DF Goblin Spherical Strut Mount Installation and Warnings

Thank you for being one of the people who joined in on this so we could make it happen! It's been a fun project, and it wouldn't have happened without your support.

Don't like reading? Search "DF Goblin Spherical Strut Mount Install Instructions" on YouTube for a video.

Safety Warning and Intended Use:

A lot of care has gone into the design, including FEA, fatigue analysis, and validation of the hardware, bearings, and fits with a FOS > 3 under a 3G bump scenario. Even so, this is a safety-critical suspension component, and you must read and follow all of the warnings, use limits, and terms below before you buy, install, or use it.

READ THIS BEFORE PURCHASING, INSTALLING, OR USING THIS PART.

WARNING – SAFETY-CRITICAL SUSPENSION COMPONENT. This spherical strut mount is a load-bearing suspension part. Improper installation, failure to inspect it as required, or use outside its intended purpose can cause the part to fail. A failure can cause loss of vehicle control, a crash, serious injury, or death. Building, modifying, and driving a Goblin kit car is an inherently dangerous activity whose risks include serious injury and death.

INTENDED USE. This part is designed and sold for off-road, racing, and closed-course competition use only. It is not intended for use on any vehicle operated on public streets, roads, or highways. The buyer is solely responsible for determining whether the buyer's use is legal and for complying with all federal, state, and local laws, including California emissions and vehicle laws.

Installation: (reference post #53 in the group buy thread for pictures)

IMPORTANT – QUALIFIED INSTALLER AND EXACT PROCEDURE REQUIRED. This part must be installed exactly as directed in these instructions, by an experienced mechanic, using the correct tools and the specified torque values. If you lack the skill, experience, or tools to install it correctly, do not install it yourself. In particular: (1) before installing, inspect the damper shaft for cracks, including flexing the threaded portion by hand, and do not install this part on a cracked, damaged, or fatigued shaft; (2) torque the three 3/8" mounting bolts to 36 ft-lbs and the retaining nut to 20 ft-lbs using a calibrated torque wrench, and do not substitute hardware; (3) correct ride height as directed before use; and (4) do not operate without the 3x ¼-20 screws, which are mandatory in all cases; the dust cap may be omitted at the buyer's option, but doing so voids the limited warranty and will dramatically reduce bearing life due to contamination.

1. Lift your Goblin and place a jack under the lower control arm to support it from drooping.
2. Remove the old mounting plate and the original stack of hardware.
3. Inspect the damper shaft for any cracks … try to flex the threaded portion with your hands to reveal any stress cracks that may already be present.
4. Correct your ride height
    a. Stack together your previous parts and measure the distance between the top of your mounting plate and the bottom of the spring seat. Compare it to the new spherical mount plate ([your setup] – [new plate] (~0.584")).
    b. Raise your lower spring perch by this difference
5. If you purchased Torrington bearings, install them now under your spring. Lower your spring perch to accommodate for the thickness of the Torrington bearing stack.
6. Optional: grind out the ID tabs on QA1 springs.

7. Install the spherical strut mount with 3x 3/8 bolts, nuts, and washers. Torque to 36 ft*lbs.
    a. The outermost hole will use a square nut and no washer on the bottom. Clock the nut so that one of the 4 flats is fore-aft. In addition, the flat face of the square nut is the load bearing face (the flat face points up towards the plate, beveled face points down).
8. Note: Some misalignment spacers will retain themselves in the bearing bore, but some may slip out. If they fall out, the smaller OD end goes inside the bearing bore.
9. Raise the damper, carefully aligning the damper through the ID of the misalignment spacers.
    a. You may need to pivot the spherical bearing, so it aligns with your damper shaft.
10. Install the damper nut without a washer, and torque to 20 ft*lbs
11. Install the adjuster knob
12. Install the dust cap
    a. If your Goblin is frequently subjected to water, or you wash it with a pressure washer, I recommend adding a sealant or thick grease to the gasket. As is, it meets IP67 requirements, but this doesn't cover > 24 hours of water, or pressurized water.
    b. If you opt to leave off the dust cap, still install the 3x ¼-20 screws.

IMPORTANT -- DO NOT MODIFY. Do not modify this part or use it with hardware, springs, spacers, or bearings other than those specified. Any modification or substitution voids all warranties and transfers all responsibility to the user.

Service:

1. MANDATORY INSPECTION. Inspect the part per the schedule and checklist below. Remove it from service immediately if any issue is found. Using this part without the required inspections is a misuse of the part, and the manufacturer is not responsible for any failure that results.
    a. Inspection schedule:
        i. Within the first ten years (approximately 1,200 hours of drive time): inspect at least once per year, or every 120 hours of use, whichever comes first.
        ii. After ten years of service: inspect at least once every three months, or every 30 hours of use, whichever comes first.
    b. Each inspection must include:
        i. Checking for cracks anywhere on the strut mount. Cracks are most likely to initiate at the axial contact face of the spring perch.
        ii. Looking for any bends or deformation in the strut mount.
        iii. Checking for any loose hardware.
        iv. Checking for looseness or play in the spherical bearing.
2. Bearing replacement (FK COM10T-F1): Removal can be difficult, but DIY-able. I can service these for a fee as well.
    a. Remove snap ring
    b. Heat in an oven @ 325-350F for 20-30 minutes. This will soften the retaining compound, and relieve most of the interference fit. Never exceed 350F or 30 minutes or you may damage the T6 temper on these parts.
    c. Quickly apply penetrating oil (just a couple drops…. you don't want to cool the assembly).

