

[J3 Gross Wt Increase.doc](#)

J3 Gross Weight Increase Parts 1 through 4:

J3 Gross Weight Increase Part 1

Identifying a Cub's Gross Weight

By Joel Gehring excerpted from Cub Clues #135 July/August 2006

Many times I'm asked, "What does it take to make a J3 eligible for 1220 lb gross weight", and/or, "how can I check to see if my J3 qualifies for the higher gross weight?" I have never seen a published, thorough, discussion on what the differences are, but, because of its length, I will try to explain it in four installments. This first article is going to focus on the information available and how to quickly identify what gross weight a Cub currently is eligible for. The second article will go into detail on the part listings and changes in production of the Cub. It will also advise how to proceed in updating your airframe. The third article will address the J3s that are not under Type Certificate A-69 1, along with related items Eke power plant changes, etc. The fourth article will look at the genealogy of the tandem 2-place (production) Cub landing gear; (from the E-2 to the PA- 18). To start, let's review a reprint of the information covered in (TC) Type Certificate A-691 for the J3C/PA-11:

Maximum Weight

Serial Nos. 7842, 7845 through 7883, and 7912 and up are eligible for 1170 lb. maximum weight. These airplanes are also eligible for 1220 lb. maximum weight provided the landing gear is revised in accordance with Piper Dwgs. 31472 and 31423.

Serial Nos. prior to 7912, and not listed above, are eligible for 1100 IN maximum weight. These airplanes are also eligible for 1170 IN maximum weight provided the lift struts and attachments are revised in accordance with Piper Dwgs. No. 12352, 13233 and 21642 and for further increase to 1220 IN upon revision of the landing gear in accordance with Piper Dwgs. No. 31472 and 31423.

Serial Nos. 10339 and up and 2356 and up of Model J3C-65 are eligible for 1220 lb. maximum weight.

Piper also addressed this in Service Memo No. 17, which states:

Structural Changes Required For Gross Weight Increases Model J3C-65 Airplanes (A) 1100 to 1170 Pounds

(Serial numbers prior to 7912 and not included of serial numbers 7842, 7845 to 7883 inclusive, 7912 and up)

The subject aircraft are eligible for 1170 pounds standard weight provided that the front lift strut is revised in accordance with Piper drawing #13233, the rear strut revised in accordance with Piper drawing #12352 and the fuselage lift strut attachment fitting is revised in accordance with Piper drawing #21642.

(B) 1170 to 1220 Pounds

(Serial numbers 7842, 7845 to 7883 inclusive, 7912 and up)

The subject airplanes are eligible for 1220 pounds standard weight provided the landing gear is revised in accordance with Piper drawings #31472 and 31423.

(C) 1100 to 1220 Pounds

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(Serial numbers prior to 7912 and not included in "B" above)

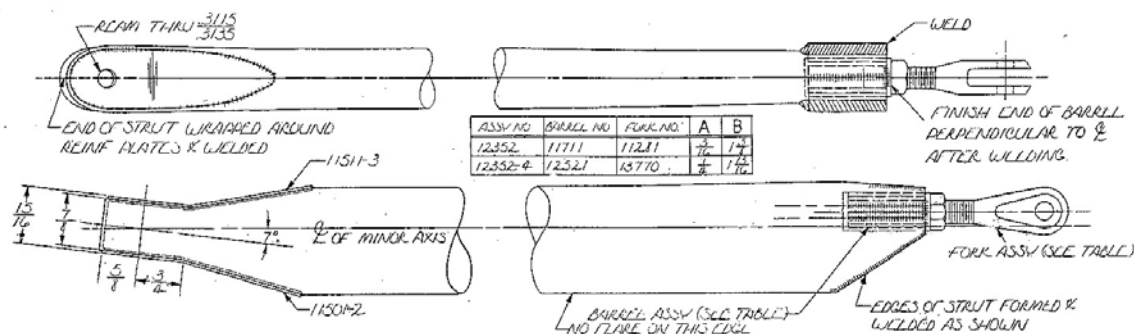
The subject aircraft are eligible for 1220 pounds standard weight provided the revisions specified in "A" and "B" above are incorporated.

The information in both documents is in agreement, but only the TC states that Cubs "Serial Nos. 10339 & up and 2356-A and & up" are already eligible for 1220 lbs. It appears the drawings' intended purpose is only to verify that a Cub has the right parts to qualify for the Gross Weight increase. They do not provide any information on how to make the modifications to a higher gross weight nor what the part differences are. The gross weight drawings only point out what most of the 1220, 'late' model parts should be.

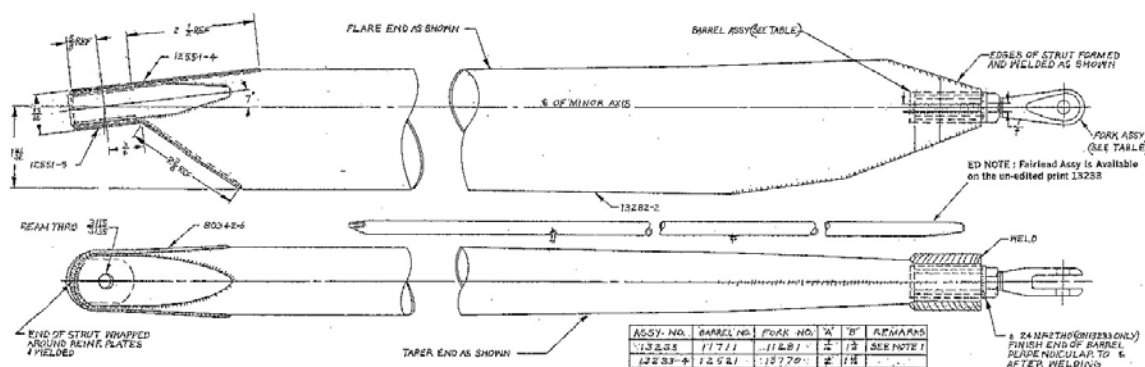
Editors Note: The 1220 lb GW increase instructions only apply to BC serial numbers (SIN) 2325, 2327, 2339, 2340, 2342, 2344 2345, 2347, 2349, 2351, 2355 and up; 2356-A and up; and 8277-1 through 8277-40. BF & J3L Cubs can qualify for 1170 lb gross weight. The early Bs, under TC A-660, and the BP (Lenape) will need to get approval from their local FSDO before the fuselage can be modified, and then a corresponding field approval (FAA signed 337) will need to be done. This also applies to BF & BL's if they want to go to 1220 lb GW (this will be addressed in Part 3).

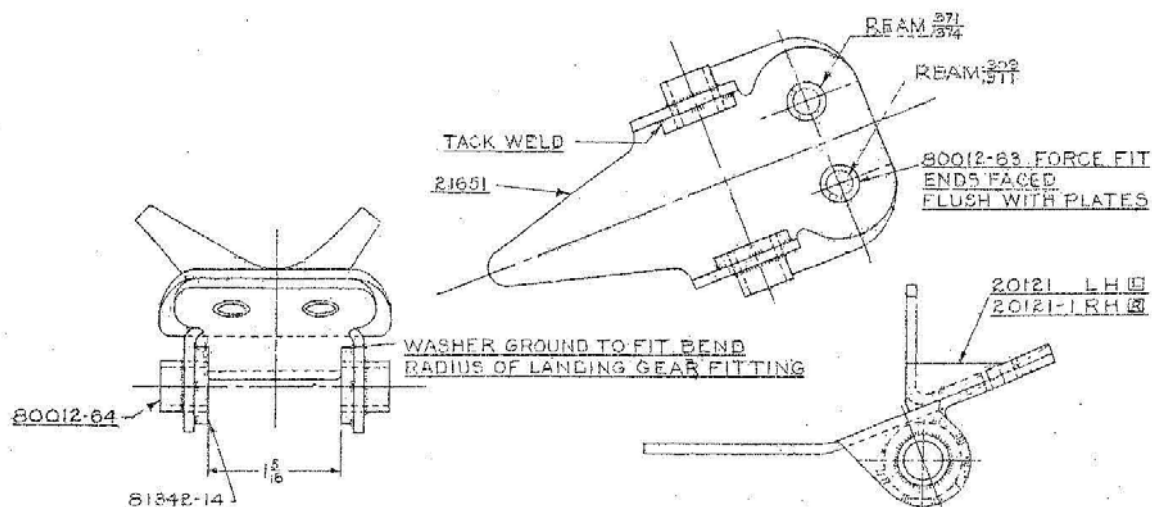
To identify if a Cub built before S/N 7912 qualifies for 1170 lb GW, Piper references these drawings:

