5-Speed Transmission to a Studebaker V-8

by Pete Kurzenhauser

(This Review of Transmissions, Adaptation of Ford 5-speed was researched and written by Pete Kurzenhauser, and comes through some January, 1993, correspondence to Bob Palma, Technical Editor of SDC and "The Cooperator" in Turning Wheels)

Dear Bob;

Thank you for your response to my last letter (the one I sent in April). I noticed you used excerpts of it in your most recent Cooperator column--hope it was useful to others too. One of the items I asked about was swapping transmissions. Since then, my T-10 four-speed developed a strange cycling sound, so it was tranny removal time. Because I was not-t satisfied with the close ratios in that box (2.54, 1.89, 1.51, 1.00), I started doing the research to fit another transmission up to the Stude bell housing. I decided to adapt a T-5 transmission and have had great success with this transplant. I strongly recommend it to other owners who drive their cars on a regular basis and who are not fanatics about 100% originality. You and the Cooperator readers may want to know what I found out in my research. Candidate transmissions:

A. The GM T-10

The gearbox bolt pattern to the GM bell housing is completely different, and cannot be bolted up without serious modifications to either the Stude bell housing, the GM gearbox, or both. However, the innards look like they can be transplanted into the Stude gearbox, because the external measurements are the same, and the center-to-center distances of the gears inside the box are the same. I don't know if the input and output shafts are interchangeable separately. If they are, then you don't have to put a sleeve on the GM input shaft pilot journal (because the GM pilot is .600" dia., and the Stude pilot is .750"), or change the clutch disc, or change the output yoke slider. The input shaft extension housing should stay Stude, or the clutch release bearing must be changed and modified (the bearing slider diameter is 1.500 for Stude, 1.375 for GM), and the bell housing alignment hole must be bored out from 4.675 to 4.685. Also, the output shaft housing should stay Stude, or the speedometer drive will be on the other side of the transmission. Since T-10's were manufactured for the major car companies with wider ratios, this could be a promising modification that would retain external originality. In my research, I found references to T-10's with 2.88/1.74/1.33/1.00 and 3.44/2.88/1.46/1.00 ratios (the latter one probably went into a truck), although most of the used ones I found for sale locally were in the range of 2.4 to 2.6 1st gears.

B. The Ford Top loader:

These are very strong trannies which have a torque rating on the order of 450 lbs-ft. There are two versions, a wide ratio (2.78/1.93/1.36/1.00) and a close ratio (2.32/1.69/1.29/1.00). Fortunately, the wide ratio is more common. Some of these have two bolt patterns, so they could be bolted to several different models, and one of those bolt patterns fits the Stude exactly! The input spline is slightly different from the Stude, so you have to use a Ford clutch disc, and the pilot is .668 instead of .750, so you have to put a sleeve on the pilot journal. Also, the input shaft housing is slightly different, but the four bolts that hold it onto the box are the same pattern as though Stude so you may be able to simply bolt on the Stude housing and retain the Stude clutch release bearing. I can't swear to this, however, so you will need to actually check the internal shapes to see if it will fit or can be easily machined to fit. Otherwise, you will have to find a different clutch release bearing that will work and bore out the bell housing hole to 4.850. Other top loaders may have only one bolt pattern which may not be the same as Stude, however, the gearbox mounting ears are wide enough that you should be able to drill them to the Stude pattern. Two other functional differences are the distance from the mounting face of the gearbox to the center of the shifter (the Stude is 17-1/2" and the top loader is about 2"longer, so the shifter will sit back further in the car, but 2" probably isn't critical), and the length of the gearbox, which I didn't carefully measure, but it is about 2", so you will likely have to shorten or change the drive shaft. The Ford output yoke slider U-joint dimensions are the same as the output yoke slider U-joint on my T10, so the old U-joint "should" be the same and interchangeable C.. The Chrysler:

I didn't do any research on these, although they may be promising. D.. Doug Nash Engineering 5-speed

This is an aftermarket transmission that is intended for racing use, and is appropriately designed. It's also

appropriately expensive about $1800 new, $1400 rebuilt. It was also an option in some Corvettes in the early to mid 80's, so you might run across one from a wrecked 'Vette. The 5th gear is not an overdrive, like most 5-speeds. Instead, the extra gear is a lower 1st gear and 5th is a direct 1-1 drive like the fourth gear in a 4-speed, so just changing the transmission will not reduce your highway engine RPM. If you wanted to use this transmission because of its additional strength, and also wanted lower highway RPM, you would have to change your axle ring and pinion gears. It is available in a variety of bolt patterns, spline patterns, and input shaft housing dimensions to fit most cars, and adapters are also available for this purpose. A variety of ratios are available, typical is 3.27/2.13/1.57/1.23/1.00.E. The Ford (Borg-Warner) T-5 (late model Mustang 5-speed)

