Adding OD Isolator Switches to Gearbox Top Cover

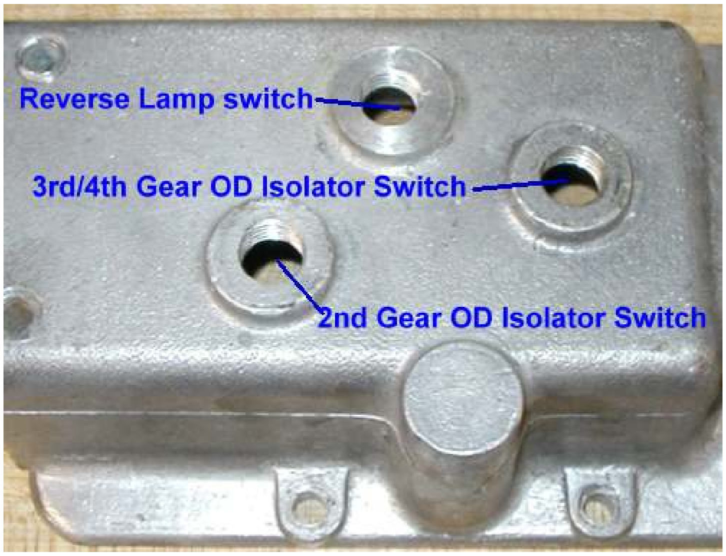
My friend Ryan recently brought over a gearbox with A Type OD from one of his fleet of TR250 carcasses. The objective was to put it on the test stand, bring it up to speed, check the hydraulic pressure, make sure it switched in and out of OD, etc. He noticed right off that there were no OD isolator switches in the top cover and the presence of a non-OD mainshaft suggested that the OD was a late addition to the gearbox. Turned out the OD worked more or less but the gearbox was a bit noisy because the rear countershaft bearing along with part of the countershaft had been ground up and deposited in the bottom of the OD main casting. This is the typical gearbox failure mode and we just happened to have the required counter shaft gear (1st & reverse) on hand so that getting the gearbox with OD back in shape was not going to be a major problem that couldn't be solved with $$$$ for bearings, gaskets, countershaft, repairing/replacing the mainshaft, etc, etc.

The remaining problem was to deal with the gearbox isolator switches. My first thought was to mill notches in the selector shafts to operate the switches as is done on the later gearboxes for the J type OD. Randall Young reminded me that the OD isolator switches were operated from the top of the selector shafts in early gearboxes. He also pointed out that all versions of the TR250 & TR6 gearbox covers used the same 1st/2nd and 3rd/4th selector forks. Therefore, it would be much easier to just drill holes in the top cover directly over the forks and tap the holes with the thread used for the isolator switches.

A quick check of one of the switches revealed the tread to be 16mm with a 2 mm pitch. I found a never used 16X2 mm tap in the tool chest. I must have bought the tap to help my son do something to one of his VW beetles or buses. That would explain my not remembering why I had the tap --- I've tried to forget the entire VW experience.

The side of the tap is marked with the statement "use 35/64 drill". I didn't have one of those lying in the tool chest. I did however have a 9/16 (36/64) drill as part of a set of 9/16 to I inch bits (in 1/16 inch steps) with 1/2 inch shanks (Harbor Freight). I figured that /16 was close enough for the light duty requirement of the switch.

The next job was to find the right spot for the holes. That was no problem since all the TR250 - TR6 top covers have cast bosses specifically for the switches. The next photo show the top cover with the holes drilled and tapped. The hole for the Reverse Lamp switch was already there. (Note that the reverse lamp switch for the later gearboxes is on the side toward the rear of the top cover.) The holes for the OD Isolator switches were drilled as close as possible to the center of the bosses. If one has a J Type OD, only the 3rd/4th gear isolator switch is used. I wouldn't bother with the switch for 2nd gear on the A Type either. Ryan is interested in autocross where the 2nd gear OD might be useful, so we did 2nd gear too.



The next two photos show the top and under side of the top cover with the switches installed. The switches are the same as used for the reverse lamp and also the seat belt alarm/neutral safety switches on the later models. We were able to salvage a pair of switches from spare covers.

Not so fast: If you look at the above photo You might notice that the plunger on the lower switch (that's the reverse lamp switch) is sticking out a little further than the others; in fact it's sticking out about 0.050" further. Then I remembered that the top of the boss holding the reverse switch was machined smooth --- see first photo. This is an ideal job for a fly cutter in the mill as shown on the right. I adjusted the cutter so that the top of the two bosses for the OD isolator switches was machined to the same height as for the reverse lamp switch.

One of the of the concerns I had was whether I got the switches in exactly the right spot relative to the selector forks so that the switches would operate only when the gearbox was in the desired gears. I checked out a cover with factory drilled holes (before I drilled my holes) and as far as I could tell the holes were in the center of the bosses

The next photo shows how the switches interface with the shifter forks. I'm holding the switch in the neutral position over the 1st/2nd fork. The shifter fork moves forward (to the right) when shifted into second gear and the raised part of the top of the fork will slide under the switch and push the switch plunger into the switch thus operating the switch. Note that there is no raised part on the forward part of the selector so when the selector is slid to the rear (left) when engaging 1st gear, the switch is not operated (and it should not be operated). The other selector on the right for 3rd/4th gear has a notch where the switch plunger rides in neutral with raised parts in the front (right) for 4th gear and to the rear (left) for 3rd gear.

Note the two dark washers on the bottom of the switch. These I think serve the dual purposes of providing some switch height adjustment through using more or fewer washers and also as an oil seal. I prefer to use a little silicon based gasket sealer on the threads to minimize oil leaks (I never say prevent oil leaks when speaking of a TR).

After the selector shafts and forks were installed I looked down through the holes for the switches and verified that the recessed part of forks were under the switch when in neutral and the raised part was under the holes when the gearbox is in the proper gear to operate the switch. No problem with the 2nd gear switch, clearly not operated in 1st or neutral and clearly operated in 2nd.

That was not the case with 3rd/4th. It appeared that the switch would barely operate in either gear. Next I took apart the shaft and fork and compared the length of the recess in the top of the fork with the distance between the slots for the 3rd and 4th gear detents in the selector shaft. The next photo shows this comparison. It's pretty clear that there is little margin for error in the position of the switch. If the switch is positioned exactly in the middle of the notch in the top of the fork when the fork is in neutral, then there will be just barely enough motion to operate the switch in either direction. If the switch is off center in neutral, it's likely that it'll operate only in only 3rd or 4th, not both. So --- why so little margin? My guess is that way back when, someone should have checked the drawing a couple more times before making the pattern for the casting. And what about wear in the top of the fork? I've heard of people having trouble. Maybe that's why they moved the switch to the rear and operated it from a notch in the shifter shaft --- they were having problems with the switch operating from the fork.

I think building up the top of the fork is the best solution for us users if we get the hole for the switch slightly off center or the switch becomes erratic due to wear. One could probably add some material through brazing then file it to the desired shape. The easiest solution that comes to mind for me is to use the head of a screw ---- drill and tap as hole maybe 6-32 exactly under the path of the switch plunger. I'd install the screw with thread lock and if necessary, file off part of the head toward the center of the slot.

I guess we were lucky that we got the hole just right --- at least for now.