Drawing #12352 is the rear lift strut

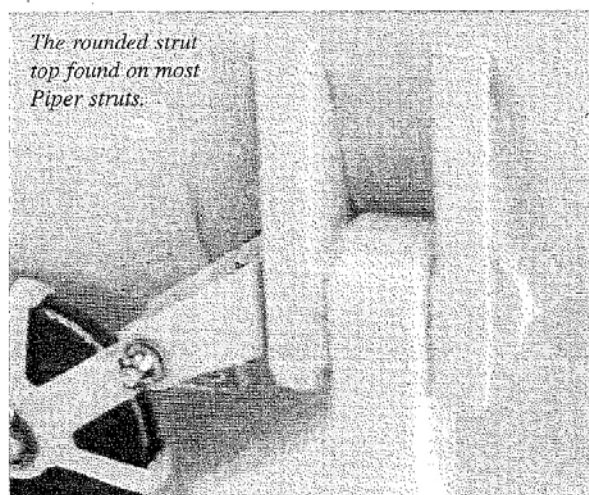
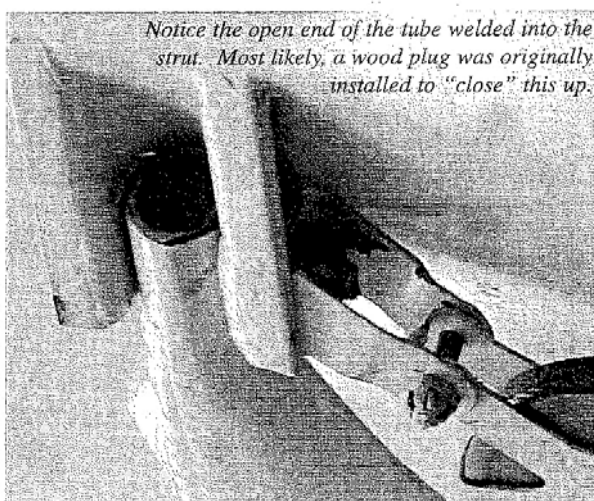


Drawing #13233 is the front lift strut





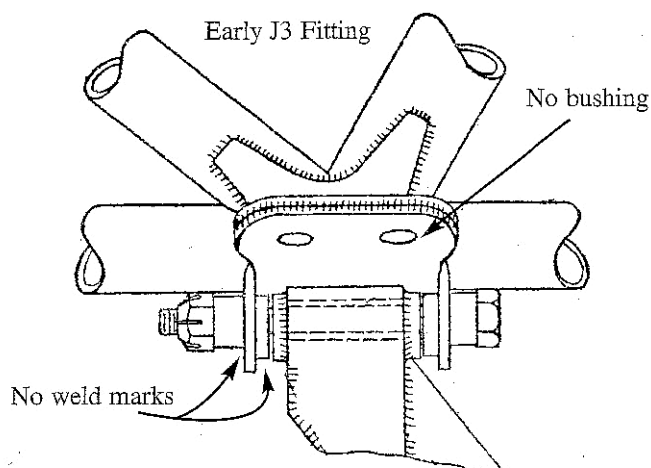
Struts 12352 & 13233 have rounded strap ends at the top of the struts. Early Cubs had a tube welded into the end of the strut with a bushing welded in place perpendicularly for the strut attach bolt to pass through. This left an open tube with a gap on either side of the bushing allowing water to run into the strut. Clyde Smith says that Piper installed a wood plug in the exposed end to help prevent this.



Editors Note: (The Piper rounded top struts are NOT SEALED struts, I will explain in Part 2).

In addition to the rounded strut top, the strut clevis (fork) should have a diameter of 7/16" (or larger if on a Univair sealed strut), instead of the old 3/8" fork. This was required by AD 52-07-03, (March 1952).

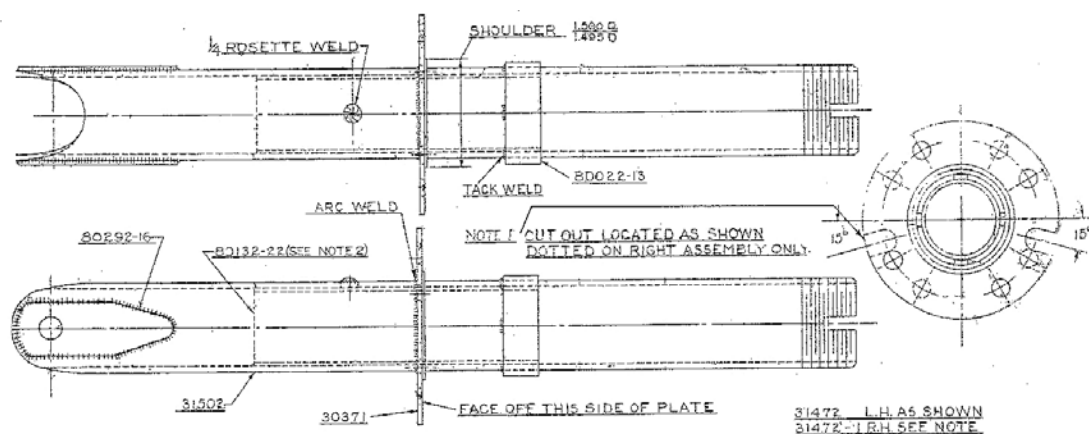
Now the strut & rear landing gear attach fitting assembly is simply a matter of bushings 80012-64 and washers 81342-14, (early B's had these pieces loose in the landing gear assembly). The new fitting has bushings installed and welded in place at the landing gear attach points; bushings are also installed at the strut attach points. The landing gear bush-hugs' sizes changed depending upon which gear legs were installed; the late model bushings accommodate a 3/8" (AN6) bolt.



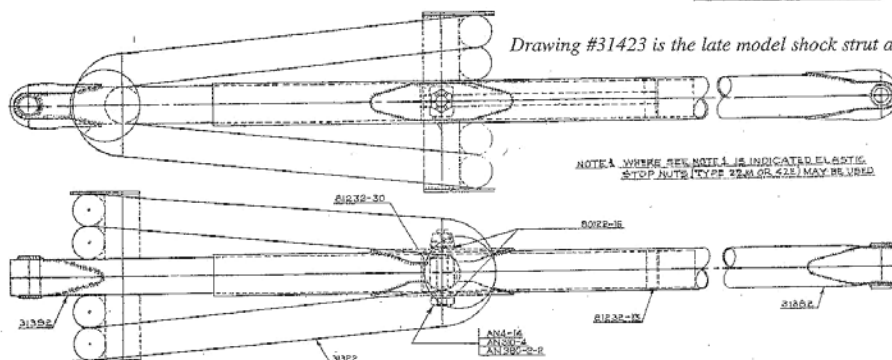
Note the absence of weld hash marks around the fitting lugs for the landing gear leg, and no bushings at the strut attach points. The weld marks & bushings are present in dwg. #21642, bottom p. 8. This sketch was taken from the J3 Pre-War Parts Manual.

