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Installing the HP-18 landing gear gas spring retrofit kit

Bob Kuykendall, 3 December 2001

These instructions describe how to install the HP Aircraft HP-18 landing gear balance strut retrofit kit.

The HP Aircraft landing gear gas spring retrofit kit features a fixed-force gas spring that replaces the coil springs, balance cable, pulley, and related parts used in the stock HP-18 to help retract the landing gear and hold it in the retracted position.

Features and benefits

The HP Aircraft gas spring retrofit kit offers the following benefits over the stock cable-and-coil spring system:

- Lighter
- Simpler
- Fewer points of failure
- Easier to service
- More positive action

Retrofit kit contents

The gas spring retrofit kit contains the following parts:

- 18-1101 spacer
- 18-1102 bushing (2)
- 18-1103 eyelet (2)
- 18-1104 gas spring
- AN3-12A bolt
- AN3-6A bolt
- AN960-10 washer (3)
- AN365-1032 nut (2)
- 18-1110 installation instructions (this document)
- 18-1111 installation drawing

Tools and materials

In addition to the contents of the kit, you will need the following tools and materials:

- 3/8" box end wrench
- 3/8" open end wrench
- 1/4" box end wrench
- 1/4" open end wrench
- 4 feet of .041" safety wire
- two 18" lengths of coat-hanger wire
- 1 lb of 1/16" thick, 3/4" OD washers with ID of 1/4" or 5/16"
- 6-inch ruler or machinists scale
- Locktite or similar thread locking compound
- electric hand drill with 12" long, 3/16" diameter drill bit
- small vice grips (for twisting safety wire)
- white lithium grease or equivalent

The following tools are optional, but will make the procedure easier:

- 1/4" drive socket set with 3/8" and 1/4" sockets
- inspection mirror
- 3 feet of monofilament fishing line
- safety wire twisting tool
- right-angle drill with short 3/4" bit or Unibit.

Precautions

When installing the HP Aircraft HP-18 landing gear gas spring retrofit kit, observe the following precautions:

- Perform all work to the standards of good aircraft workmanship. When in doubt about anything, consult AC43.13.
- Be careful to test the finished installation to make sure that it is free of binding, sticking, or rubbing between any of the moving parts and anything else. Improper assembly plus inadequate testing may result in a gear-up landing, for which HP Aircraft is in no way responsible.
- Be careful while performing the installation not to get your hands or fingers caught in any of the moving parts of the landing gear assembly. The landing gear system has many moving parts and considerable inertia.
- Be careful not to disassemble or disturb any of the nitrogen-pressurized parts of the landing gear system. In specific, do not disturb the restraining cable that is looped around the valve stem of the 18-578 upper frame. The only cable you should be working on is the 18-586 spring balance cable located in the right-side well outboard of the landing gear well.

- Be careful around the 11-590 balance springs. Even in the gear-retracted position, they store considerable energy. Releasing them suddenly can release their stored energy in ways that can cause damage or injury. The method of releasing the springs described in this document is relatively slow, but also relatively safe.

Installation procedures

To install the gas spring retrofit kit, perform all of the following procedures.

Procedure 1: Getting ready

In this procedure, you set the aircraft up so that you can conveniently work on it.

1. Study drawing 18-1111, *Installing the HP-18 gear balance strut* to become familiar with the arrangement of the original and retrofit gear balance systems.

2. If the aircraft is assembled, remove the wings and place them in the trailer or other secure storage appliance.

3. Place the fuselage in its cradle or other appliance so that the landing gear is off the ground.

4. Extend the landing gear, and place the gear lever in the down-and-locked position.

5. If the fuselage is fitted with a cover for the top of the landing gear well, remove that cover.

   You will need access to the bolt that secures the 18-578 upper frame to the 18-585 spring bellcrank.

Procedure 2: Removing the old springs

In this procedure, you carefully remove the old 11-590 springs. The springs can be difficult to remove, since they are under considerable tension even when the gear is retracted. Also, the springs are located so that access to them is awkward.

You will get around these problems by positioning the gear so that the springs are at their greatest extension, and then inserting washers between the spring coils. After that, when you reposition the gear so that the springs contract, they compress against the washers before reaching their at-rest length and the balance cable goes slack.

1. At the top of either of the 11-590 springs, slide a 3/4" OD washer into the gap between two spring coils.

   If there is adequate room for two washers between the coils, slide two washers in.

2. Engage the washer(s) by sliding the coat hanger wire down the center of the spring through the hole in the center of the washer.

3. Repeat Steps 1 and 2 as necessary to fill all the gaps between all the coils of both springs with washers.

4. Bend the remaining ends of the coat hanger wires over to prevent them from sliding out.

5. Retract the landing gear by moving the gear lever to the up-and-locked position.

Since the springs are filled with washers, they will not assist the retraction. In order to get the gear all the way up, you or an assistant may have to manually lift the landing gear to engage the lever at the up-and-locked position.

