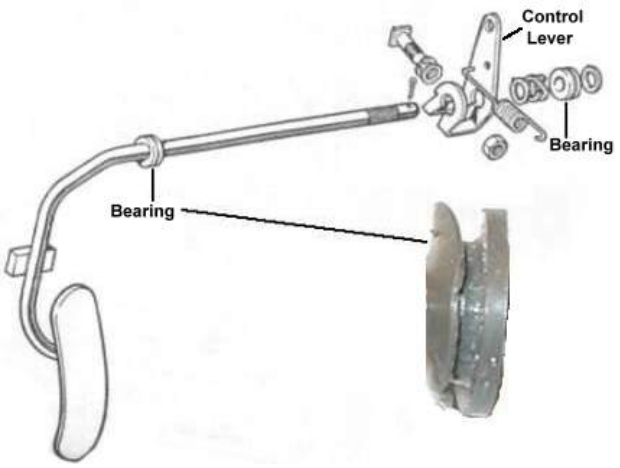
Fabricating Easy-to-Install Accelerator Shaft Bearings

The accelerator shaft of the TR250 and TR6 is supported at each end by nylon bearings in the bulkhead. These bearings wear and deteriorate with age; in many cases they are completely missing. The holes in the bulkheads are 5/8-inch diameter and the shaft is 3/8" so that makes for a lot of slop when the bearings are gone.

The Problem: Replacing the bearings is about as much fun as hosting the in-laws for a month.

The sketch from a TRF catalog shows the accelerator shaft components. The insert shows an enlargement of the bearing.



Removal of the shaft is no big deal, pull the cotter pin and loosen the nut on the bolt squeezing the control lever so the lever will slide off and then withdraw the lever through the driver's side.

The maintenance manual then says to "fit new bearings to the bulkhead if necessary." They don't tell you how because they don't know how. The problem is that the flanges on each side the bearing are 7/8" diameter and the hole is 5/8" diameter.

Lubrication doesn't help --- I've tried. The nylon is stiff and tough. Some say to soak them in boiling water to soften them up. That works in that they get soft, but it doesn't help get them into the hole. I've had some success with first boiling and then using a small screwdriver to push the thinner flange through the hole from the engine compartment side. It usually chews up the inner flange, but at that point I don't care. Besides, no one can see that side. I've been told that some have had success with cutting a V in the inner flange, pushing the inner flange through on one side of the V and then rotating the bearing and sort of screw the bearing in. I don't know whether they boil it first or not.

It is really exhilarating when you finally succeed in getting both bearings in place in the bulkhead. The inside flange is probably 50% chewed up, but no one can see it and the lateral forces on the shaft are probably small so they shouldn't work out.

The next step is to slide the shaft back in. It is then that you realize there isn't room to get the shaft straight before pushing the end into the bearing. You know what happens --- you push the shaft into the bearing at an angle and push the bearing out of the bulkhead --- so much for small lateral forces. So you next try to shove the bearing in after the shaft is in place ----- fat chance. There is a solution --- drill out the inside of the bearing to ½ inch. This makes everything more flexible (flimsy) and after you boil the thing for a while, it goes in much easer. Also, there is more room to allow the first few inches of the shaft to go in at an angle. Once the shaft is in a few inches there is room to straighten it up and then slide it in far enough to put the control lever and washer on. It can then slide thorough the bearing in the other bulkhead and the washer and cotter pin installed.

Drilling out the bearing does however have a downside; it is no longer a new bearing, it is a nearly worn out bearing. It's sloppy, but not as bad as no bearing and the nylon softens the clank for a few months till it wears through and falls out.

So how did the factory do it? No one knows. It is a mystery just like the mystery of how the Brits managed to get the big rocks to Stonehenge and then erect them. Some speculate that extraterrestrials helped with both tasks.

The Solution: The solution is of course obvious to any child ---- install the inner flange after the bush is in place. This would allow the driver's side bearing to slide into place after the shaft is through the hole in the bulkhead, so you don't have to deal with shoving the shaft through the bearing at an angle.