To identify if a Cub built before SIN 10339 qualifies for 1220 lb GW, Piper references these drawings.

Drawing #31472 is the late model landing gear axle



Drawing #31423 is the late model shock strut assembly



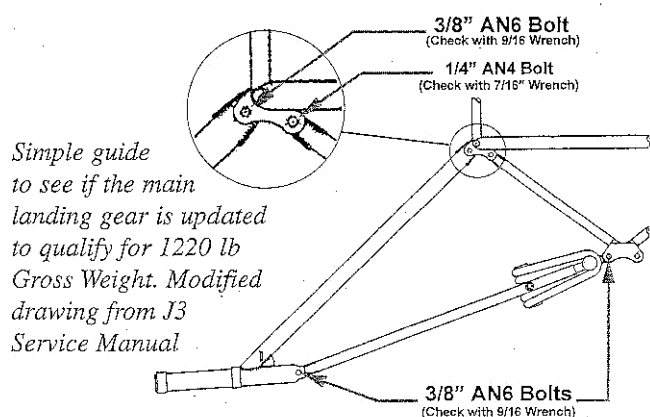
The axle #31472 is only found on the late model landing gear and the gear attaches to the fuselage via 3/8" bolts. The above shock strut assembly is also used on the late model J3. These drawings are noted be the 1220 lb Cub takes 3/8" bolts at both ends of the late model (12352) shock strut assembly, whereas the early Cub shock strut assembly attached with 5/16" bolts.

Note: the drawings do not call it out, but the front landing gear attach fitting and the Vee cabane on the landing gear will need to be changed. This will be addressed in Part 2.

Editor's note: The reference to S/N 10399, and up, specifically refers to the tail spring assembly. Cubs up to S/N 10399 came with a 2 piece leaf spring assembly. Starting with 10399, Piper changed to a 3 piece leaf spring assembly.

I know all of this can be a bit overwhelming and confusing, so I am going to make it really simple to figure out if your Cub qualifies for the different gross weights.

1. If the struts on a J3C, F or L have at least 7/16" diameter forks, and a rounded top, (Instead of a tube) they are the updated models. The landing gear & strut attach fitting must have bushings welded into the fitting at the landing gear attach points. It also must have bushings at the strut attach points. If this all complies, the Cub qualifies for 1170 pound gross weight.



2. If a DC has landing gear legs that attach with 3/8" (AN6) bolts; shock struts that attach with AN6 bolts; a cabane Vee that takes AN6 bolts where the shock strut attaches; and there is a 3 piece tail spring assembly installed, it qualifies for 1220 pound gross weight.

Editors Note: All of the drawings with this article, modified and unmodified, will be available to members on the website: www.cubclub.org. Part 2 will go into detail on the part listings and changes in production of the Cub; it will also advise how to proceed in updating your airframe.

J3 Gross Weight Increase Part 2:

Modifying the Airframe for Compliance

By Joel Gehring excerpted from Cub Clues #139 March/April 2007

Note that this is Part II of my 33 Gross Weight Increase series. To gain better understanding, I recommend reading Part I in issue #135 July/Aug. 2006, pgs. 7-11. Part III will run in the next issue.

In looking at the production changes of the J3 series, (in this case using serial number 2355 as the starting point for this discussion) we must first compare the differences between the 1100 and 1170 lb gross weight

models. The 1170 lb model differed by using a different size front lift strut, a different strut & rear landing gear attach fitting, as well as a different front landing gear attach fitting.

The following was taken from the J3 Post-War Parts Manual.

The 1100 lb Cubs used:

P/N: 12363-00 Strut - front lift

Note: Above strut used on ships to Serial No. 8277.

P/N: 12352-00 Strut - rear lift

P/N: 11281-00 Clevis - (with lock nut) [Qty. 2]

P/N: 20722-02 Landing gear front

P/N: 20401-00 (L), -01 (R) Landing gear and lift strut
[left & right respectively]

Note: The above landing gear fittings were used from Serial No. 1999 to 8277, inclusive.

The 1170 lb Cubs used:

P/N: 13233-00 Strut - front lift

Note: Above strut used on ships from Serial No. 8278.

P/N: 12352-00 Strut - rear lift

P/N: 11281-00 Clevis - (with lock nut) [Qty. 2]

P/N: 21272-02 Landing gear front

P/N: 21642-02 (L), -03 (R) Landing gear and lift strut
[left & right respectively]

Note: The above landing gear fittings were used from Serial No. 8278 and up.

Both the 1100 lb and the 1170 lb models used the same rear strut and 3/8" clevis (fork).

Now let us make sense of what these parts and drawing numbers mean and how they apply to the J3s. Those of you astute Cub members there may have noticed that the strut devices listed above have a 3/8" diameter. That is because all J3s & PA-11s originally came with a 3/8" fork. Most people will note that the smallest size fork that they see on a Cub these days is 7/16". This is due to AD 52-07-03 (March 1952) in which all struts had to be refitted with a 7/16" barrel (P/N 12521) and clevis (P/N 13710). The clevis was later changed to P/N 13770 which under AD 81-25-05, became P/N 13770-02. Univair lists it as P/N.U13770-003. *(For details on how to modify old struts see Piper SB #120. At one time I assumed that the 318 "forks were pre-war & 7/16" were post-war Now I know better So if one sees a J3 or PA-11 with the small size (318") forks, that cub has not complied with an AD, and should be fixed for safety reasons. The best option is to replace the old struts with Univair sealed struts and 5/8" heavy duty forks).*

If one compares the later model J3 struts (with strap tops), 12352 & 13233 to new sealed struts, they may ask what the difference is. On the top of the older struts, there is no bushing welded in place where the attach bolt passes through, to seal the top of the strut. The two outside plates are used as a bolt guide, but they have the open assembly of the strut between them, (see #135 p. 8 for the strut drawings). Water and air can pass into the strut through these holes. The barrel (bottom) end of a sealed strut is closed up as well. If one removes the fork on an older strut, they can look up the end of the strut. Simply put, sealed struts are exactly that.

Piper made a different strut assembly for the front lift strut, and converted the strut tops from tubes to straps, (see #135, p. 9). But then Piper used a different lift strut & rear landing gear fitting for each side as well as a different front landing gear fitting. Fitting 21642 seems to have progressed, which is not stated clearly by Piper. Early versions of this fitting had landing gear attach bushings that accommodated an AN-5 bolt. It appears that this early version of 21642 (most likely with suffix P/Ns -00 & -01) was likely used on

serial numbers 7912 to 8277, (ref A-691 & SM #17). On 8278, Piper went from an AN-5 bolt to attach the landing gear legs, to an AN-6. I have not been able to find documentation on this, probably because the change occurred during WWII. The version of Print 21642 that I have shows that it was redrawn and revised on 4/13/43 which is where the trail ends. It is my belief that this undocumented change also occurred to the front landing gear fitting for those select serial numbers, (explaining why the "New" front fitting has a suffix P/N starting with "-02" instead of "-00").

The 1170 lb J3s had a different chassis than the 1220 lb ones.

The following was taken from the J-3 Post war manual.

The 1170 lb Cubs used:

P/N: 00021-09 Vee Assy. – cabane
 Note: Above cabane vee was used from ship Serial No. 2315 to Serial No. 8277, except No. 2316, 2332 and 2353. [FYI: The earliest J-3's used vee cabane, P/N: 00020-89, also used on the J2. See Part IV for more details]
 P/N: 30452-00 (L), -01 (R) Gear Assy. – landing uncovered [left & right respectively]
 Note: Used on ships equipped with brakes from Serial No. 6440 to Serial No. 8277. This type had the brake lines mounted on the front landing gear legs. [Old ones had them on the rear landing gear legs, and there were gear legs without brake lines. See Part IV.]
 P/N: 30562-00 (Shock) Strut Assy. – long
 P/N: 30442-06 (Shock) Strut Assy. – short
 Note: Above shock struts used to ship Serial No. 8277, inclusive
 P/N: 30522-00 Spring – Tailwheel – short
 P/N: 30512-03 Spring – Tailwheel – long
 Note: Above springs used to Serial No. 10388 inclusive.