The springs should have compressed firmly against the washers between the coils, and the 18-586 spring balance cable should be slack. If the cable is not slack, re-extend the gear and repeat Steps 1 and 2 so that all of the coils are fully filled with washers.

6. Remove the following parts from the aircraft:

- 11-590 springs (2)
- 18-589 spring clip
- 18-586 spring balance cable and hardware
- 18-588 forward/lower spring anchor
- AN-210A pulley and any mounting hardware and reinforcements

Save the parts in a marked baggie in case they someday become historically significant.

Procedure 3: Repositioning the spring bellcrank

In this procedure, you reposition the 18-585 spring bellcrank so that it will work with the retrofit gas spring. Then you will drill new holes in the 18-585 so that you can reattach it to the 18-578 landing gear upper frame in the new position. Be careful to position the 18-585 correctly, since the proper position is important to maintaining the geometry of the landing gear retraction system.

1. Carefully extend the landing gear by moving the retraction lever to the down-and-locked position.

Since the balance springs are absent, you may need an assistant to support the weight of the landing gear while you slide the lever to the down-and-locked position.

2. Inside the landing gear well, remove the AN3 bolt that connects the 18-578 upper frame with the 18-585 spring bellcrank.

3. Reposition the 18-585 bellcrank so that it fulfills the following two conditions:

a. The center of the 3/16" hole at the end of the arm is 5/16" below a reference line between the pivot axis of the bellcrank and the center of the upper aft bolt on the forward right 18-575 pivot plate.

You may find it convenient to represent the reference line with a piece of monofilament or other string. Also, if the hole is well centered in the end of the arm, you may find it convenient to note that the radius at the end of the arm is 5/16".

b. The space between the bellcrank arm and the surface of the landing gear well is 5/8".

4. While maintaining the alignment described in Step 3, use the holes in the 18-578 landing gear upper frame as a guide to match-drill new holes in the 18-585 spring bellcrank.

   You may find it convenient to match-drill the first hole, place a short 3/16" bolt, rod, or clevis pin in the hole, reposition the landing gear, and then match-drill the second hole.

Procedure 4: Preparing to install the gas spring

In this procedure, you prepare the retrofit gas spring for installation in the aircraft.

1. (Optional) Drill a 3/4" hole in the landing gear well wall that aligns with the axis of the hole in the arm of the 18-585.

   You can use this hole to insert a socket to more conveniently install or remove the bolt that will attach the 18-1104 gas strut to the 18-585 spring bellcrank. A Unibit drill bit chucked in a right angle drill is the most effective way to drill this hole. Alternatively, you can use a right-angle 1/4" die grinder as a drill.

2. Drill 1/16" holes in each of the 18-1103 eyelets as shown in the diagram.

3. Apply Locktite or similar thread locking compound to the threads at each end of the 18-1104 gas strut.

4. Install the two steel eyelets on the threads at each end of the 18-1104 gas strut.

   Take care not to crush the cylinder or mar the bearing surface of the rod. Use a strap wrench or other non-marring, non-crushing tool to apply tightening torque to the cylinder and the rod. Because you're using Locktite or similar threadlocking compound, only 2-3 ft-lbs of torque are necessary.

5. Loop a length of .041 safety wire (or equivalent) through the 1/16" holes in both 18-1103 eyelets.

6. Compress the strut to an end-to-end length of about 16" and secure it at that length by twisting the ends of the safety wire together.

Procedure 5: Installing the gas spring

In this procedure, you install the retrofit gas spring in the aircraft.

1. Install the following parts at the upper aft mounting hole of the forward right 18-575 pivot plate:
   - AN3-12A bolt (insert from inside the gear well)
   - 18-1101 spacer
   - 18-1102 bushing

2. Smear the interiors of the 5/16" holes in both 18-1103 eyelets with white lithium grease.

3. Lower the compressed strut into the aircraft and engage the 18-1103 eyelet on the rod end of the strut with the 18-1104 bushing you installed in Step 1.

4. Install an AN960-10 washer and AN365-1032 nut on the AN3-12A bolt you installed in Step 1.

5. Place an AN960-10 washer and an 18-1104 bushing on the AN3-6A bolt supplied.

6. Orient the AN3-6A bolt so that the head faces left, and insert the bolt through the 18-1103 eyelet on the cylinder end of the strut.

7. Reposition the 18-585 bellcrank so that the hole in the bellcrank arm aligns with the bolt you inserted in Step 6 and so there is room for the bolt between the bellcrank arm and the landing gear well.

8. Engage the bolt you inserted in Step 6 with the hole in the arm of the 18-585 bellcrank.

9. Install an AN960-10 washer and AN365-1032 nut on the bolt you engaged with the 18-585 bellcrank in Step 8.

10. Unlock the landing gear lever and position it so that the holes in the 18-578 upper frame align with the holes in the 18-585 spring bellcrank.