The standard T-5 has ratios of 3.35/1.93/1.29/1.00/0.68, and a torque rating of 275 lbs-ft. There is also a heavy duty "Motorsport" version which has ratios of 2.95/1.94/1.34/1.00/0.63 and has a torque rating of 305 lbs-ft. Both of these give much wider ratios than other transmissions mentioned here. A very nice feature is the shifter, which is integral to the transmission, instead of hanging on the outside of the gearbox as with the other transmissions. This gives a very smooth, tight and positive shifter feel (test-drive a late model V-8 Mustang to see what I mean). These transmissions are modern designs with metric fasteners and dimensions, so none of the T-10 parts are interchangeable. Making one of these fit will require some machine work. Because of the wider ratios, overdrive gearing, and vastly improved shifter feel, I decided it was worth doing in my own car. Details follow. But, a word of caution here: The T-5 is not made for drag-racing, so don't "sidestep the clutch" at stoplights--it won't last if you do that, as some Mustang owners have learned the hard way. Put in a Ford top loader or automatic instead. Adapting the T-5 transmission:

I have been involved in engine and transmission swaps before, and as swaps go, this one was fairly easy and uncomplicated (except for the ever-present Murphy factor!). Stock parts could be used with little or no modification. Other than the clutch linkage bracket, pilot Journal sleeve, and altering the drive shaft, nothing had to be custom made, and the only machining required was for the bell housing bore and bolt holes.

External dimensions: The T-5 is a little bigger than the T-10. The gearbox is about 2-1/2" longer and the shifter sits about 2" further back, 2" to the right, and about 2" or so higher than the shifter on the T-10.

Bell housing: The two lower mounting holes are close enough to the Stude pattern that the bolts will slip right in without modification. The two upper bolts are about 1-1/4" wider on each side than the Stude pattern, in fact, they are off to the sides of the Stude bell housing mounting face, so you cannot simply redrill the holes and put in the bolts. What you have to do is build up mounting bosses on the curved part of the bell and tap them, or install some kind of stud arrangement. Adding bosses involves welding on cast iron, which requires special nickel welding electrode and is not the strongest way to join materials, so you should not depend upon the weld to take the full stress of mounting.

You should bore a hole through the built up boss and through the bell housing and back up your bolt with a nut, or, as I did, put the bolt through the bell housing from the inside so that the threaded end sticks out like a stud, then weld around the hex head to keep it in place. Obviously, make sure everything is correctly positioned before you weld (I assembled the transmission to the bell housing with the bolts and nuts in place and then welded).

The diameter of the base of the T-5 input shaft housing is 4.910" instead of the 4.675" of the Stude T-10. Therefore, either the T-5 input shaft housing must be turned down, or the bell housing must be bored out to that dimension. I chose to bore the bell housing, since I might want to change to a Ford engine, clutch and bell housing someday, or go to an automatic and resell the transmission separately. Since this operation will most likely be done on a milling machine, this is a good opportunity to reposition the centerline of that hole if it is off-center and to mill the mounting face if it was not perpendicular to the crank axis (remember to dial indicate both the radial runout and face run out of the bell housing before removing it. If not, reinstall and measure them). This is also a good opportunity to drill the holes for your two upper mountings, since you can get them precisely positioned with the mill, and it is a lot easier than trying to align and drill the holes by hand and eyeball (just trust me on this). I also drilled and installed a grease fitting on the right side of the bell housing to lubricate the right end of the clutch release shaft. Hey, it was easy to do.

Transmission: The T-5 input shaft housing is longer than on the T-10. According to my measurements, the clearance would be about 1/8" interference between the end of the housing and the Ford clutch disc. Since there was some slop and "guestimation" in my measurements, I sawed off 1/2" in order to make sure there was sufficient clearance. The mounting holes in the transmission are .493 in diameter. Most 1/2" bolts are .492-.495 in diameter, so you may need to open them up a little with a round file. I took my calipers to the store and selected the bolts that were on the small side of those measurements to give a good precise fit.

Input shaft: The input shaft is 7-1/8" long, compared to the Stude T-10's 7-7/16", so it is long enough to adequately fit into the pilot bushing in the crank. I made a steel bushing out of mild steel (but a harder material would be better) with an internal diameter of .667" and an external diameter of .750", 1" long. Since the pilot Journal is .668, this gives a good heat-shrink fit.