The first step was to construct a prototype of brass with a flange on one end and a groove near the other end as shown on the right. The C retaining ring holds the bearing in place (the removable inner flange). It worked exactly as planned except that the hole in the bulkhead is not uniform from car to car, ranging from about 0.605" to 0.620". Part of the variation is due to paint in the hole. My '76 also had a small burr sticking

out from one side of the hole. The nylon is flexible enough to accommodate the variation. I was concerned that if I made a metal bearing small enough to fit in all holes, it might rattle around in the larger holes.

I looked at the McMaster-Carr Website (http://www.mcmaster.com/) and found nylon that could be turned down and used. However, more interesting was the ready made bronze flanged bearings I found.

An alloy of copper, tin, and carbon, these porous sintered bronze bearings are vacuum-impregnated with 18-20% SAE-30 oil. Heat created by shaft movement draws the oil to bearing surface. The oil acts as a cushion between the shaft and bearing, reducing wear and increasing resistance to shock loads.

These bearings are available with a 3/8" ID, 5/8" OD and 7/8" flange OD. Perfect! The shortest one is ½" long (McMaster-Carr part #6338K461 --- $0.54 each). It was a minor turning task to cut the length to 3/8" for the right side bearing and to cut the groove in both. The OD had to be turned down slightly. To accommodate the various bulkhead hole sizes and still insure a snug fit I turned a 2 degree taper on the outside with the maximum diameter of ~ 0.620" next to the flange. For those cases with the smaller hole, the end is small enough to enter the hole and the bush can then be driven home with a hammer and a wood block. I drilled the ID for the shaft 0.010" oversize so that it will pass over painted shafts and not screw up the paint. There are ridges & grooves pressed in the shaft where the control lever fits. It may be necessary to tap the left side bush to get past the ridges.

A completed bearing set is shown on the right. The longer bearing is used on the left side (I didn't waste the effort cutting it off).

Installing the Solution: The first installation of the bronze bearings was in my '76 TR6. The first step in the installation was to remove the cotter pin from the right end of the shaft. This is accessed from under the right side of the dash. The end of the shaft with cotter pin is show in photo on the right. After the pin was removed the shaft was free to slide to the left.

The next task was to disconnect the control rod from the control lever, remove the spring attached to the control lever, slide the shaft towards the left and slip the washers off the end of the shaft. The photo shows the lever and control rod.

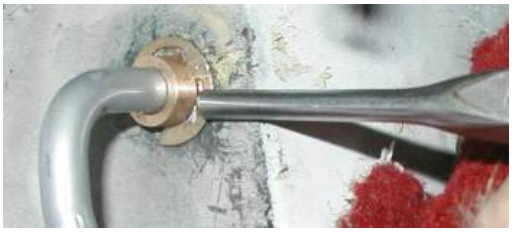
I then made a mark on the control lever and shaft that could be used to align the lever and shaft when they were reassembled.

Next, the nut on the control lever pinch bolt was loosened and I tried to slide the lever off the shaft. The lever wouldn't slid off so I placed a piece of plastic between the end of the shaft and the bulkhead and drove the lever past the ridges on the shaft using a long screwdriver & hammer as shown on right.

The remains of the old bearings were then removed.

The left bearing was slid down the shaft into position in the bulkhead. I used a long wood stick and hammer to drive the bush in the final tenth inch as shown in the photo. The same procedure was used on the right bearing.

The bearings were then secured with the retaining rings. After several attempts the easiest way I found to install a ring was to position the ring in the edge of the grove, hold it there with one hand and then bring a punch against the edge which will also hold it in position so the first hand can be removed to grab a hammer to tap the punch.



The next task was to get the control lever back on. Mine wouldn't slide over the ridges on the shaft so I slid it on as far as I could and then put the right end of the shaft in the bush. I then tapped on the shaft at the bend above the pedal and lever slid into position. The lever pinch bolt was tightened after the lever was aligned to the marks made previously. The washers and cotter pin were then installed. The last thing was to reconnect the control rod and spring. The whole instillation took less than an hour including removing the old bushes and taking the photos.

