Trigear Main Gear Looseness Repair

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The Europa Trigear and for that matter, the RV series gear mounting in the 4/6/7/8 have experienced some looseness in the main gear over time as the chrome moly tubing used in the gear support is only cross drilled for a 5/16 to 3/8 inch diameter bolt. Over time, the bolt hole in the top of the tube support will wear causing the gear to begin to rattle, increase tire wear and just plane be annoying. Just when you thought you would never have to work on this area ever again….Surprise!


To correct the wallowed out hole causing a bit of gear looseness, one can weld another piece of tubing over the existing support tube end that is about 1 inch long and in the RV that has to be done in the aircraft as no one wants to pull the wings on the RV to get the gear leg support out. The Europa has its chrome moly tube imbedded in fiberglass layers which should not be welded on as the glass would release from the tube causing a complete main gear support rebuild and we don't want to do that. Another way to fix this issue is to bush up the main gear hole which I will cover below.

First the hole has to be checked. After any hard landing, excessive tire wear noticed, or noticeable rattling of the gear one should always investigate. With the aircraft fully rigged, one can push up on the wing at the spar, and with another assistant push down on the opposite wing to lift one gear at a time and check the gear leg for security. If working alone and assistance is not possible, this can be done easily in your shop or hangar. With the wings and tail planes removed. Using a hoist, raise the aircraft by use of the tail plane tube to elevate at least one main at a time and check. To initially check, with an engine hoist or similar, Raise the aircraft and support it properly in a fuselage cradle similar to how the main gear was installed. Once the gear is off the ground, check for play in your main gear. How much is too much looseness is a matter of taste. Personally, if the main gear can be moved at the tip of the axle more than 1/16 inch either way or 1/8 total fore and aft at the tip, it is time to secure that up.

If the movement is too far gone look at the bolt while wiggling the gear. If you see the bolt move, the next step is investigate. Unbolt the AN5-21A and wiggle it. Remove it if it is loose and check the hole for wear (it is supposed to be 5/16 or 0.3125 inches and round), if it is not a nice tight round hole, it is time to devise a repair method. Do not over torque the bolt as the glass will flex and may separate from the tube top causing other issues. Do not pull the bolt down until you hear the glass cracking. That's too much. Normally an AN 5 bolt torque is about 100 to 140 inch pounds or 15Nm and that is enough.

Back to the slop in the hole, if the hole in the gear socket is less than 0.315 inches at its maximum the best method is to ream for an 8mm bolt. That should take care of any slop. Snug the bolt down and use washers and Redux as a shim. Once the Redux cures, tighten the bolt down.

If the hole has elongated and wallowed out beyond the 0.315 I mentioned above, you need to make the hole round again and fabricate a shim or bushing. My method is to first pull the gear leg out (remove the gear leg cover, the wheel, brake disk, and caliper with the brake lines attached of course so rebleeding is not necessary, and push the gear leg up to expose the hole. If the gear won't go up into the fuselage, then suck it up and pull it out. Next, determine if the gear leg bolt hole at the top of the leg is still uniform in size and still a snug 5/16 inch. I normally can push the gear leg up and down and If so, measure the hole size and make a shim for a 3/8 inch OD and 5/16 ID, then ream the tube support. If the gear leg hole is a sloppy 5/16 inch I ream to a 7 or 8 mm bolt shank and bush up to those dimensions.

To make a bushing one has to open the gear leg support to ream out the hole to a uniform 3/8 inch. To do this one may make a grievous error and align the gear leg to the wrong angle. So much prep will prevent this from going horribly wrong.

To assure your repair is as perfectly aligned as you can get it set the gear up as you did when installing the gear. First lay an angle across the gear (refer to Chapter 29T). Using a mirror and careful measuring, assess the hole. Align the gear and note the hole in the gear should be fairly well centered in the MG03 P or S hole. If the MG03 hole is uniform in its wear lock everything down and prep to ream. You will use the gear leg as your pilot for the 3/8 inch reamer so you will be in good shape. If the 3/8 inch diameter shim will cover the hole, I prefer to start with a piloted reamer to cut the glass and tube support and ream to start a 3/8 inch hole in the crown of the tube. Since the tube is round, the pilot on the reamer will follow until the cutter has just cut the peak of the tube hole. Once this is done we don't want to ream the hard gear leg out, so remove the tool, drop the gear leg down a bit and finish reaming in steps for precision. Use of a short pilot reamer set as listed in the tools required section is advantageous for those with a ¼ - 28 aviation close fitting 90 degree air tool or similar as close fitting tools are essential for this job.

**Tools to have on hand to make a precise 3/8 bushing installation:**


A good high speed air too is really handy. Using ¼-28 threaded bits and bores it makes short work of drilling in metal. A drill powered 90 degree will also be fine as shown here.

Making the wonky 5/16 inch hole in the gear leg symmetrical and in alignment with the gear leg hole can be done precisely. Here are some bits and devices that can make the task machine shop accurate but done in the aircraft with hand or air tools on both the front and rear of the tube where room is at a premium.

