

TECH NOTE

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Nose Wheel Shimmy

One of the questions most asked of the CPA is how to correct nose wheel shake or shimmy. The Cessna factory also receives numerous inquiries on this subject and has issued SE84-21 Service Information Letter to provide some guidelines for troubleshooting shimmy problems in the field. The following is a compilation of what CPA and Cessna suggest are the usual causes of, and solutions for, nose wheel shimmy.

Nose Wheel Tire & Wheel Assembly Balance

Balancing the nose wheel/tire assembly is the most important point to check in trying to solve a shimmy problem. Aircraft tire and tube manufacturers paint a red dot on the tire for the "light" spot. A yellow stripe on the tube, or the valve stem should be aligned with the red dot for coarse balance during tire buildup. Then the tire/wheel assembly is balanced with a static type (bubble) balancer and generally does an acceptable job.

However, the preferred method, and sometimes the only method that can solve persistent shimmy problems, is dynamic balancing. (Dynamic balancing is when the wheel/tire/bearing assembly is spun and the proper weights and locations determined electronically). Very few light aircraft maintenance shops have the capability to do spin balancing, so CPA suggests that local motorcycle shops be contacted until one with a spin balancer is found. Usually these shops have the necessary mandrels to mount an aircraft tire/wheel assembly. Balance is achieved by affixing lead weights to the wheels.

CPA has received new tires that cannot be balanced successfully no matter how the tire is mounted, or the wheel indexed. Replacement with a new tire is the only option in these cases. If the tire won't balance fairly quickly with a static balancer, and the wheels and wheel bearings are in good shape, phone your tire supplier for a replacement and return the faulty tire for warranty adjustment.

CPA NOTE: *Whenever changing tires and tubes, or experiencing a vibration upon lift-off in tubular landing gear legged Cessnas, the main tire/wheel assemblies can be balanced in the same way.*

Nose Wheel Tire Condition

In some cases a nose wheel assembly may balance but still cause a shake due to an out-of-round tire, or tire damage such as a broken belt or separating ply. Gross damage can be seen while spinning the tire and looking from the side and end-on. All new tires should be checked for out of round as soon as they are installed.

Torque Links (Scissors)

The torque links are the connection between the nose tire/wheel assembly and fork, and the steering collar and shimmy dampener. Therefore, any wear, slop or looseness in the torque link bolts, spacers or bushings will allow

shimmy to continue, undamped by the shimmy dampener. Cessna proposes that a test for torque link condition would consist of removing the three castle nuts on the torque link bolts, and replacing them with self-locking nuts that are tightened tighter than the castle nut ordinarily is. Then conduct a high speed taxi. If the shimmy recurs, then remove the torque links and rebush them. CPA experience is that all bushings, spacers and bolts should be replaced at the same time. Parts cost for complete rebuild of the torque links in mid 1996—approximately \$75.

CPA NOTE: *It is critical to install the correct high strength bolt in the center joint of the scissors. The head of this 3/16" bolt must have a triangle on it, or an NAS part number such as NAS 464, NAS 1103, NAS 6203 etc.*

Steering Arm Assembly (Collar) Shims

This is an area that is often missed when trying to correct nose wheel shimmy problems. The upper end of the torque links attaches to the steering collar, so shimmy is transmitted from the wheel to the torque links, then to the collar. It's vital that the collar only move in a rotational motion around the strut; any up and down, or cocking movement of the collar will allow shimmy to continue since the shimmy dampener isn't designed to combat the cocking movement of the collar. If cocking is detected, or shimmying continues after all other solutions have been attempted, removal of the complete nose landing gear will be necessary for re-shimming of the collar.

There are three shims of varying thickness that are designed to tighten up the collar and eliminate any up and down movement. The test for tightness would be to look very closely for any up and down movement of the steering collar as a helper moves the nose wheel back and forth with a towbar. In severe cases the up and down movement can be seen when manipulating the collar with normal hand pressure.

The Shimmy Dampener

The shimmy dampener is a closed chamber full of hydraulic fluid. When shimmy occurs the motion is damped by hydraulic fluid being forced through a small hole in a moveable piston. Fluid leakage past the shaft and endcap seals, fluid leakage past the thermal relief valve O-ring in some models, and bent piston shafts can occur.

Also, the bolt holes at the shimmy dampener attach points should be checked for elongation. Any play at these points will cause a shimmy that can't be dampened. In CPA's experience, servicing the shimmy dampener to reduce shimmy without checking and remedying any defects in nose wheel balance, torque link play, and steering collar will be ineffectual.

(See diagram on the other side of this page).



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