The 1220 lb Cubs used:

P/N: 30602-00 Vee Assembly – cabane
 Note: Above cabane vee was used from ship Serial No. 8278 and up.
 P/N: 10033-00 (L), -01 (R) Gear Assy. – landing uncovered [left & right respectively]
 Note: Above landing gear used on ships equipped with brakes from Serial No. 8278 up. Brake line is on front leg.
 P/N: 31382-00 (Shock) Strut Assy. – long
 P/N: 31392-00 (Shock) Strut Assy. – short
 Note: Above shock struts used from ship Serial No. 8278 and up.
 P/N: 30522-00 Spring – Tailwheel – short
 P/N: 30512-02 Spring – Tailwheel – long
 P/N: 30512-04 Spring – Tailwheel – long
 Note: Above springs used on Serial No. 10389 and up.

The changes are numerous here. This is when the shock strut went from attaching with a 5/16" (AN-5) bolt at both ends, to a 3/8" (AN-6) bolt, (the shock cord rings also changed). The later cabane vee accommodates this shock strut change by having 3/8" fittings on the bottom. The landing gear on earlier Cubs attached to the fuselage with 5/16" bolts. The later gear uses 3/8" bolts. The axle fitting attach point on the two gears also makes this change, (to accommodate the bottom of the shock strut) from 5/16" to 3/8". The tail spring assembly is an easy one in that they went from a 2-tail spring assembly to a 3-tail spring assembly.

The Service Memo and Type Certificate, (see #135 p. 7) call out drawings 31472 (axle) and 31423 (3/8" shock strut assembly). Those drawings just show the parts so one can verify what is installed. Remember that fitting 21642 was covered under the 1170 lb section. I used to think that this could mean that the cabane vee did not need to be changed, but instead could be reamed out to take a 3/8" bolt, (since Piper never called it out in the SM or TC). That might work for the cabane, but it would not work on the axle fitting. Besides the old cabane vee can be swapped out for a newer one with no difficulty. Even though I once thought, the old axle could be reamed, Piper clearly called out a new axle, P/N 31472, which is the axle assembly used on the late model J3 landing gear (10033).

Further, with fitting 21642, it accommodates an AN-6 bolt for the landing gear attach fitting, which is also only found on the late model landing gear (10033). This leads me to believe that the only option to go to the 1220 lb gross weight is to install the new landing gear, (10033), which is what I believe Piper intended.

I have heard of people reaming fittings and attachments to accommodate the newer components, but there is no documentation to support this. By Piper listing the strut & rear landing gear attach fitting and axle, they created a sort of 'Catch 22' for anyone trying to ream or modify existing components. If one would try to install a new axle on an old gear leg, they would not have replaced the strut & rear landing gear fitting; likewise, if one tried to ream out the old strut & rear landing gear fitting to install a late model gear leg. Piper engineered all fittings and components with certain material requirements in mind, (meaning material specifications changed as flight and ground loads changed). If one reams/modifies fittings to make a special installation work, there is an issue of safety that would be compromised.

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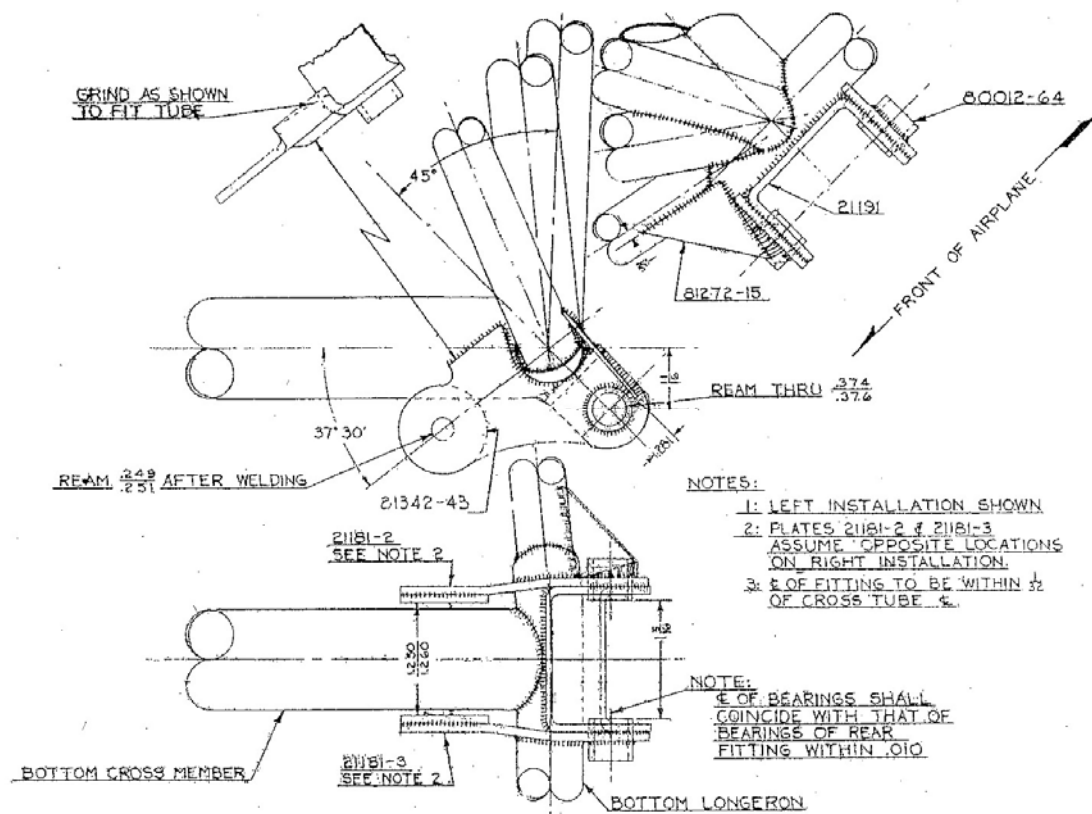
The only correct thing to do is to change both the front and rear landing gear attach fittings on the fuselage, so the new gear can be bolted on. Once that is done, the Cub can receive all of the parts listed under the 1220 lb parts list. That, along with the correct struts, would make the Cub legal for 1220 lbs.

The rear landing gear & lift strut fitting install taken from Dwg. listed in Our Blueprint List as "No # - Fuselage structure with "measurements", was drawn 6/30/41. This can be used as a reference until a copy of print 23962 becomes available.