Clutch: Use the Studebaker style clutch with a Ford 10-1/2" disc. Obviously, this is also a good time to upgrade to new or heavy duty components, and to have the flywheel resurfaced if needed. Release Bearing: There are several choices here. The diameter of the area where the release bearing slides along the input shaft housing is smaller on the T-5 than the T10 (1.430 versus 1.500). The Mustang release bearing is made for a completely different linkage and clutch and will not work. I used a release bearing for a Chrysler (don't know which one it was because the parts man took my old bearing, along with the description of what I needed and came-back with one he said was common to most Chrysler products that looked like it would work). The inside diameter was 1.427, and I used a brake cylinder hone to hone it out to 1.432 so it would slide easily on the T-5 input shaft housing. With a file and hacksaw, I modified the "ears" and spring clips of the bearing to work with the Stude clutch release shaft/arms, and spread the arms apart a little. Another option is to make a sleeve to fit over the T-5 input shaft housing to make it 1.500 diameter and use the original bearing. A variation on that option is to make a sleeve that fits on the inside of the original bearing to take up the clearance (I actually tried this by using .032 aluminum sheet metal, and it gave a very good fit, but I decided to use the Chrysler bearing because I wanted to get a different geometry on the arms than original). Clutch linkage: The clutch linkage was mounted to the gearbox cover screws on the T-10, so you will need to make a bracket that mounts to the bell housing and other convenient spots on the T-5 to hold the end of the linkage (also a good time to weld the arm on the shaft so it doesn't twist and leave you clutchless some dark rainy night). I chucked up a piece of 3/4" steel rod about 1-1/2" long in a drill press and used a hand file to turn it down to create a barrel shape on one end which was .700" at the middle, about .650" at the ends, and 3/4" long (the inside diameter of the clutch operating shaft is about .710", and the reason for the barrel shape on the end of the rod is to allow for some rocking of the engine/trans assembly with respect to the clutch cross-shaft, without causing binding). I then welded this to a piece of 1/2" steel plate 1" by 1-1/2" which I drilled so that the bottom left bell housing bolt clamped it in place (and substituted a longer bolt). I also drilled and installed a grease fitting so that I can easily grease that pivot point. Because engine and transmission alignments can be significantly different from car to car, you should measure carefully and adjust these dimensions to fit. The barrel part should not fit all the way into the clutch cross shaft--leave about 1 /8" to allow for movement of the engine/trans on the rubber mounts.

Output Shaft Yoke: If you didn't get this with the transmission, get a used one from the junkyard (a new one from the dealer is about $80, used about $25). It is common to many Ford transmissions and uses the same 3.25" x 1.068" U-Joint as the Stude T-10.

Drive shaft: As best as I can determine, there were several different drive shafts with different style U-joints, so what I say here pertains to my car -- yours may be different. Mine has a 57-1/2" shaft (U-joint center to center) with the internal circlips on the shaft, and outside circlips on the yoke. I got a Ford Econoline short wheelbase drive shaft from a junkyard (about 59") and had it shortened to 55" and rebalanced (note: when balancing a drive shaft, have it done as a complete assembly with the transmission and differential yokes and U-joints attached).

Shifter position: The shifter on the T-5 is about 2" further back, 2" to the right, and 2" higher than the T-10 shifter, so you will need to modify the hole in the floor accordingly. Test fit for correct position. Unless you have real short arms, you will also probably want to straighten up the stock T-5 shift lever, or install a different lever. You will also have to do some forming of the hump in the floor because the shifter is integral to the gearbox and sits up higher than the original. I also used the late model Mustang shifter boots (inner and outer) and brackets to complete the installation. Speedometer Drive: The drive hole is on the left side (same as original), but the Stude speedo drive does not inter operate. I'm working on this right now. I will probably put in the Mustang parts here also, and have the speedo recalibrated if it is too far off. A speedometer shop may have a better solution. Backup Lights: The T-5 backup light switch has screw terminals, so you will have to change the connector to attach. Cost: After it was all said and done, the drive shaft cost $25 and the work on it was $57, the bell housing machining cost $65, the sleeve on the pilot journal cost $25, I got the shifter boots included with the transmission, the output slider yoke was $25, the Chrysler release bearing was $25, the nickel welding electrodes were $12, and various nuts, bolts, and washers were another $5. The rest of the work I did, and the materials to fabricate various other parts and brackets I already had. I spent $700 for the heavy-duty Motorsport version of the transmission, but it was practically new, and I got a Mustang bell housing, clutch, clutch disc, release bearing, linkage, and boots thrown in (the seller was changing to an automatic, so he didn't need to keep any of this). If I had got these parts good used, the transmission would have been about $300, the clutch disc $50 (new), and the shifter boots about $10. So, expect a total around $600, plus any work you choose to pay someone else to do instead of doing it yourself (making brackets and parts, modifying the transmission hump, welding, etc.). Driving impressions:

Let me tell you, this swap makes a world of difference in the feel and operation of the car! You get good ratio spacing in the lower gears for optimum performance, and the overdrive brings the engine RPM down to about 1600 at highway speed. Starting out in 1st gear requires a lot less clutch slipping than with the old close ratio, especially on hills. In 5th, the engine still has sufficient torque at this RPM to move the car up moderate hills and execute easy passes, but it is significantly quieter, and the engine just sounds a lot more relaxed. The difference in noise, comfort

and general feel of the car when shifting from 4th to 5th is as great as the difference between 3rd and 4th at highway speed. Of course, if you need to climb a steep hill, or pass quickly, dropping back to fourth gear gives you the same characteristics you had before the swap. Would I recommend this swap to others? Let me put it this way: After enjoying the results and knowing what I know now, I would do this swap even if my old transmission wasn't bad.