Mod 71 Nose gear leg bungee, replacement with springs

Classification Optional

Applicability Europa Tri-gear Classic and XS

Compliance Optional

Introduction

The steel tube of the Europa's nose gear leg is designed to act as its spring. The leg is supported in a structure that is attached to the undercarriage mounting frame via bearing blocks so that the assembly can pivot in the event of an overload on the landing gear. Preventing the leg from pivoting during normal operations is a single continuous length of bungee cord tensioned round a "T" bar at the rear of the leg assembly and the upper strut of the undercarriage mounting frame (6 loops, 12 active strands). The bungee should prevent any rotation of the nose gear assembly until a 150kg force is reached, measured at the nose wheel. When a force in excess of 150kg is experienced the nose gear will then rotate up to 50mm until restrained by a safety cable. This is designed to protect the aircraft structure and nose gear in the event of an excessive load being applied or failure of the bungee cord.

This modification uses two, handed steel springs to replace the bungee. See figure 1. The safety cable is retained as in the original design. As with the bungee, the initial springing is done by the nose leg/tyre. Once the nose leg is bounced off the stop the steel springs will give a "harder" ride due to the higher Young's modulus of the steel springs. This reduces the likelihood of the cable stop being reached and, in consequence, reduces the chance of a bent leg or prop strike. Once the nose leg hits the stop, and if sufficient further force is applied, the nose leg may bend as with the bungee supported system.

Future kits will be delivered with a ¾" diameter stop tube which will facilitate use of the springs. Older kits have a 1" diameter stop tube and this may need modification to prevent abrasion of the tube by the springs depending on the exact position of the welds, (see Appendix).

Action

Step 1 - Preparing the springs

Note that the two springs are different from each other. The upper hook ends, which are slightly larger than the lower ends, are slightly offset from the spring's centre line. Refer to figure 6. To prevent the springs catching on the "T" tube file a small radius on the inside edge of the cut end of the lower hook.

Extend each spring just sufficiently to open the coils to insert a 6mm or 1/4" spacer between each turn and no more. Excessive extension may result in a permanent set on the spring. This will require a force of some 270kg so must be done with great care. A safe way of achieving this is shown in figure 2 below. *Do not* use the method shown in figure 1 as this may distort the hook of the spring. Be very careful to ensure the spring cannot slip off. Should this happen, at this tension, the spring can be propelled at very high speed so wear gloves and some form of face protection in case this happens.

From the front, insert eleven 6mm or 1/4 inch metal spacers (flat stock is best but bolts will do) between the coils (see figures 2 and 3) to hold the spring open. Carefully release the jacking tension and ensure the spacers are stable and the spring can be handled. The spring will take on a slight banana shape with the open ends as far apart as possible, figure 3.

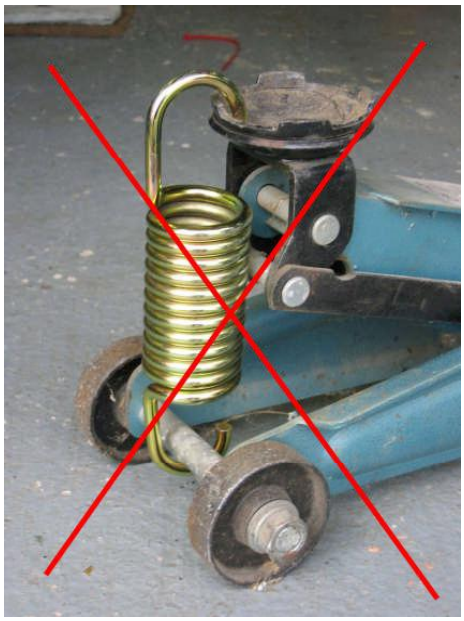


Fig 1. Incorrect method.

Fig 2. Correct method.

Fig 3. Tension released

Step 2 - Bungee removal

Ensure that the main wheels are chocked and the aircraft is secure against movement. Support the nose of the aircraft either side of the nose wheel leg pivot.

Remove the bungee. The bungee is exerting over 400kg of force on the nose wheel leg and could cause serious damage if released uncontrollably, so take care.

It will be necessary to remove the edges of the curved plate at the top of the bump stop to provide clearance for the springs. See figure 4. The nose wheel can be raised by hand to give limited access to the bump stop. Pushing the catch cable forward towards the pivot bearings as far as possible will enable the leg to rotate further. Use a hacksaw and file for this job.

Step 3 - Springs installation

Wear protective gloves and use extreme care.
Remembering that the springs are handed port and starboard, the upper hook being offset slightly towards the aircraft centre line, place them in position as shown in the figures 4 and 5, installing them from the rear of the nose gear assembly.

The upper hooks should be as far apart as possible. The lower hooks should be sufficiently far apart to ensure the spring does not bind on the stop tube and the leg can move to the wire bump stop under excess load. Do not position the lower hooks at the extreme end of the "T" of the nose wheel leg to avoid excess bending loads. Ensure the springs are equidistant from the nose leg.