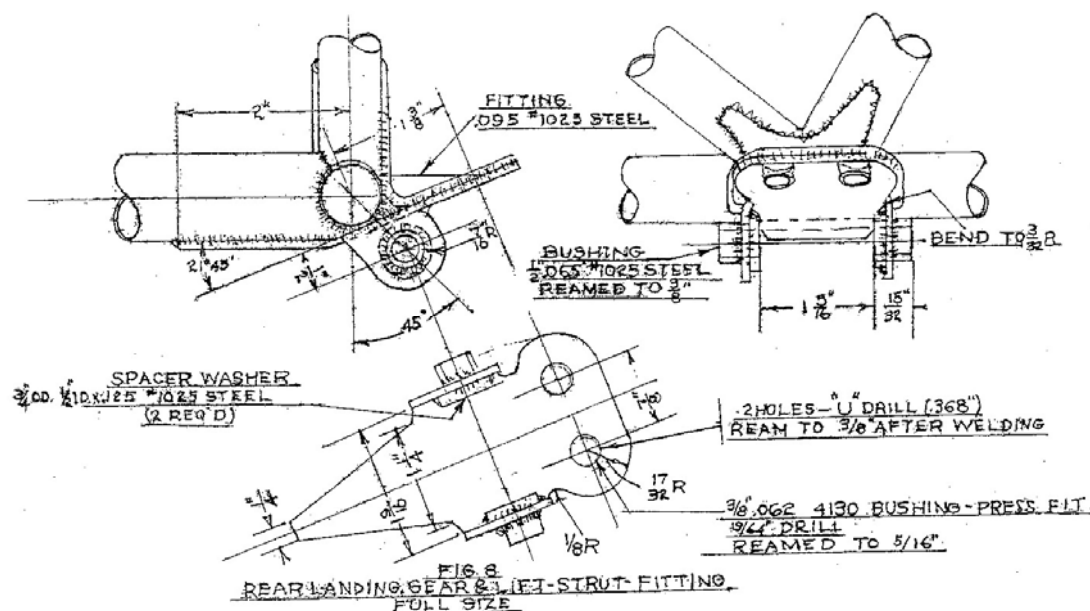
The drawing to install the 13 front landing gear attach fitting is 21272. The installation drawing for the 13 rear landing gear fitting is 23962. I have not been able to find a copy of 23962, but I did find installation instructions for a very similar J3 rear landing gear fitting under Figure 8 on a blueprint we list as "No # - Fuselage structure with measurements".

It was drawn on 6/30/41. One can use print 21272 and then follow Figure 8 (as a reference) for installing the landing gear fittings. If any member has a copy of 23962 - rear landing gear & lift strut fitting install, please contact us or send a copy.

I realize that this is an extensive and expensive modification, but it is clearly what needs to be done to attain the 1220 lb gross weight. If one is restoring an earlier Cub, now is the time to update that fuselage for oneself and future generations. This is also a good improvement in terms of resale value with the introduction of LSA rules. As always, consult with your IA.



J3 / PA -II front landing gear attach fitting installation Dwg. 21272



Note: If one has to make these changes also check to see that the fuselage has fair cads or pulleys that the lower aileron cables pass through. Refer to the Aileron Cable Pulley Installation article (night. it is another modification' that should be done at the same time as the landing gear fitting change to update an early Cub airframe for extended use.

J3 Gross Weight Increase Part 3:

How to Modify Cubs not on TC A-691

By Joel Gehring excerpted from Cub Clues #140 May/June 2007

Supporting Data for the Installation of a Continental Engine and Other J-3C Approved Equipment and Gross Weight on a J3F or J3L

Note that this is Part III of my J3 Gross Weight Increase series. To gain better understanding, I recommend reading Part 1 in issue #135 July/Aug. 2006, pgs. 7-11 & Part II in issue #139 Mar/Apr 2007, Fgs. 8-11. Part IV will focus on the genealogy of the tandem Cub landing gear.

In the early days of the FAA, (when known as the CAA) aircraft manufacturers were required to apply for a new TC. (Type Certificate) whenever a different engine was installed on an airframe. Then they slowly came around to making manufacturers get a new TC when a different engine make was used. By the very late 40's and early 50's the FAA allowed most TCs to have different engine makes on them, eliminating model change problems for future aircraft. Unfortunately this did not help the early models.

The Piper J3 series has five different TCs, (and also the TG- 8 glider which can be converted & certified into a J3C, F or L with supporting paperwork). There were important structural changes made to the J3 between TCs A-660 and A-691. The spars needed to be reinforced for overseas certification, so those changes, along with changes to the gear and fuselage (needed to install a larger engine) were incorporated into the J3 design when Piper received certification for the J3C-50 & J3F-50, on July 14th, 1939. Structurally, all of the J3s produced from this point on were essentially the same, firewall back, (accounting for changes made during production). The FAA still required Piper to get different' TCs for each different engine make.

Since the FAA required Piper to have multiple TCs for the J3s, Piper looked for a way around this problem if future owners wanted to make engine changes. Piper addressed this in the Serial Numbers Eligible heading for each model. The Aircraft TCDSs (Type Certificate Data Sheets; A-691 for the Continental J3, A-692 for the Franklin J3, and A-698 for the Lycoming J3, are the three main TCDS for the J3 Cub) list the airframe serial numbers eligible for a particular engine and equipment. According to Piper, a J3 Cub airframe is eligible for any equipment or rating found on the three TCDSs if its serial number is among the following; 2325, 2327, 2339, 2340, 2342, 2344, 2345, 2347, 2349, 2351, 2355 and up; 2356-A and up; and 8277-1 through 8277-40. These eligible serial numbers are the same on the three main Cub TCDSs and their respective models. *(Under the BF-65 & J3L-65, Serial Number Eligibility, Piper also accounts for "all AAF Nos. eligible. Use Manufacturers Serial No. if available." this is to account for any L-4s being certified after WWII).*

Even though a Continental engine is not listed among the approved equipment on the J3F and J3L TCDSs, most of the airframes are eligible for the installation. In order for BC equipment to be approved on the BF and J3L, supporting documents (in addition to the TCDSs referring to the Serial No. eligibility) are necessary to demonstrate that this can be accomplished with a 337 field approval.

Piper Service Memo No. 41 lists the General Specifications for the J3. Other than the *performance specs*, which are specific for the J3C-65, the *airframe specs* are identical for the J3C, J3F and J3L. This helps support the fact that the airframes, firewall back, are the same.

The *J3 Pre-War Parts Manual* includes an 18-page section on engine conversions. These pages include equipment and part listings for engine changes to any one of the engines approved on the three main Cub TCDS. For example, the Manual lists what is needed to convert a 65 hp Franklin to a 50 hp Continental, as well as installing a 40 hp Continental on a 65 hp Lycoming J3. At the beginning of the Power Plant section in the manual, (the following is also printed in the J3 Post-War Parts Manual) Piper notes:

"Ships from Serial No. 2355 and up equipped with 40 H.P engines are eligible for a 50 to 65 H.P engine installation. When such a conversion is made, a twelve (12) gallon fuel tank must be installed in place of the nine (9) gallon tank (which was original equipment installed.)"

Neither manual states that the 40 hp J3 must receive a higher hp, *Continental engine* because it was an accepted practice to install any engine make at that time, (Piper's main reason for the note was to make sure that the 12 gallon fuel tank was installed with higher hp engines; see the Pre-War manual for fuel system conversion info). The passing of years, lower rate of engine changes, and the constant rotation of new FAA inspectors resulted in this knowledge and practice "disappearing".

As far as I know, Luscombe, with their Model 8 Series (TCDS A-694), was the first light airplane company to have two different engine makes on one TCDS. The 65 hp Lycoming SB, along with the Continental models, were all approved on A-694. Piper was first able to-do this on the J5 series and then finally again with the PA18s, with the PA-18-95 Super Cub, which had a 90hp Continental, followed by: the PA-18-105 Super Cub Special, which used the Lycoming O-235, (TCDS 1A2).

To make the case for equipment and/or engine change with your IA, and then with your FSDO rep, one should gather the following information; (1) Type Certificates A-691, A-692, and A-698, (which are available for free to anyone under the Type Certificate Heading, on the left hand menu, at www.cubclub.org), (2) Piper Service Memo No. 41, & (3) A copy of the Pre-War Parts Manual 18-page section on engine conversion, (the Post-War manual is an overall better manual for general use, but in the, case for engine changes, the Pre-War is needed).

Note: This is the supporting data we have given to us by Piper to help make the case that the airframes are the same and that they are eligible for equipment listed for the J3 on A-691, (even if that equipment is a higher C series Cont. engine). For those wanting further confirmation in installing a larger Continental engine, read the submission following this article from member Dave Henderson.

