shaft toward the other outside shaft forcing the other steel ball into the recess in the other outside shaft keeping it from moving too.



The switches on each side of the interlock are only used on later TR6 gearboxes. The interlock is identical to that on earlier covers except for the switches. In the later cover, there is a cutout section in the shaft neutral position next to each switch that allows the switch button to be fully extended and switch to be off when the shaft is in the neutral position. When the shaft moves off the neutral position the cutout section moves from under the switch button and the full width shaft slides under the button pushing the button in to operate the switch. (Thanks to Pete Chadwell for describing the neutral switch in his '73 TR6 gearbox cover.)

The 1st/2nd shaft for those gearboxes equipped with the neutral switch has a hole and pin identical to the pin in the 3rd/ 4th shaft. This pin will push the switch button and thus operate the switch when either the reverse or 3rd/ 4th shafts move out of neutral. For example, if the the 3rd/4th shaft moves out of neutral, both balls move toward the outside. The right ball will push the pin in the 1st/2nd shaft to the right and operate the switch. If the reverse shaft moves out of neutral the left ball will be pushed to the right in turn pushing the pin in the 3rd/4th shaft to the right in turn pushing the right ball and the pin in the 1st/2nd shaft to the right operating the switch.

The little pins in the shafts come out with the selector shafts. The steel balls usually remain in the holes between the shafts. I use a wire with a half inch right angle bend on the end slid down the outer cylinder and then into the hole between the shafts to push the ball into the center cylinder.

Cover Plate: The final thing to remove is the cover plate that exposes the three O-rings I wanted to replace. The left photo below shows the cover plate with screws. The right photo shows an O-ring being removed from one of the recesses. Standard Buna O-Rings can be used here size #112, 1/2" ID, 11/16" OD, 3/32" cross-section.



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Before starting the assembly, all the components are cleaned and inspected, including the cover. The outside of the cover had already been cleaned; this time the inside and the passages were worked on. Next, each component was checked for excessive wear. The major wear component is the selector forks. A heavily worn 1st/2nd gear fork is shown on the right. That is the 1st gear side that exhibits the most wear. I don't have specs on how much wear can be tolerated. One of the mechanics at TRF said the fork should be replaced when the end is worn to the same thickness as the stem. The one in the photo is close. Apparently new replacements are NA so one should hold onto old covers.

If I experienced the gearbox jumping out of gear, I'd look both at the detent spring and the associated fork. If the fork on the right was matched with a gear that wouldn't stay in place, I'd replace it.

Driving with your hand on the gearshift may be one cause of excessive fork wear. (I'm guilty of that.)



Reassembly: The reassembly is the reverse of disassembly. First, the three O-rings were put in the recesses and then the cover plate installed. The interlock balls were then coated with grease to both lubricate them and to hold them in position during reassembly. A screwdriver was then used to push each ball down the center shaft cylinder and into the side hole. The interlock pin was then positioned in the middle (3rd/4th gear) selector shaft which was then inserted through the center hole in cover plate and on into the casting. The shaft was pushed into the associated fork and, if on the later cover, into the sleeve. The orientation of the fork and sleeve was double checked and then the tapered screw inserted and tightened. The setscrew was inserted in place of the sleeve on the earlier cover and then both the tapered screwed and set screw were secured with safety wire. The other to selector shafts and associated components were then installed using the same procedure. The shafts already installed were placed in the neutral position before inserting an additional shaft. The photo below shows safety wire on a partially assembled early cover. (The safety wire is a real pain, fortunately, I didn't have to use it on the TR6 cover.)



Installing the detent hardware: The detent balls, plunger, springs and plugs are installed next. The top of the plug is screwed in until it is about one turn below the cover surface. The pull off force should be 32 to 34 pounds for the forward speed selectors and 26 to 28 pounds for reverse. This can be checked using a spring scale like those used by fisherman to weigh their catch. The scale can be wired to the end of the shaft --- the casting that fits at the end of the shaft will keep the wire from slipping off the shaft. If the force is too low, shims can be placed under the plugs. The springs can be ground down a bit if the force is too large. I've never made this measurement but have shimmed a spring that seemed too weak.

Final steps: The final steps to the reassembly involve reinstalling the OD isolator switches and the reverse switch (if present) and installing the cover on the gearbox. I apply Hylomar sealer to the underside of the cover gasket before placing it on the gearbox. The two longest cover bolts go in the rear, the other two longer ones in the front and the four shorter ones on the sides.