Make sure you install both springs together. If a single spring is installed and the tension released it can exert sufficient force to twist the "T" assembly.

Pack a small quantity of grease round the four contact points between the springs and the tubes. This is to prevent water (that could be held in place by capillary action) corroding the contact points.

Fig 4. Bump stop sides trimmed

Fig 5. Springs installed

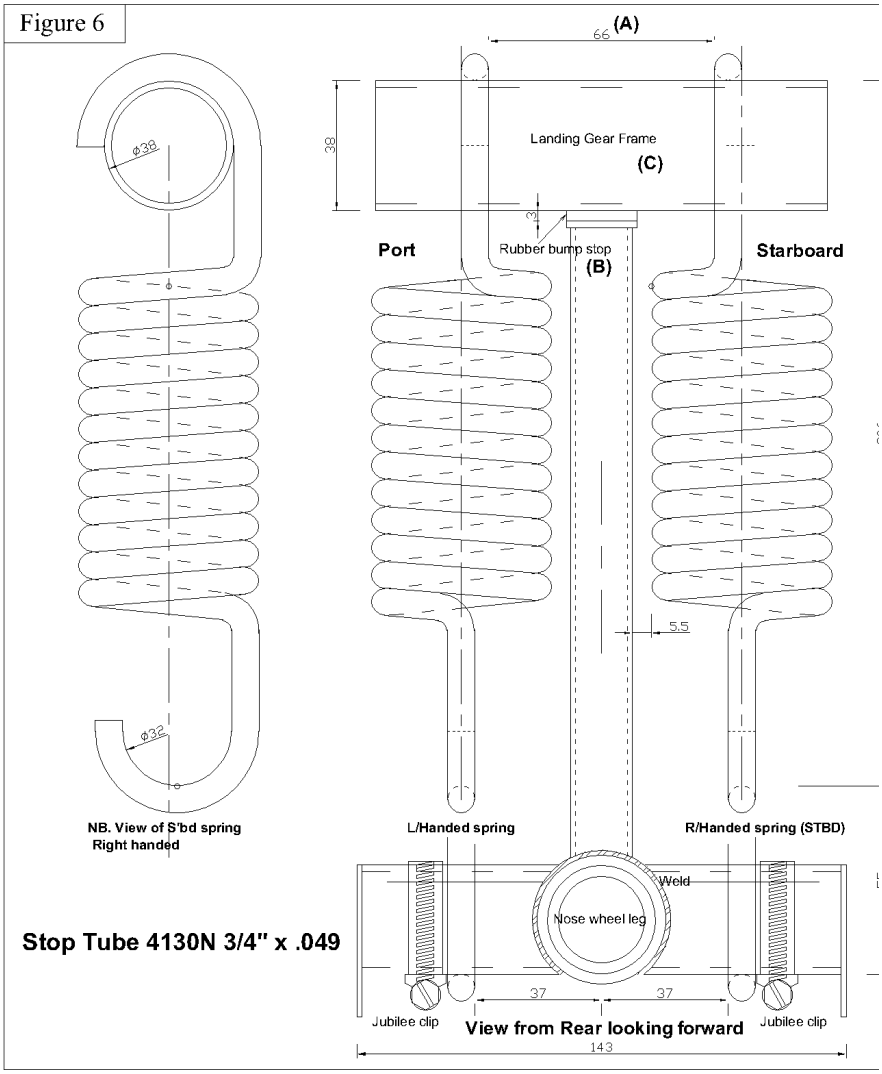


Fig 6. General arrangement (springs shown not stretched)

Install the jubilee clips on the nose wheel leg as shown in Figures 6, outboard of the springs, to ensure that they cannot move outboard.

Step 4 - Removing spring spacers

After checking the installation, remove the jack supporting the aircraft. Reverse the nose wheel, as if the aircraft had been pushed backwards. This significantly increases the leverage, so reducing the force needed. By a combination of pushing the rear of the aircraft upwards and carefully applying body weight to the root of the propeller blades, sufficient force can be achieved to extend the spring sufficiently to allow the spacers to drop out. Push them out using a piece of wood if necessary.

Step 5

With the nose wheel in the normal trailing position, check that the force on the nose wheel at which the nose leg just moves off the stop is around 150kg.

Annotate the aircraft records that Mod 71 has been fitted. Amend the weight and balance records by calculation to reflect the following changes. Weight removed 1.1 lb, added 3.5 lb. Net change +2.4 lb.

