ModTiger Engineering LLC

TECHNICAL TIPS

ON THE SUNBEAM TIGER

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Front Suspension Bushing Fitment

The Urethane Bushings available from suppliers at the current time are some where between difficult and impossible to install. The OEM style Rubber Bushings, currently available from Europe, have the same problems. I've been dealing with this problem for a couple of years now and I have developed some techniques to make the job of installing the bushings a lot easier and less stressful. The main problems are normally associated with the diameter of the bushing shells, where they press into the A-arm tubes and the distance between these tubes.

As with many small lot manufacturing operations, quality control is difficult to maintain between batches and it would appear that the bushing manufacturers have encountered this problem. The physical properties of Urethane, are much different than the rubber used by Metalastic and other previous OEM rubber replacements. This difference makes the Urethane Bushing dimensions and tolerances even more critical. With rubber bushings, the internal tube and shell are bonded to the rubber and the bushing works by twisting the rubber between these attachments. Urethane bushings are bonded only to the external shell and are designed to rotate on the external surface of the internal tube. Another problem with urethane is that it "cold flows" when compressed and will squeeze out of it's appropriate design shape when excess pressure is applied.

This tendency to "flow" causes several different undesirable characteristics. When attempting to press oversize shells into the A-arm openings, you run into two separate but related problems, the first is the excessive force required to compress the diameter of the metal shell and this typically results in catastrophic deformation of the shell before it is fully inserted. This is also true of the currently available rubber bushings. The second problem is the reduction of the internal diameter of the Urethane which will now be too small to accept the internal tube. When the internal diameter of the urethane is reduced, the bushing cannot operate effectively and the resistance to rotation will be excessive. The dimensions in the length of the bushing will also be adversely affected as the Urethane "grows" in length.

The lack of Urethane bonding to the internal tube also makes the length of the assembly much more critical. If the installed length of the bushing and fulcrum pin assembly is too small, the urethane simply pops out at the inside washer yielding no linear support.

The bushing tubes welded into the lower A-arms are finished to a diameter of approximately 1.280 inch, plus nothing minus about 0.003". The bushing shells should have a press fit of approximately 0.005' or less. Since the A-arm tubes are not very precise in their "roundness", a shell diameter of 1.280"normally yields a very nice and effective press fit. If they somehow feel too lose, a few drops of 609 Loctite will correct the loose fit.

The lower bushings have been measuring between shell diameters of 1.290 and 1.300. Attempting to force these oversize bushings into the A-arm tubes typically results in crushed and bent shells. Even if you are successful in forcing the ovesize bushing shells into place without bending them, the resulting undersize ID of the Urethane will be too small to glide properly on the internal tubes and will end up causing excessive rotational forces.

It is possible to hone the A-arm tubes to accept these oversize shells but once current manufacturing problem is resolved, that set of A-arms will the forever require oversize bushings requiring Loctite, or some other cure to hold them in place at the next service. The best all around solution is to correct the diameters of the bushings.

Figure 1. This is typical of current bushing availability. This bushing starts out at 1.290 and tapers to 1.297 near the flanged end.

The nature of elastomeric bushings makes this a bit of a challenge. I've tried several techniques and found that I can turn them in my lathe, with attention to detail and sharp tooling. Sanding, grinding and most other abrasive removal methods typically generate excessive heat in the bushing shell which has an adverse effect on the bond between the shell and the rubber or urethane.

I use a Bushing Arbor sized to accept a light slip fit of the typical bushing with an internal thread to accept a washer and bolt to clamp the bushing tightly.

Figure 2. Bushing Arbor, the bushing just fits on the diameter and the bolt and washer clamp it solid without distorting the urethane excessively.

Using this method of holding the bushing allows me to take fine cuts from the shell without developing excessive heat. Use a a very sharp carbide tool, and never cut more than a couple of thousands at a time. This method doesn't typically yield a precision finish and feed and speeds are also important to the end result.

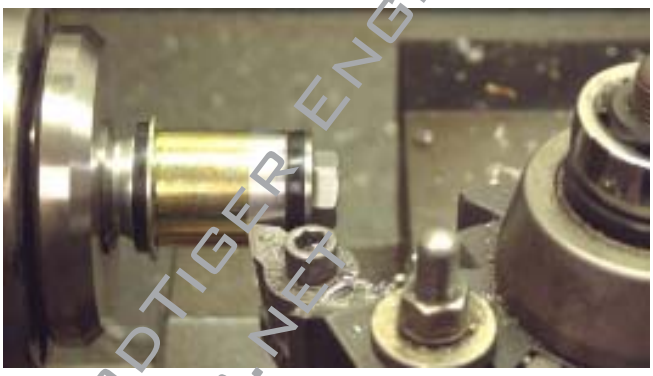
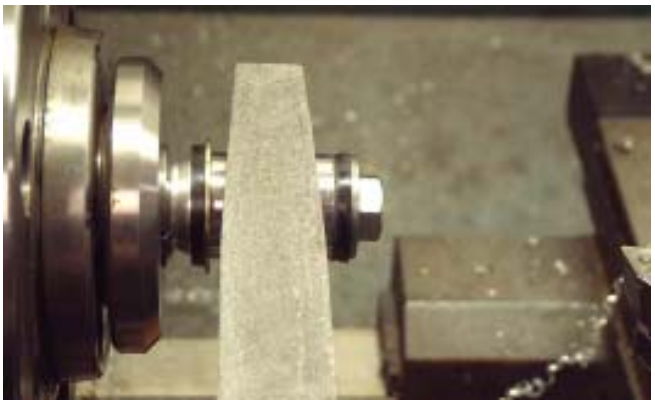