Gearshift: I usually remove the gearshift from the top cover before removing the gearbox from the car. The shift lever will side up and out of the top cover after the shift lever cap has been removed. Two designs of caps were used in on the TR6, the change occurring possibility in '73. The photo below shows the two cap designs. The earlier design on the left, also used on the TR250, has shift lever locating pins that pass through holes in the cap; both these locating pins as well as the small bolt at the rear must be removed before the cap can be removed. The later design on the right uses locating studs with shoulders. This cap can be removed by first removing the small bolt at the rear and then pushing the cap down and rotating it counterclockwise enough for the tabs to clear the shoulder on the locating pins. The cap can then be lifted up and off. There are two different locating pins shown for the later cap. The short one is used on the left side and the long one on the right. The long one has a threaded stud that retains the top cover steel support strap. The flat washer, lock washer and nut secure the strap. A thread locking compound similar to Loctite had been used on the longer stud removed from my '76 TR6.

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The photos below show the remaining parts for the late TR6 gearshift. The shifter is on the left, cap on the top and spring and retainer on the bottom in the left photo. The right photo shows the anti-rattle spring and plunger that fits in the hole in the bottom of the shifter. The Moss catalogue mentions that a rattling gearshift lever is a very common Triumph problem. They say the source of the problem is usually a worn or missing plunger and/or spring shown in the right photo. The plunger on the '76 shifter shown here was pushed in when it was removed from the gearbox. I at first thought the spring was missing. I had to tap the side opposite the hole with a small hammer to get the plunger to come out. There was a spring behind it, but in four pieces. The spring shown below is new.



The TR3 & TR4 gearboxes used a different cap than the later gearboxes. The photo below is of parts from a TR4 gearbox and is similar to that on that for the TR3 except that the TR3 shifter is straight.. Note the bolt that goes through a hole in the bottom of the shift lever and both side holes in the cap.



A Haynes TR5, 250 & 6 Owners Workshop Manual says that the shift lever was changed in the later gearboxes to incorporate a rubber bushing between the lever and the ball at the lower part of the shifter. Later in this context probably means the mid to late '60s. The purpose of the bushing was to prevent transference of noise to the interior of the car through the shift lever. Both this change and the anti-rattle plunger and spring are interesting. One should expect cars as old of these to have some minor noises. I find the best noise abatement device is a pair of fairly loud mufflers such as the sport mufflers sold by the major vendors. These also cure minor clutch and brake squeaks, road noise, valve clatter, etc. They also mask instructions to **SLOW DOWN** from the RH seat.

Gearshift Reassembly: The gearshift components and the mating surfaces of the cover were cleaned of all grease. Fresh grease (I use wheel bearing grease) was applied to the recesses in the castings at the end of the shifters that the end of the shift lever sets. Grease was all spread over the rounded bottom of the shift lever and the extension that contains the anti-rattle plunger and spring. The spring and plunger were

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then fed into the hole and retained by the grease. The shoulder locating pins were then screwed into position on the later cover. This was deferred for the earlier cover. The shift lever was then positioned in the top cover as shown in photo on the right. Next, the spring was positioned on the shift lever (small coil on the bottom) and the spring retainer slipped into position. Notice that the retainer was coated with grease. The insides of the cover were then coated with grease and pushed down over the retainer. The slots were aligned with the shoulders on the retaining pins, and the cover was then pushed over the shoulders and rotated so that the tabs are under the shoulder. The small bolt in the rear was installed to secure the cap.



The similar procedure to above can be used to install the earlier shifter that uses retaining pins and cap except that retaining pins are not installed until after the cap is secured. In this case, the cap must be held down against the spring force while the small bolt in the rear of the cap is installed. The retaining pins are then installed through the cap. A final adjustment is required on these pins. The shifter is put in the 1st/2nd gear position and then the RH pin is tightened until the shifter just moves and then backed it off 1/2 turn and the lock nut tightened. The shifter is put in the reverse position and this procedure repeated for the LH retaining pin.

The following photo shows a cover that uses the adjustable retaining pins (left) and one that uses retaining pins with shoulders (right).



The procedure to install the cap with the shifters that use the long retaining bolt is similar to above, except that that long bolt that goes through the hole in the shifter rather than the small bolt at the rear secures the cap. No adjustment is required in this case.

The steel cover support strap (if provided) is secured on the threaded end of the long bolt on the LH side of early gearboxes or under on the threaded stud on the RH side of the late gearboxes.

The final step is to install the gaiter over the shift lever (TR250 and TR6) followed by the lock nut and the shifter knob.