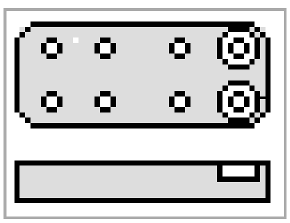
Landing Gear Legs and Extenders for the Cessna 120/140/140A Planes.

To create this note, the Technical Adviser #65 insert in the International 120/140 newsletter written by Bill Rhoades of Northfield Minnesota, was revised by extensive corrections and additions, and the accompanying figures have significant added features and corrections.

The legs were made of 5/8" thick chrome vanadium steel (6150) plate, formed and heat treated at the factory. After the heat treatment, it was shot blasted to reduce stress. According to Cessna: 1. each part was numbered, and 2. records were kept at the factory and one story notes that they even cut a small piece from each leg and kept it on file as well. Other reports state that the numbers are imprinted near the bottom of the legs and listed as part of the plane data. (I have seen numbers imprinted, but no matches)

After some experience in the field with the planes, it was noted that pilots were putting some of these airplanes on their backs. Cessna decided that more weight was needed on the tail to help reduce this tendency and so they made extenders optional (see the entry for them in your Parts Manual, Optional section). In this case especially, do not rely on just the serial of the plane to determine if you have the subsequent swept-forward gear which do the same as the extenders. Check the plane!

The extender consisted of a 5/8" plate bolted to the bottom of the gear leg at the normal axle attach point. This plate shifted the axle attach point forward three inches. Cessna earlier had also changed to brakes which used a smaller puck and a smaller diameter disc so as to diminish the effectiveness of the brakes. The changes reduced the noseover incidents considerably.