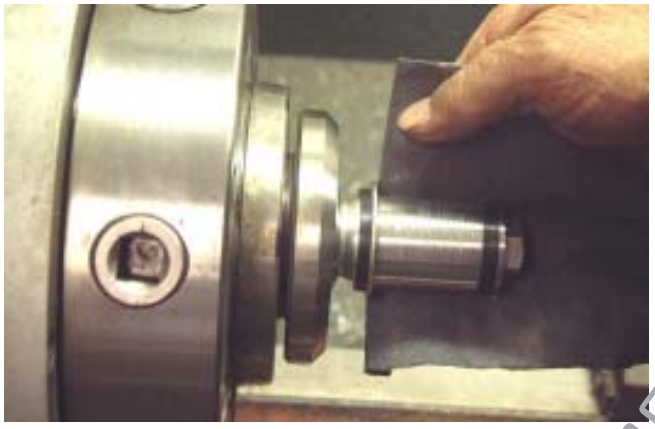
Figure 3. Here's a shot of the bushing being resized with a carbide tool. You may note that the cut is very fine. This is not the time to rush the job. You need to cut to within about 0.075" of the flange on the left.

Because the shell is riding on the Urethane, there is a minimum that you can cut without having the shell simply ride on the end of the tool. When you approach the final diameter, it's also possible to file and sand the shell diameter to continue minor reductions and smooth the surface. As previously stated, your objective is a press fit of about 0.003". You may need to measure and cut for each bushing tube. Marking the bushings LF, LR, RF, RR helps keep track of the target location.

Figure 4. Kind of like making steel wool.

Historically, to date, this problem of oversize bushing diameters has been limited to the lower bushings. That's not to say that it won't pop up in the upper bushings, so be sure to check those diameters also. The design diameter of the upper bushings is 1.160 inch, again plus 0 minus 0.005. with a 0.003- 0.005 press fit.





Figures 5. & 6. Here's how to get the surface as smooth as possible, filing and sanding.

When it comes to installation, I like to grease the shells prior to pressing them into place. I know that some instructions say not to do this but I'd rather have to clean off the grease to apply 609 Loctite (cylindrical fit formula) if it's too loose than destroy the shell if it's too tight for a dry press fit. It is critical to align the bushings with the bores as you start to push them into place. If they start crooked they generally stay crooked and end up all bent up. I have a tool for pushing the bushings that has a machined recess for the urethane on the large end. this allows the force of the press to be applied directly and evenly to the flange on the bushing shell.

At the current time, the majority, but not all, of the upper bushings in both rubber and urethane seem to be delivered in a useable size range and don't require rework. Always double check the diameters anyway just to be sure. In any case, the same .003 to.005 press fit will work just fine with the greased tubes. It's always advisable to sand a small bevel on the leading edge to make sure the bushing shell starts smoothly in the bushing tube.

The second situation related to fitting the urethane bushings to the lower A-arms is the distance between the bushing tubes welded into the A-arms. This distance tends to collapse when the old bushings are pressed out. While it's often possible to assemble the bushings and fulcrum pin when this dimension is too close, the normal result is that the inner portion of the Urethane casting (visible next to the inner flat washers) tends to pop out and if this happens, you lose most or all of the positioning stability that this portion of the bushing is supposed to add.

The Factory Manual indicates the distance is supposed to be 12.00 inches, measured from inside to inside. I've found that this distance works OK for rubber bushings because the rubber doesn't exhibit the tendency to cold flow out of position. For Urethane bushings, it is preferable to use a minimum dimension of 12.200". To obtain this dimension, I developed a custom tool for my hydraulic ram.

Figure 7. The hydraulic ram sits snuggly inside a piece of pipe with a threaded plug on one end. A steel plug fits into the A-arm Tube from the inside and bolts to the plug. The other end has a similiar steel plug with a bolt sized to the thread of the cylinder bore.

Figure 8. Here's the ram in place. The stiffness of the assembly keeps the bores in alignment while spreading them farther apart.

All four of the A-arm tubes will generally require a tweak of bore alignment prior to pressing the bushings into position. This has always been a requirement. I use a long brass rod that just fits through the respective tube bores and a plug of the same size bolted to the floor.

Figure 9. Here's a shot of my Alignment fixture. It bolts solidly to the concrete so that I can apply a lot of force to obtain alignment.

Figure 10. This is typical of the misalignment you will find when you start this process. Note this A-arm is not reinforced.

You know your done when the brass rod slides through both bores. Be advised, if you hear a pop or snap during the alignment of the bushing tubes, it's likely the spin weld fracturing. This means you get to go back to a far earlier step, perform the appropriate reinforcement welding, repaint, and begin the alignment process all over again. I recommend that you do the reinforcement work first to avoid this possibility.

Figure 11. Here we're starting the process of alignment. The rod is sized to be a tight slip fit through the bushing tubes. Note that the misalignment seen in this photo is in the rear tube. I lever the A-arm on the fixture and apply force using the brass bar to box it toward the correct position.

Figure 12. After the appropriate adjustments, the brass rod now slides through both bushing bores and the bushings will be in good alignment.

You will need the proper tooling to hold the A-arms and guide the bushings while appropriately spreading the pressure of the ram on the big end of the bushing. I've described this part of the operation in previous Tech Tips. You will find this tip and others on my web site www.tigerengineering.net .

I also still strongly recomend that the A-arms and Urethane bushings be drilled for zerk fittings so that you can direct grease to the inside bearing surface to aid lubrication and help keep water out. This will substantially reduce the chances of ending up with that annoying squeak whenever the suspension goes over a bump.