**Boring Bits:**
A counterbore is a flat bottomed cutter with a pilot bit that fits in it which rests in our 5/16 gear leg hole and allows us to cut most of the hole out but not deep enough to cut into the gear leg itself. You can use the pilot by lengthening it far enough to reach the other side of the MG03 and finish the bore.

You can also get away with using a reverse counterbore. A reverse counter bore goes through the hole then with the drill turning clockwise, pull on the pilot toward you to begin the bore. The bores pilot is normally 3/16 inch so make a 5/16 OD 3/16 (or #10) ID spacer to keep the assembly straight with the bore. It is a bit cumbersome to set up, but, it works beautifully in tight spaces where you can't get to the back side due to lack of space. The nice thing about a counter bore, by reversing the drill and working the bit attachment to a common bolt, one can bore the face side as well. Or one can by a clockwise bore with pilot.


3/8" Aircraft Counterbore with 3/32" Pilot Hole


Counterbore Pilot - Pilot Diameter - 3/16", Shank Size: 3/16"

The backside of a counterbore has to use a reverse counterbore with reverse pilot.

Reverse counter bore

Reverse Pilot shown is a 3/16x3/16 inch

Counter bore Description:
Counter bore: 4 Flutes, 3/8" Diam, 3/16" Pilot Hole Diam,
Pilot: 5/16 inch
High Speed Steel Reverse Counterbore - 1/2" Overall Length, 1/32" Corner Radius, Standard Pilot Ref. 185-4, Oversize Pilot Ref. 186-4
Reverse Pilot: 6" overall length. Use with any Reverse Counterbore with a 3/16" thru hole.

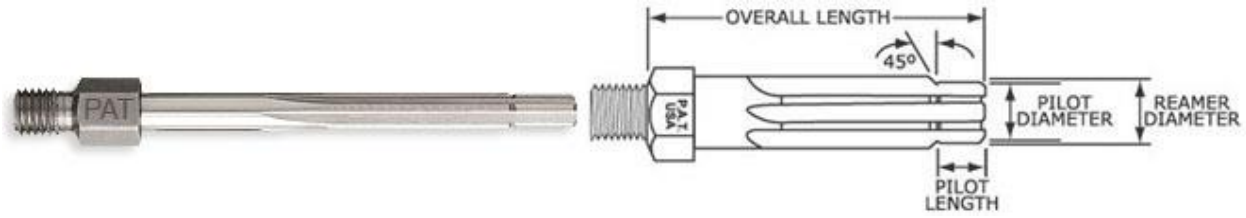
Each counter bore and pilot set retails for about $40.

**Piloted Bits:**
A piloted drill bit works on the face side and is an acceptable method but the hole is not as smooth. This will not work on the back side.

**Reaming:**
By stepping the reamer sizes one can get a very precise hole using an air tool. Of course, the price of the bits is a bit higher as reamers can only jump in in stages so as many as 4 piloted reamers may be necessary. This is fairly expensive but the cut is really clean and round. Cost is only slightly higher than a counterbore set.

Pan American Tools HSS Piloted Reamer. Shank Thread 1/4-28 Cost: $25 to $33.00 each

| | | | | |
|---|---|---|---|---|
| P/N: 45-680 | OD: .3750 | Pilot: .3494 | Pilot Length: 1/2 | Length OA: 2-1/2 Final |
| P/N: 45-560 | OD: .3281 | Pilot: .3125 | Pilot Length: 1/2 | Length OA 2-1/4 1st Step |
| P/N: 45-660 | OD: .3438 | Pilot: .3281 | Pilot Length: 1/2 | Length OA 2-1/4 2nd Step |
| P/N: 45-670 | OD: .3595 | Pilot: .3438 | Pilot Length: 1/2 | Length OA 2-1/4 3rd Step |




Of course, one can use a file and very carefully and slowly ream the hole by hand with some specific hardened round files and over time make the holes true. Also possible is a simple taper reamer of close quarters.

Once the hole is reamed through one side then the reamer can be pushed through the other side and be fairly well aligned.

**Installing the bushing:**

Start with a piece of 3/8 OD .035 wall chrome moly tubing. The ID of this tube is nominally .305 inches and a 5/16 inch bolt shank is .3125 inch so the tube will have to be drilled out to .3125 to be a proper fitting bushing. Time to do some of what we call lap top machining or also known as fitting.

First the bushing is not shaped to fit into the curved gear leg diameter. File the tube end to the contour of the gear leg. Debur and fit the tube into the hole and it should be about 3-5 thousands loose fit. Now that tube must be cut to length. The length should be 1/16 to 1/8 inch longer than the maximum outside distance of the MG03 and glass. (See Drawing Below.)

Repeat for the other side. Then with both bushing is position you are going to squeeze them like a rivet.

Using a Grade 8 5/16-24 bolt and a hardened 5/16-24 nut, and two hardened 5/16 washers pull down the bolt until tight the two bushings no longer move. When pulled down hard until the chrome moly compresses and begins to flatten out, the bushing fills the hole and no movement of the gear leg should be evident. Loosen the grade 8 bolt and pull the washers back and fill the void with Redux. Snug it down again and allow to cure.

Reassemble the wheels, brakes, and fairings to finish the job.