Now, how this relates to increasing the gross weight is that in A-691, the J3 series is allowed to go up to a 1220 lb gross weight in the info for the model J3C-65. Under that model Piper lists the Serial Numbers

Eligible, which are the same serial numbers listed for the J3F and J3L airplanes. If one updates the airframe to comply with the TC A-691 and/or Piper SM 17, (covered in Part I, issue #135, pgs. 7-11, and Part II, issue #139, pgs. 8-11) the airframe would be eligible and could have the gross weight increased (and any other J3 via a Field Approval. This can be done with the FAA inspector, once the logical case is made. Remember, that you are trying to educate the FAA rep.

In most cases you may have more knowledge about your Cub, as you should. The goal is to have agreement on your case with proper supporting data.

It is my belief that the J3P (TCDS A-695) could be updated to 1220 as long as the serial number falls in the previous numbers listed. Any other J3 that does not fall within that serial number range, (like those on A-660) would have to update the wings, gear and fuselage before the airframe would equal that of the later J3 models. As always, consult with your IA.

Another Option for Installing a Continental on a J3F or J3L

While reading about recurring problems installing Continental engines in J3Ls and J3Fs, Dave Henderson submitted the following to us.

"While I am sure everyone knows the story about the three different TCs, I won't bother to go back to the problem but offer a solution. Back in 1993 when I was hot and heavy into the Cub restoration business I came across the same dilemma a number of times. 'Many of the Cubs that came through either were made with a Lycoming or a Franklin and somewhere almost all of them were converted to a Continental. Rather than fight the system and try to get an STC or field approvals each time, I approached the FAA New York Certification Office Propulsion Branch to get final FAA opinion on the conversions. I submitted the request through my local FSDO and they forwarded it to New York. To make a long story short, the result was a letter of determination that the airframe for both the Lycoming and the Continental airframes were the same therefore the Continental could be simply installed onto an original Lycoming powered Cub. The only requirement was a log book entry that the engine was placed into the particular Cub and conformed to the Continental TC, A-691. I have used this letter many times over the years and it was also accepted for the Franklin powered Cubs that were converted as it is exactly the same situation except for the engine type. I researched my files and found a copy of the letter and am forwarding it to the Cub Club for all to reference."

This document is available from the Cub Club.

J3 Gross Weight Increase Part 4:

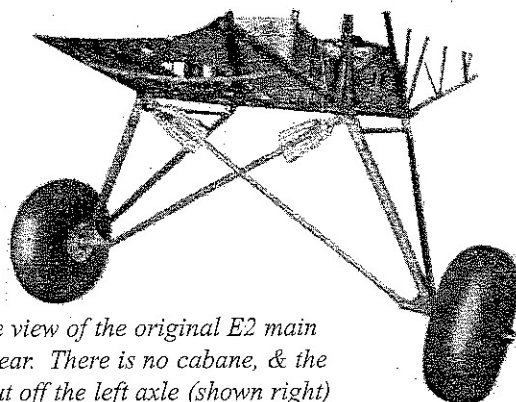
Genealogy of All Tandem 2-Place Piper Gear

By Joel Gehring excerpted from Cub Clues #146 May/June 2008

Note: This 4th part in the gross weight series is a look at the evolution of the Cub landing gear Outside of the J3 landing gear part analysis; this has little to do with increasing a J3 Gross Weight. Parts I & II really cover the GW increase. Part III shows how an increase, (& equipment change, i.e. engine) is possible for J3s not on TCA-691, (Part I is in Issue #135, pgs. 7-11; Part II in Issue #139, pgs. 8-11; and Part III in issue #140, pgs. 9-10).

The progression of the landing gear will follow in order, (E2, J2, J3, PA- 11, & PA- 18). The original E2 gear was a narrow, squat gear when comparing it to other Cub models, but it did start the simplistic configuration that made servicing very easy. Starting in 1930, Taylor used 4130 for the tubes in the Vee gear legs, (which held true for all subsequent Cubs). They were given suspension via a shock strut assembly that attaches to

the interior axle, and terminates on a fitting on the opposing front gear attach fitting. To do this, there is a built in stagger of the shock struts, where they attach to the front landing gear attach fitting, one on the front side, the other on the rear. Most E2s that I have seen have the shock strut off the left axle, staggered in front of the right strut. The gear legs attached to the fuselage with 5/16", AN-5 bolts. The evidence I have found, says that the E2 shock struts attached to the fuselage and axles with 1/4", AN-4 bolts, but I have seen some E2's using AN-5 bolts.



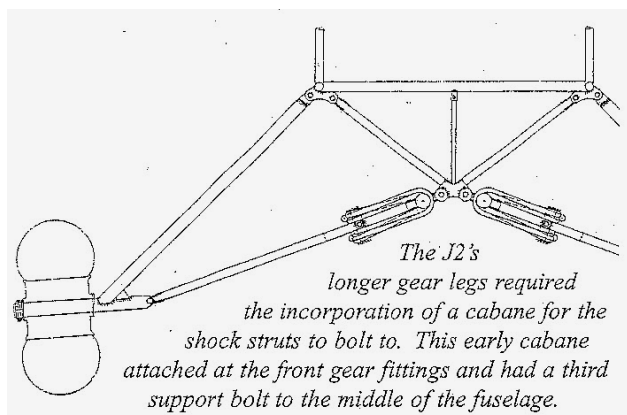
An engine view of the original E2 main landing gear. There is no cabane, & the shock strut off the left axle (shown right) typically staggers in front of the other.

The axles retained the wheel via a collar that was bolted in place with an AN3 bolt. They used a 3" Goodyear wheel, the 4" Shinn wheel, or 4" Hayes wheel. The Hayes (Goodrich) wheel eventually became the standard "Cub" wheel, (see issue #143, pgs 7-10). Replacement part versions of this gear incorporated the later J2 slotted, threaded axle and round axle nut. A two-piece tail spring was used along with a tail skid.

E2 LANDING GEAR LIST (verifiable)

E2-A34	Short Shock Strut
(missing)	Long Shock Strut
E2-A31	Landing Gear Vee (Right), bolt collar axle
E2-A301	Landing Gear Vee (Right), threaded axle & nut (later alternate gear)
E2-8244	Tail Skid Spring - Long
E2-8243	Tail Skid Spring - Short
E2-8245	Tail Skid Shoe
E2-315	Tail Skid Clamp Plate

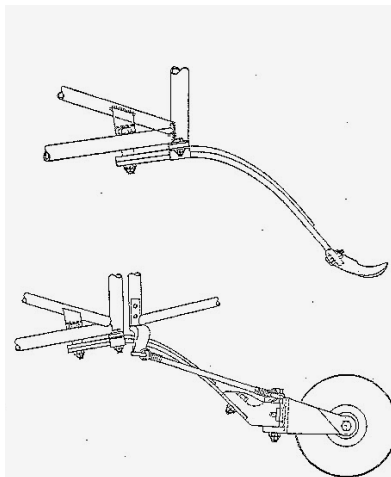
When Walter Jamoneau was commissioned by C. G. Taylor, (and later given permission to proceed from Wm. T. Piper) to modify the gear for the J2, he did not relocate the placement of the landing gear attach fittings. This means the distance between the attach points of the E2 gear is the same on all Cubs, including the PA-18. He elongated the landing gear Vees, to solve the nosing over tendencies. By lengthening the gear he increased the distance required of the shock struts. Seeing that the distance would be too long if the E2 style shock strut was used, Jamoneau incorporated the familiar landing gear cabane Vee. This early cabane had a vertical brace that attached to the middle of the bottom fuselage via a 3/16" AN-3 bolt and to the front landing gear fittings via 1/4" AN-4 bolts. Also, the shock struts attached with AN-4 bolts to the cabane and landing gear axles, (ref. print J2-A35).