d. Quickly (don't let it cool) press out the bearing, there are a few ways to do this:
    i. Press ball w/ < 1000lb: If you're lucky, you'll be able to press the bearing off the ball using an arbor press. Never apply excessive (>1000lb) force to the ball, or you'll expand the outer race. It will act as a wedge anchor, potentially leaving you with an unextractable outer race and a ruined bore.
    ii. Press outer race: **This is the method I use, and it's the best one**, but requires you to make or find tooling that pushes on the outer race. There is a sliver of outer race accessible from the back side, and you want a sleeve/tube/pipe/bushing that is of the largest OD that you can fit, but has an ID that doesn't touch the ball. In other words, your tool should use as much of the exposed outer race as possible. I turned some pipe to size on a lathe for my tooling. It should be made of mild steel or stronger.
    iii. Welder: Instead of pressing on the top side, you can TIG weld to the outer race on the bottom side, and pull rather than push.
    iv. Add knockout holes: As an absolute last resort, the shoulder at the end of the bore is not structural. You can drill 3 small (3/32" max) holes for dowel pins, and press on the dowels to push on the outer race.

e. Clean the bore w/ scotch brite, sand paper, and/or acetone depending on the bore condition. The bore must be clean and free of burrs, debris, retaining compound, and oil.

f. Measure new bearing + snap ring stack. These bearings aren't very consistent batch to batch in terms of width, and I had to turn some of them narrower. You will need to reduce your outer race bearing width if the bearing + ring stack exceeds the following:
    i. If your bearing bore is raw aluminum (silver): 0.542" max (0.536" nominal)
    ii. If your bearing bore is anodized (black): .553" max (0.546" nominal)

g. Clean and lightly coat the bearing OD with retaining compound: Use Loctite 609 if the bore is healthy, Loctite 660 if the bore was damaged and needed to be sanded out/significant cleanup was needed.

h. Heat strut mount in oven at 275-300F for 25-30 minutes

i. Pull it out of the oven, and immediately perform step j-l (you have seconds)

j. Add several drops of retaining compound (609 or 660 from step g) around the bore ID

k. Install bearing: half the time it would drop in, half the time it needed a light touch on the arbor press; seat bearing to end with a press. I highly recommend using the 3D printed bearing guide I posted in the group buy to guarantee a smooth perpendicular insertion.

l. Add a drop of retaining compound around the perimeter of the outer race so it can wick down the wall.

m. Clean out any cured retaining compound that is in the snap ring groove.

n. Install snap ring (sharp side away from bearing) and verify that it's fully expanded (there is a 3D printed gauge for this posted in the group buy) … If it isn't fully expanding, the bearing likely wasn't pressed in fully, or the bearing/snap ring stack is too wide.

3. Spring centering ring (switch to a 2.25" coilover spring)

a. Apply heat (a small heat gun works best) to one edge of the plastic spring centering ring

b. Pry out/stretch the heated area and remove the spring centering ring

c. Note: If you want to go back to a 2.5" spring, you'll need to print and press on a new centering ring

Proactive FAQs/explanation of design:

1. Why are these bearings so stiff? They're F1 fit bearings and it's required for longevity in our current loading scenario. They feel stiff, but it's comparable to what you'll see in a new ball joint, and is the correct bearing for this application.
2. Why do I need to replace one of my nuts with a square nut? If the spring is clocked in a particular way, it would slightly interfere with a washer. Running a square nut provides a comparable bearing area to running a washer + hex nut, but provides clearance for the spring.
3. Why is there a plastic ring at the spring perch instead of a single piece of billet? The plastic snap-fit centering ring allows for a large hidden fillet between the perch and body, which greatly improves fatigue strength by reducing stress concentration in a critical area. As a bonus, it also allows switching to a 2.25" spring with a spacer.
4. Can I run without the dust cap? You absolutely can, just make sure you still install the 3x ¼-20 screws. Keep in mind that you will dramatically reduce the bearing life due to contamination.
5. How long will these bearings last? I couldn't tell you that unfortunately. I can tell you that the bearings I selected are wildly overkill for this application, and I have experience with a similar bearing in a similar application that is subject to over 3X the forces that we'll see, and it's just starting to show signs of wear after 7 years of monthly track abuse.

Warranty and Terms:

DISCLAIMER OF WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DISCLAIMED. EXCEPT FOR THE LIMITED WARRANTY BELOW, THE PART IS SOLD WITH NO OTHER WARRANTIES, AND THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THIS PART IS WITH THE BUYER.

LIMITED WARRANTY. The manufacturer warrants only that this part is free from manufacturing defects at the time of sale, and the sole and exclusive remedy is replacement of the defective part. This warranty does not cover improper installation; use of incorrect hardware, tools, or torque; accident, collision, impact, abuse, misuse, neglect, or alteration; normal wear; failure to perform the required inspections; operating without the 3x ¼-20 screws; omission of the dust cap; or use other than for off-road, racing, or closed-course competition. TO THE FULLEST EXTENT ALLOWED BY LAW, THE MANUFACTURER IS NOT LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, OR INDIRECT DAMAGES OF ANY KIND, INCLUDING DAMAGE TO THE VEHICLE, OTHER PROPERTY, OR PERSONS, AND TOTAL LIABILITY IS LIMITED TO THE PURCHASE PRICE OF THE PART.

ASSUMPTION OF RISK AND RESPONSIBILITY. By purchasing, installing, or using this part, the buyer acknowledges and accepts the risks described above and assumes full responsibility for installation, use, inspection, and maintenance. The manufacturer is not liable for any injury, death, property damage, or other loss arising from the installation, use, misuse, modification, or failure of this part, except as required by law.

RESALE. If the buyer sells or transfers the vehicle or this part, the buyer must give this warning, disclaimer, and the installation and service instructions to the new owner and inform them of the annual inspection requirement.