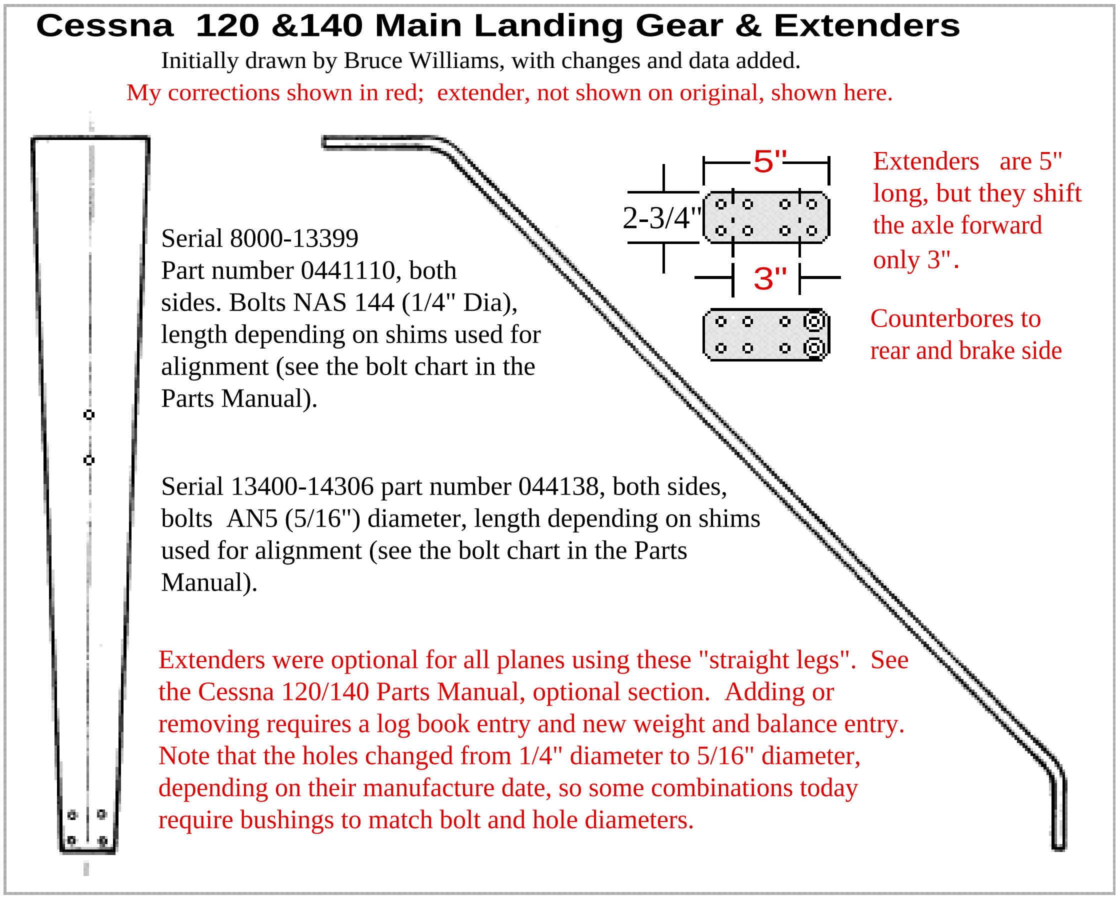


The extenders created a potential weak spot. With the axle three inches further forward, additional torsional shear stress was created for the 1/4 inch diameter NAS type gear leg bolts. Starting with aircraft serial number 13400 (Mid 1947) Cessna increased the bolt size to 5/16" in the gear legs (using an AN bolt to replace the NAS type), increasing the diameter on the gear extension holes at the same time. The final changes on the gear legs were made in late 1947 (serial number 14307) on both the Cessna 120 and the 140. The legs were now "twisted" forward three inches, eliminating the need for extensions but providing the same effect. These twisted-forward gear legs are not interchangeable between left and right sides. That same design was carried through the 140A model and continued until production ceased. (In the sketches following, it is noted that the planes with the "twisted forward" gear legs should not also use the extenders...and we know there are some out there.)

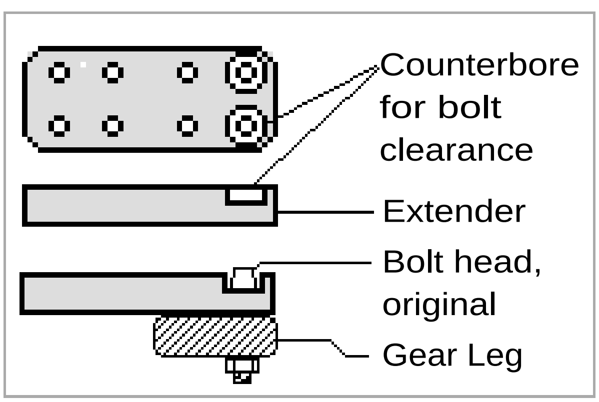
The legs have stood the test of time with only one known problem. Failures have been caused by corrosion in the holes for the rivets which initially attached the steps, that corrosion leading to cracks and sudden failure of the leg. By way of Cessna notes and club notices, all legs should have the rivets replaced by bolts, after carefully inspecting the holes following removal of the steps. The holes should be cleaned and the area closely inspected with a magnifying glass. Cessna Service Letters SLN-67 and SLN 63-14 provide more information. Wisdom suggests taking the steps off yearly and cleaning, inspecting, and repainting the holes.

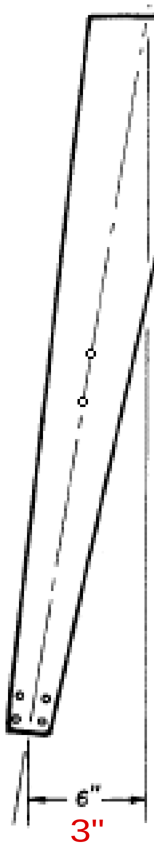
The official weight of the extenders is noted at the end of this article, along with the weight and balance, and make sure you make a log book entry if you install them or take them off.

In the figures are the hints for the proper installation of the extenders. Not shown are the usual shims for wheel alignment; make a sketch of their orientation before you remove them and make sure they go back on the same way. After installation, you may have to adjust them, but at least start reassembly this way.



The next figures indicate details of the extenders and the installation which Cessna left out or misrepresented in their parts manual. The extender, said often to be six inches long, is measured at five inches and the center to center distance between the two hole patterns accounts for the three inch shift of the axle attach point. Not shown in the Cessna parts manual is that there are two sides to the extender and both are not the same; the side meant to be placed at the rear and closest to the brake disc has been counterbored so as to displace the heads of the bolts from the brake clips. The first figure indicates the counterbore of the two holes.





The later serial "swept-forward" gear legs and all 140A's

Aircraft Serial 14307 and subs.
Part number 0441149 Left
0441149-1 Right

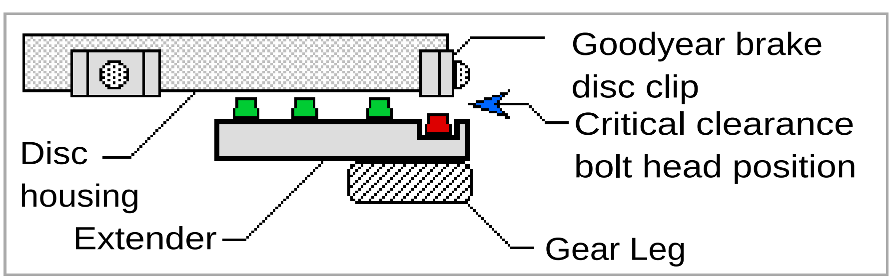
Bolts at the bottom to attach the axle should be AN5 (5/16ths) diameter, length depending on shims used for alignment (see the bolt chart in the Parts Manual).

The drafter initially showed this as a six inch shift but it should be noted as being a three inch shift to match the extender. He also states that the wheel extenders are not necessary with these gear legs, but the reality is: The extenders should never be used on planes with the swept-forward gear!!!
Neal (June '01)

Not to Scale. Filed as ldg gear 2.