It appears that the early J2's used 3 shock cord rings per side. The two 9/16" thick rings on the bottom with a 1/2" stretched on top. This then progressed to a two ring system, which used one 9/16" and one 11/16" thick cords. Since no one is making 9/16" thick cords in a 7 1/2" diameter ring, J2 owners just use two of the 11/16" rings, #1174, which are used by all J3's up to 1170 lb GW, (and all J3s, 3 per side).

J2 LANDING GEAR PARTS

J2-A312	Landing Gear Vee (Left)
J2-A313	Landing Gear Vee (Right)
J2-A30	Cabane Vee Assembly
J2-A303	Shock Strut - Short
J2-A304	Shock Strut - Long
J2-A99	Shock Cord Cover - Leather
or	
J2-A900	Shock Cord Cover - Aluminum (Special)
E2-8244	Tail Skid Spring - Long
E2-8243	Tail Skid Spring - Short
E2-8245	Tail Skid Shoe
E2-315	Tail Skid Clamp Plate
J2-357	Tail Skid Brake Lining



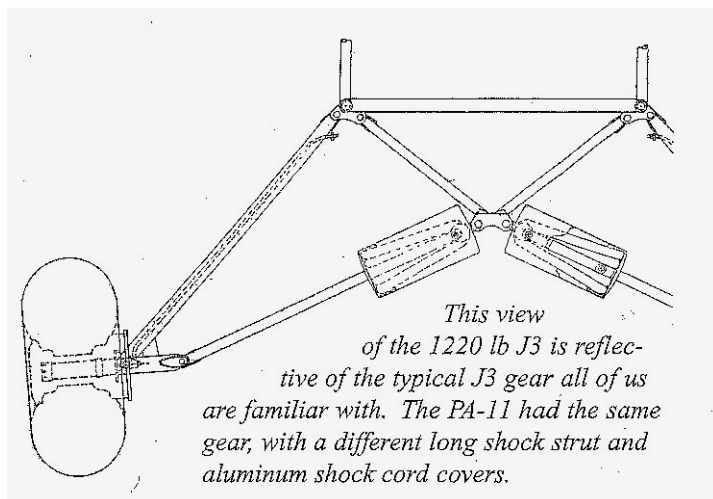
The tail skid (top) was stock on all early Pre-War Cubs. The Air Associates tail wheel assembly (Bottom) was an option introduced during J2 production, and can be installed on E2's, J2's & J3's. It used bungees instead of springs.

Into the production of the J2, 'customers were requesting a steer-able tail wheel. This led to the introduction of the Air Associates 'bungee controlled tailwheel, which is approved for installation on E2's, J2's, and 133s, (since some early J3 's were produced with tail skids).

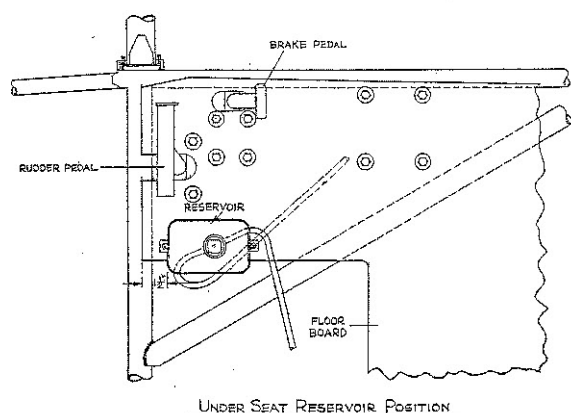
The J2 gear continued into production on the Bs produced under TC A-660. When the J3 underwent modification to receive engines larger than 40 hp, the fuselage and landing gear were also strengthened. The vertical support on the landing gear cabane that bolted to the bottom of the fuselage was removed, and the bolts that attached the shock struts to the cabane and axles were increased to AN-5's

During the life of the J3, there were 4 different gear legs that saw production. The J2 non-brake gear leg; a J3 gear leg with a brake line on the rear tube used with the below the floor brake master cylinder; a J3 gear leg with a brake line on the front tube using the Scott above the floor master cylinder, and then the 1220 lb GW J3 gear leg.

With the introduction of brakes on the J3, automotive style brake master cylinders were incorporated along with a circular disc on the axle that would accept the expander tube brake assembly. These cylinders were mounted underneath the floorboards, with the rear brake pedal attached to the front of it. The fluid would then be pressurized out the back of the cylinder. Because of the length and location of the assembly, the brake line would exit out of either the teardrop shaped cover (with a Stevens master cylinder) or with a half cylinder style cover (with an Air Associates or Hayes master cylinder), and connect to a brake line tube that ran along the back diagonal tube of the landing gear leg to the axle and the expander brake assembly. Also,



Also, the brake pedals were located outboard of the rudder pedals on these early J3's. There were two possible locations of the brake fluid reservoir. The first had the master cylinders interconnected with a tee fitting-in between the two master cylinders. The line off of the tee went forward, where it ran up the front of the firewall to a shared brake fluid reservoir. The second location had the reservoir mounted above the floorboards, underneath the front seat on the right (door) side.



The right rear brake on a Pre-war J3. Note the rectangular outline showing the location of the master cylinder mounting plate, the later position of the brake fluid reservoir, and that the brake pedal is outboard of the rudder pedal.

Everything became less complicated once Piper standardized production to the Scott brake master cylinders. The brake pedals were moved to the inside of the rudder pedals, which allowed for easier use. The fuselage belly no longer had unsightly bulges, and the external brake fluid reservoir was deleted. This led to the brake line being routed on the rear side of the front tube of the gear leg. The routing of the brake line is the main difference between these two early gear legs with brakes.

J3 LANDING GEAR PARTS

Note. J3's on TC A-660 should refer to the J2 Parts listing

The 1170 lb Cubs used:

00021-09 Cabane Vee Assembly
 00041-50 (L), -51 (R) Landing Gear Vee, no brake
or
 00041-60 (L), -61 (R) Landing Gear Vee, brake line on rear tube (below the floor master cylinder)
or
 30452-00 (L), -01 (R) Landing Gear Vee, brake on front tube (Scott master cylinder)

and

30442-06 Shock Strut - Short
 30562-00 Shock Strut - Long
 31073-00 Shock Cord Cover - Leather
 30522-00 Tail Spring - Tailwheel - Short
 30512-03 Tail Spring - Tailwheel - Long

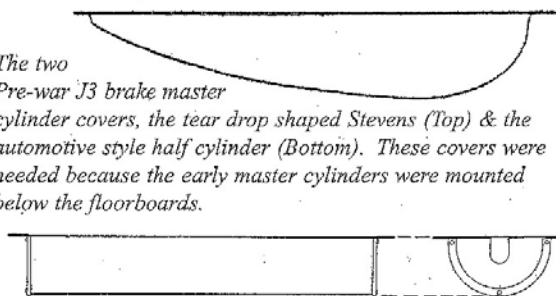
The 1220 lb Cubs used:

30602-00 Cabane Vee Assembly
 10033-00 (L), -01 (R) Landing Gear Vee
 31392-00 Shock Strut - Short
 31382-00 Shock Strut - Long
 31073-00 Shock Cord Cover - Leather
 30522-00 Tail Spring - Tailwheel - Short
 30512-02 Tail Spring - Tailwheel - Long - Middle
 30512-04 Tail Spring - Tailwheel - Long - Bottom

The two

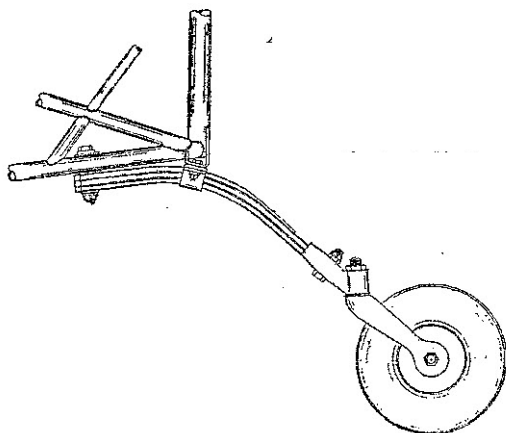
Pre-war J3 brake master

cylinder covers, the tear drop shaped Stevens (Top) & the automotive style half cylinder (Bottom). These covers were needed because the early master cylinders were mounted below the floorboards.