    You may find it convenient to have an assistant support the weight of the landing gear while you find the position where the holes align.

11. Bolt the 18-578 upper frame to the 18-585 bellcrank using the bolt, nut, and washers (if any) removed in Procedure 3: Step 2 through the holes drilled in Procedure 3: Step 4.

Procedure 6: Finishing up

In this procedure, you perform the finish-up tasks that complete the installation.

1. Extend the landing gear, and place the gear lever in the down-and-locked position.

   The loop of safety wire you installed in Procedure 4: Step 5 goes slack.

2. Remove the loop of safety wire.

3. If you drilled the optional hole in Procedure 4: Step 1, tape over the hole with aluminum tape on both sides of the gear well.

4. Test the landing gear through several extension and retraction cycles to make sure that there is no binding or rubbing, and that the counterbalance strut works effectively.

   The balance strut is calibrated to apply enough force to hold the landing gear in the retracted position under average conditions. The prototype installation was tested with a 5" Cleveland wheel and disk brake unit, and an 11" OD Lamb-type tire. If the strut does not effectively hold your landing gear in the retracted position, you can exchange the standard strut for a more powerful unit.

5. If the fuselage is fitted with a cover for the top of the landing gear well, replace that cover.

Notes:

- Perform all work to the standards of good aircraft workmanship. When in doubt about anything, consult AC43.13.
- Be careful to test the finished installation to make sure that it is free of binding, sticking, or rubbing between any of the moving parts and anything else. Improper assembly plus inadequate testing may result in a gear-up landing, for which HP Aircraft is in no way responsible.
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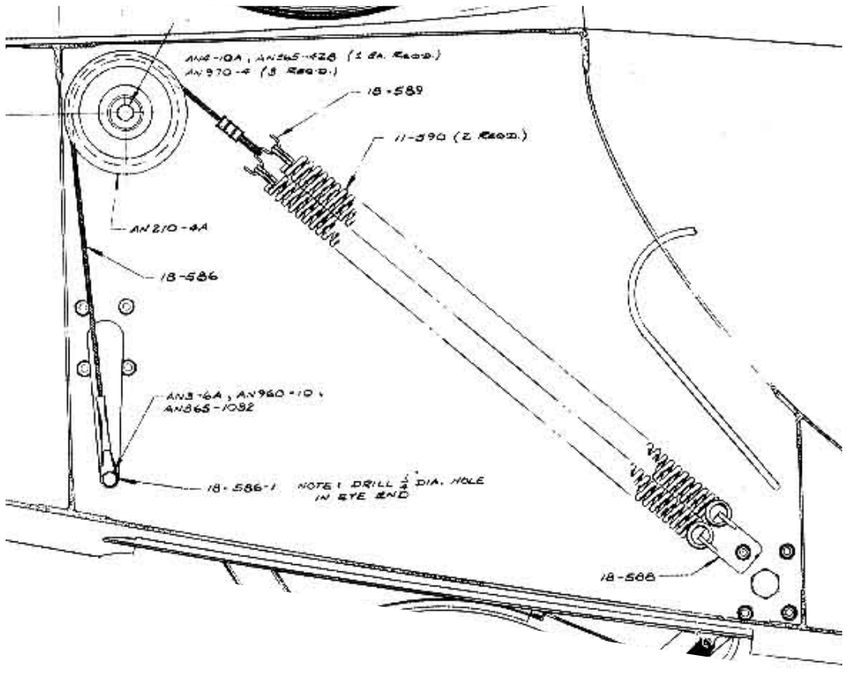
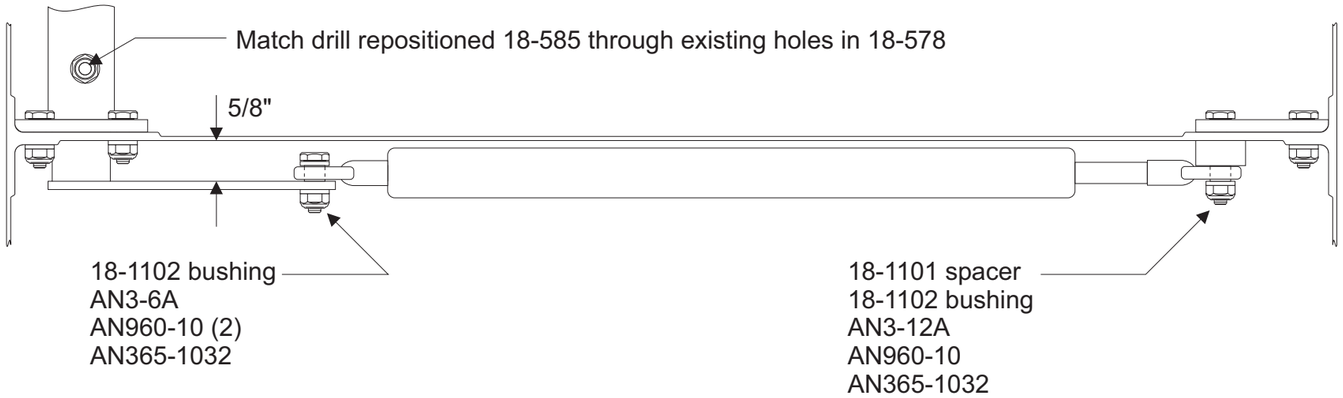
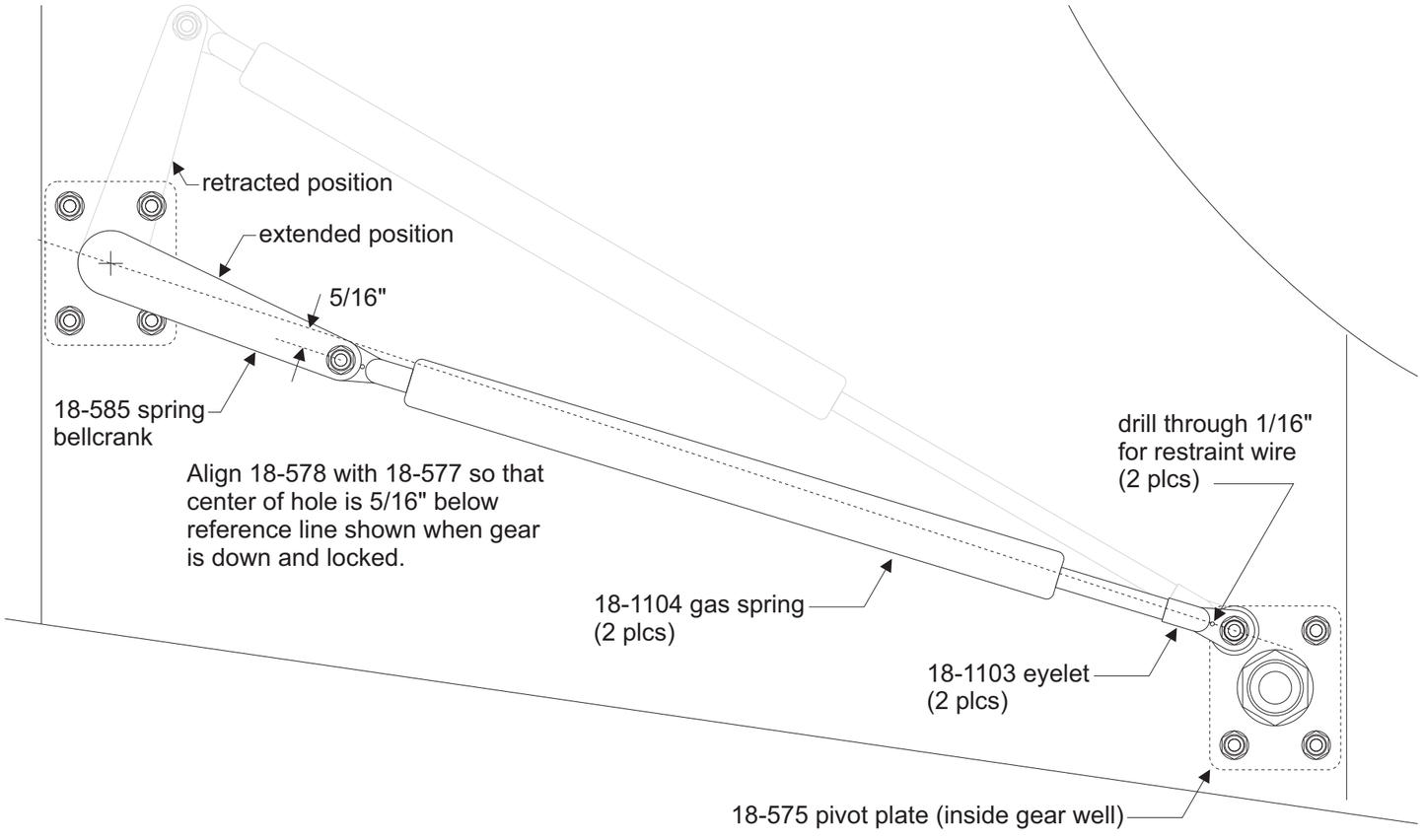


Original balance system installation drawing, showing coil springs, spring hooks and anchor, balance cable, pulley, and original orientation of 18-585 bellcrank





Installing the HP-18 gear balance strut
Drawing 18-1111
Drawn 2 December 2001 by
Bob Kuykendall