Next is the view of the right landing gear leg, shown crosshatched, the extender, bolt heads, and the relationship of the Goodyear (Clevelands have much greater clearance) brake disk clips to the extenders and the bolt heads. In the Cessna book, the heads are all shown on the inboard side. Only the two rear bolt head (shown red) clearances are critical so the others can be head outboard or inboard. I have left out the complexity of the other wheel parts and do not show the nuts and any protrusion of the bolt threads from the nuts. If misinstalled, for the critical bolts with the bolt nut outboard, the length protruding beyond the nut can become extremely close to the brake clips. This is especially true if the tapered shims between the axle mount and the extenders are stacked for alignment such as to swivel the extender close to the wheel.

Because there is no useful guide in the Optional parts section of the Cessna Parts Manual for the extenders, some operators have not understood the reason for the counterbores and the need to maintain clearances and have installed the extenders with the counterbored end forward, which drastically diminishes the clearance between the bolt parts and the brake assemblies. (NAS type bolts have a conical exterior head and an Allen indent; the AN bolts used on the later planes have hex heads.)



Many owners of the planes without the twisted-forward main gear, those without extenders, having learned how to handle their planes, are happy without extenders. Many with extenders are happy with them. When I fly with a friend who does not have extenders, one of the original batches, I am a lot more careful when braking just to make sure I don't dump it on the nose because his brakes are very effective (also the original and more effective size). Another has no extenders but has the Cleveland brakes and we all three have no trouble with the others' planes.

I did a study a few years ago to find out just what the difference the extenders made on tail weight, and took a bathroom scale to the airports and placed the tailwheels of all the 120/140's I could find on them. Some had as little as 60 pounds on the tailwheel and some had as much as 120. Not a great study, but illuminating.

The bottom lines? If you get used to whatever you have, it will work just fine for you. We all like our planes and a good indicator is that so many keep them for so long. That would not happen if they had shortcomings they were unhappy with. Some owners take off the extenders and others put them on, so the evaluation goes on.

Weight and balance:
Just as the misinformation for years about the extenders shifting the cg by 6 inches, so too the weight is guessed, rather than determined. The actual weight, per the book, is 5 pounds for both extenders.

Remove wheels and brakes	-36 at +2 = -72	
Add wheel extenders	+5 at + 1.5 = +8	
Add wheels and brakes	+36 at -1 = -36	
Net	+5 at -20 = -100	(International big book 3200/49)

Note Four of the TCDS for the applicable 120/140's notes the changes in the positions and moments of the other things that might be affected, such as wheel pants and so on. See note Four!

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Addendum late additions:

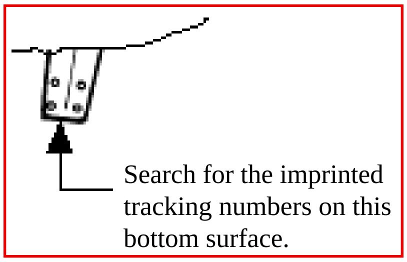
from Curtiss Wright: Shot Peening effects and howto

Shot-peening is a cold working process performed on metal parts which substantially increases fatigue strength and resistance to stress corrosion cracking. In the shot-peening process, thousands of spherical steel balls are propelled against the part at high energy. Shot-peening, under controlled conditions as practiced today, is a closely defined mechanical pre-stressing process capable of producing uniform results on a consistent basis.

Shot-peening is a cold working process in which the surface of a part is bombarded with small spherical media called shot. Each piece of shot striking the material acts as a tiny peening hammer, imparting to the surface a small indentation or dimple. In order for the dimple to be created, the surface fibers of the material must be yielded in tension. Below the surface, the fibers try to restore the surface to its original shape, thereby producing, below the dimple, a hemisphere of cold-worked material highly stressed in compression.

Overlapping dimples develop a uniform layer of residual compressive stress in the metal. It is well known that cracks will not initiate or propagate in a compressively stressed zone. Since nearly all fatigue and stress corrosion failures originate at the surface of a part, compressive stresses induced by shot-peening provide considerable increases in part life. The maximum compressive residual stress produced at or under the surface of a part by shot-peening is at least as great as one half the yield strength of the material being peened. Many materials will also increase in surface hardness due to the cold working effect of shot-peening.

Benefits obtained by shot-peening are the result of the effect of the compressive stress and the cold working induced. Compressive stresses are beneficial in increasing resistance to fatigue failures, corrosion fatigue, stress corrosion cracking, hydrogen assisted cracking, fretting, galling and erosion caused by cavitation. Benefits obtained due to cold working include work hardening, intergranular corrosion resistance, surface texturing, closing of porosity and testing the bond of coatings.



If you change to or from using the extenders, consider that the extra weight on or off the tail wheel can cause a change in the angle of the tailwheel pivot, and that affects the ease of steering on the ground. See the tailwheel article for the details of the correct angles.