The big change came with the 1220 lb GW gear. The landing gear (leg) attach bolts, along with the bolts attaching the - shock struts, were increased from AN-5 bolts to 3/8" AN-6 bolts. The front tubes of the gear legs had their diameter, decreased from 1 1/2" to 1 1/4", while maintaining the same wall thickness. The shock cord rings now became 8"x 3/4", #1280. At the tail wheel, a third tail spring was added to the assembly. As for the tail wheels, the Scott tail wheels became the popular models over the years, but many options are available via the TC's.

All 1220 GW Cubs should have 3 springs on the tail wheel assembly to qualify. This image came from the J5 Parts manual, but the installation is nearly identical to a Post-War J3.



The PA- 11 inherited the J3 landing gear except for one major change, and that was the replacement of the long shock strut with reduced cross tube and larger retainers for the shock cord keepers. To get a slimmer profile, the shock cords are doubled up on the long shock strut end. This allowed for aluminum landing gear shock cord covers to be put back into production on the PA-11, (early fatter aluminum shock cord covers were an option on Pre-War J3 Cub Sports).

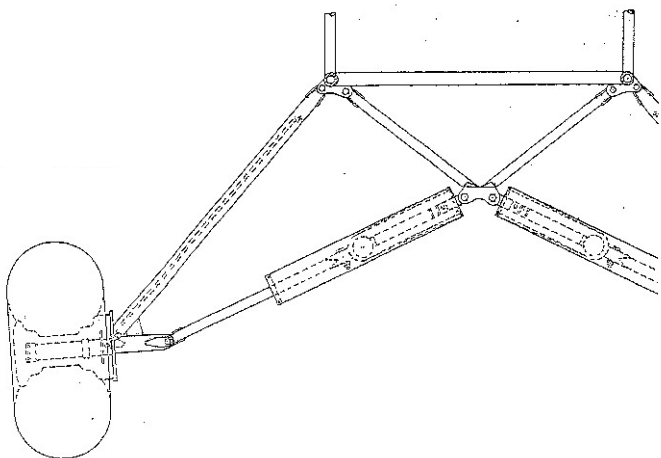
Further, the early PA-18's had inherited the PA- 11 landing gear, with no initial changes. The first couple of changes were to increase the tube diameters front (to 1 3/8") and rear (to 1 1/4"), the rear tube wall thickness (to .058"), as well as the axle design. The changes on the gear legs are improvements, and, once covered and installed on wheels, one cannot tell what model they are "intended" for unless they have a caliper on them, or know the inner axle stubs. That is why if one orders a 1220 lb gear leg for a J3, Univair will supply the newer PA-18 gear legs.

PA-11 LANDING GEAR PARTS

Use all 1220 lb GW J3 Gear except for:

10537-00 Shock Strut – Long
10566-00 Shock Cord Cover – Aluminum

Note: Because of the quantity of material, I didn't go in depth on the evolution of the landing gear axles. A liner tube was incorporated into the J3 axles, but the biggest change was between the 1220 lb J3 / PA11 axle and the PA-18. See issue #127.

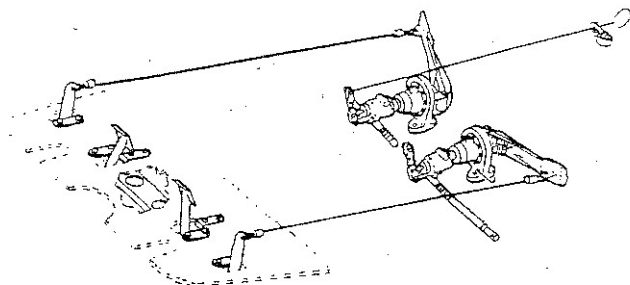


The Cub gear eventually evolved to the PA-18- 150 Hydrasorb landing gear. Note that the landing gear cabane attaches to the fittings with AN-5 bolts, replacing AN-4's.

When Piper came out with the PA-18-150, (outside of other - airframe changes) they increased the bolt size that attaches the cabane to the fuselage -from AN-4 to AN-5. Also, they beefed up the long shock strut. However, the biggest improvement in the landing gear was the addition of the Hydrasorb shock cord units. This is a hybrid between a shock cord and oleo strut suspension. It allowed the use of lighter shock cords (#1080) on the early PA-18's, but Piper went back to a #1280 HD with the introduction of the PA18A's, with Hydrasorbs.

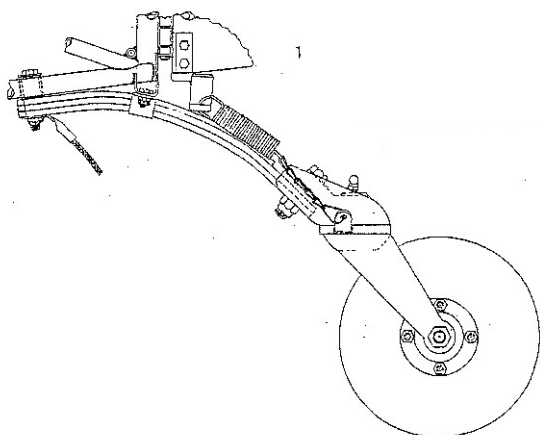
Note: It is legal to install PA-18 Hydrasorbs on a 1220 lb J3/PA11 per the TC See Gary Burkett article, . Issue #139, pg 8.

The Post-War brake system layout is pretty much the same in the stock PA-18's with a couple of variations. The PA-18-105 Special did have toe-brakes, (which I believe was a requirement at the time to sell planes to the Air Force). Another variation was a parking brake that was incorporated into the Scott master cylinder. Using a new back cover, the Scott master cylinder had a lever that, if flipped, could hold the pressure in the brake line when the brakes are applied. For those who are curious, the J3 TC's do allow the use of these Scott parking brake master cylinders.



The PA-18 Scott master cylinder parking brakes.

These parking brake assemblies can be installed in most J3s per the TC.



One of the later stock PA-18 tail wheels was the Scott 3200. There is a static discharger on the tail wheel that I believe was added late in production.

In later production, Piper ended up switching to 8.00 x 6 Cleveland wheels and brakes. Even the tail wheel assemblies also progressed with the inclusion of the Scott 3200 and the Maule pneumatic assemblies. The PA-18 gear has many combinations and variations, especially when including the PA-18A's. Furthermore, there are many after market mods-too many to detail at this time.

Note: Because of the numerous parts, only the PA-18-150 Hydrasorb is listed:

PA-18-150 HYDRASORB LANDING GEAR PARTS

30602-07 Cabane Vee Assembly
10033-06 (L), -05 (R) Landing Gear Vee
12844-03 Shock Strut
487-558 Hydrasorb unit
12845-00 Hydrasorb Upper Fitting
12875-00 Hydrasorb Lower Fitting
85012-00 Bumper Washer
10566-05 Hydrasorb Cover – Aluminum
12567-04 Tail Spring – Tailwheel – Short
12567-03 Tail Spring – Tailwheel – Long – Middle
12567-02 Tail Spring – Tailwheel – Long – Bottom

So, this concludes the overview of the Cub landing gears, to the best of my knowledge. I am open to any additional comments and suggestions.