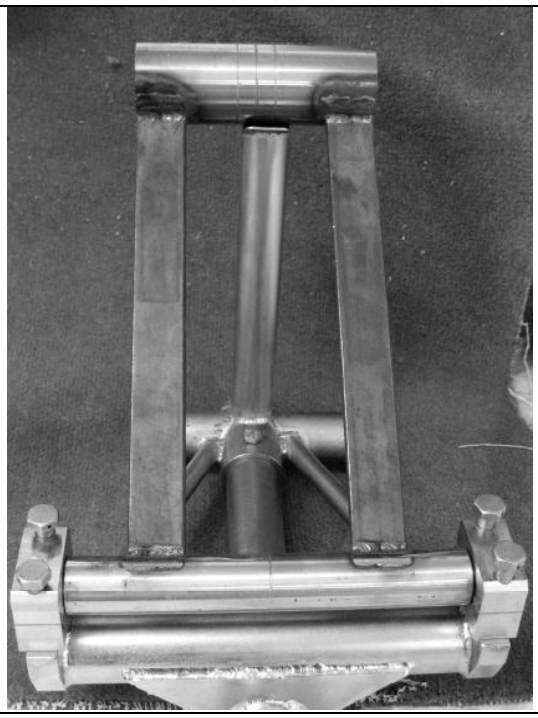
Weight Change	Moment arm	Moment Change
+ 2.4 lb	+ 37 inches	+ 89

As large metal objects have been installed, check the compass and prepare a new compass deviation card if required.

Appendix

Initially the production springs were installed with the original 1" diameter stop tube on two aircraft. This was done without removing the sides of the top plate. After some three hundred landings (on grass, reasonably bumpy) they were examined for wear or other damage. The spring had been rubbing on the stop tube (see Picture 1) and the top plate has bent although, when installed, the springs appeared to have sufficient clearance. A jig was made to allow accurate measurements to be made and facilitate accurate setting of the stop tube (Picture 2). It was also noted that the stop arm was not central on the frame tube, leaning 6mm to port. A new nose gear leg from Europa was a similar distance out.

Picture 1 Nose wheel stop, port side



Picture 2 Jig (on a new leg from Europa

On one aircraft the top hooks of the springs were the specified 77mm apart. On the other this distance was reduced to 68mm by the position and bulk of the welds on the diagonal frame tubes. If your aircraft has both the narrow gap and the stop tube is not upright then you may have problems with the springs rubbing on the stop tube. The solution is to reposition the stop tube centrally (and the method is not a big hammer). As welding is needed to reposition the tube additional clearance can be obtained by reducing the diameter of the stop tube at the same time. LAA have agreed to the changes below.

The original (1" x .049) stop tube is replaced by a 3/4" tube (4130N tube 3/4" x .049), held in place by a 7/8" sleeve (4130N tube 7/8" x 0.58). Both the 3/4 and 7/8 tubes extend to the bottom of the original tube so there is no shear load on the welds. These tube sizes give a good fit with minimum gap for welding but enough play to make the adjustment needed. The cuts and welds shown are diagonal to allow the maximum adjustment and weld area but straight cuts would be adequate. The stop tube is not structural so you do not need a CAA approved welder (just a very good one).

Picture 3 Reworked stop tube

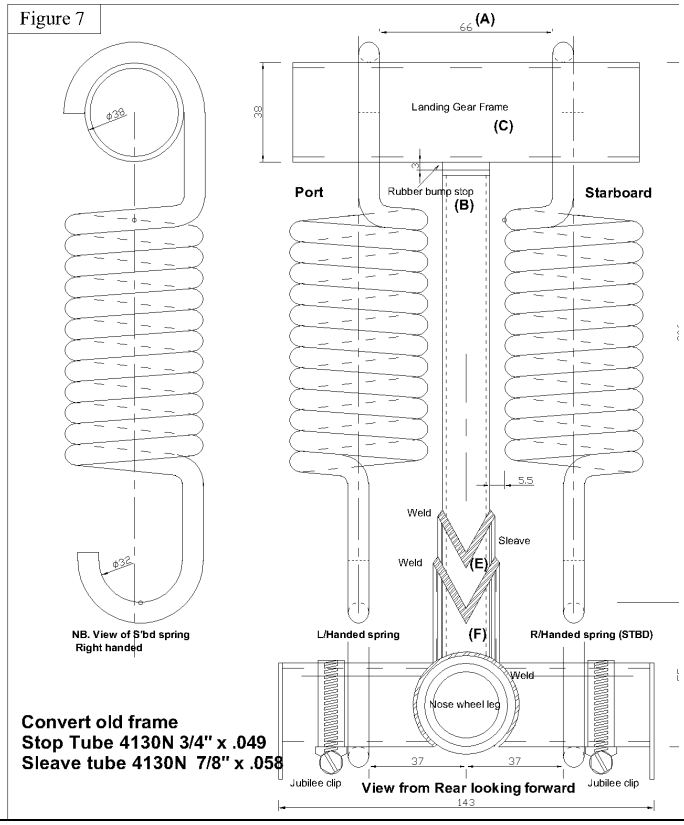


Fig 7

The jig (made to do the measurements) is used to ensure the new leg is upright. The jig can be borrowed from the Europa Club (you pay for postage and it's heavy) if required.