Don't Call Me: A one point I considered making a bunch of these and selling them at a small profit. However, I soon came to my senses when I realized the potential liability. So, don't call me for bearings. After a number of friends asked me to make a set for them, I went back to the drawing board and come up with the following alternatives.

Alternatives for those who haven't been able to sneak a lathe past the spouse:

We start with the same #6338K461 bearings from McMaster-Carr and do the following:

1. Enlarge the ID from 0.375" to 0.386" using a Letter W drill (<$5 from McMaster-Carr).
2. Cut off the end of one bearing with a hack saw so that the overall length is ~3/8". The sawed end is then smoothed with a file.
3. The holes in the bulkhead are enlarged as required using a half round file. These holes are usually covered with paint and rust. Once the paint and rust has been filed off, the holes will be about the right size to admit the bearings.
4. After the bearings have been successfully test fit in both sides, follow the procedure outlined above to install the accelerator shaft.
5. Once the shaft and bearings are in position, mix up some epoxy and spread a thin layer at the joint between the bearing and the bulkhead --- on the inside of the car. Don't use the car until the the epoxy sets. (It's probably a good idea to roughen both surfaces with course emory cloth before applying the epoxy.)

Yet another alternative: Those of you that can't stand the thought of using glue to hold you baby together might consider using shaft collars to hold the bearings in place. The collars are slipped over the end of the bearings and the set screws are then tightened to hold the bearings in place. (Note that the collar for the driver's side bearing must be slipped on the accelerator shaft before the shaft is installed.)

Part Number 6435K15 $1.99 Each
Type: One-Piece

Several types of collars are available from McMaster- Carr. The collar ID must be 5/8" to match the bearing OD. The next most important dimension is the width, it must be as narrow as possible because there just isn't much room on the right side. The collar show on the right is the narrowest one I could find at 7/16"

	Clamp-On Shaft Collar
Bore Size:	5/8"
Bore Tolerance:	-.001" to +.005"
Width:	7/16"
Outside Diameter:	1-5/16"
Material:	Steel
Finish:	Black
Cap Screw Size:	10-32 x 1/2"

If collars are used to secure the bearings, the length of the right bearing should not be cut down. This will cause the accelerator shaft to be positioned about 1/4" to the right of where it would be using the standard nylon bearings. I don't think that will cause any problem. In fact, there seems to be some room for a longer bearing on my '76 without the shaft moving. There seems to be plenty of room on the left side to allow the pedal an shaft to move to the right much more than 1/4".

If any of you folks come with an alternative design for these bearings or any other TR component, let us know and we'll be happy to add it to the website.

Update 6/17/2002: Michael Graham of Ontario passed on the following. Check out the very interesting link.

> *Appreciated the tip on accelerator bushings ... especially the use of off the shelf parts. I tackled the same problem a couple of years ago and had some bushing made to my specs by a local machinist. They are working fine, but as you say, not something one would want to produce en mass. If you are interested, there is a short article is in the "interests" section of my website: www.mgedit.com*

Update 6/18/2002: Dale passed on this suggestion:

> *What do you think of this. Place the flanges on the inside of the cockpit for both sides. That means the bushing must be put on the shaft for the driver's first. Then install the lever and spring after the shaft as come though the driver's side. Put the shaft though the other hole and install the bearing on the passenger side. Place washer and cotter pin in. Go back to the driver's side, snug the shaft by pulling it toward this side and sliding bearing in hole till tight. Mark shaft with a hacksaw blade. Using a drill make a small hole in the shaft on the driver's side. Use small roll pin or cotter key. This keeps the bearings trapped in place. Dale (tpdwinch@yahoo.com)*

Update 6/18/2002: After looking at Dales suggestion, I had another thought ----- Put the bearings with the flanges on the engine compartment side, use the control lever to hold the right bearing in place and use a collar on the shaft against the flange of the left bearing. That will keep the shaft and bearings trapped. This requires one 3/8" ID collar, McMaster-Carr part # 6435K13 at $1.52. The collar may need to be drilled with the Letter W bit to get over the ridges in the accelerator shaft.