Service Newsletter

September 12, 1986

SNL86-44

TITLE

FLIGHT CONTROL SURFACE BALANCING INFORMATION

TO

CESSNA DISTRIBUTORS, CATEGORY I THRU CATEGORY IV DEALERS, AG DEALERS, CARAVAN I AND CARAVAN II REPRESENTATIVES/SERVICE STATIONS AND CPC'S

MODELS AFFECTED

All Cessna piston engine and propjet propeller airplanes manufactured since 1946.

DISCUSSION

This Service Newsletter supersedes Customer Care Newsletter NL83-8 dated March 4, 1983.

Newsletter NL83-8 announced the latest flight control surface balance kit and provided instructions for its use. These instructions have since been incorporated into many of the Service/Maintenance Manuals.

The purpose of this Service Newsletter is to provide Supplemental information for the earlier instructions and Service/Maintenance Manuals and more detailed information for use of the balance fixture on older airplanes and airplanes with piano type aileron hinges.
The attached balancing information includes the following:

A. Pages A-1 thru A-6 - The original flight control surface balancing fixture instructions which provided general procedures for its use.

B. Pages B-1 thru B-6 - Supplemental instructions to those listed in A. above, includes information for balancing ailerons with piano type hinges on model 150, 152, 172, 180, 182 and 185 airplanes and information on balancing control surfaces on 120, 140, 170, 190 and 195 airplanes.

C. Page C1 - A table of limits and specifications for control surface balancing on models 120, 140, 170, 190 and 195.

MATERIAL

The flight control surface balancing fixture kit is available from the Cessna Supply Division for the suggested list price shown.

<table>
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<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
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<tr>
<td>5180002-1</td>
<td>Flight Control Balance Fixture Kit</td>
<td>$1,654.00 (T) ea.</td>
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ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE
FLIGHT CONTROL SURFACE BALANCING FIXTURE KIT
(PART NUMBER 5180002-1)

*5180002-12
WEIGHT ASSEMBLY,
WASHER AND BOLT

*5180002-5
SLIDING
WEIGHT

*5180002-2
BEAM ASSEMBLY

*INCLUDED IN 5180002-1 FLIGHT CONTROL
SURFACE BALANCING FIXTURE KIT

USED FOR BALANCING AILERONS, ELEVATORS AND RUDDERS
ON ALL CESSNA SINGLE AND MULTIENGINE AIRPLANES

FEATURES OF THIS BALANCING FIXTURE ARE:

* UNIVERSAL CESSNA
APPLICATION

* AN ACCURATE METHOD OF
BALANCING CONTROL SURFACES

* QUICK AND EASY TO USE

* DURABLE ALL METAL
CONSTRUCTION
FLIGHT CONTROL SURFACE BALANCING

STATIC BALANCING OF FLIGHT CONTROL SURFACES
(WITH THE 5180002-1 CONTROL SURFACE BALANCING FIXURE)

1. General Information
   A. Refer to the applicable Service/Maintenance Manual for specific information concerning the conditions for balancing control surfaces and the adjustment of the balance weights.

2. Control Surface Balancing
   A. (See Figure 1.) Adjust beam to fit onto control surface as follows:
      (1) Beam can be located anywhere on control surface as practical. On control surfaces with hinge bolts, the best location is directly over a hinge bolt to allow easier beam alignment.

      NOTE
      Do not allow the beam or hanger assembly to rest on any rivet heads.
      (2) Align the beam so that it is positioned 90 degrees to the hinge line and the centerline mark on beam (0 position) is directly over the hinge line.
      (3) Adjust the hanger assembly to fit against the trailing edge of the control surface so that the beam is parallel to the chord of the control surface. Check position of the beam centerline mark to ensure that it is still directly over the hinge line.
      (4) Mark the location of the beam on the control surface and remove the beam assembly from the control surface.
CENTERLINE ON BEAM MUST BE ALIGNED WITH CONTROL SURFACE HINGE CENTERLINE

BEAM ASSEMBLY

HANGER ASSEMBLY

CONTROL SURFACE CHORD

HINGE CENTERLINE

Figure 1. Adjustment of Beam to Fit Control Surface
B. (See Figure 2.) Balance the beam assembly as follows:

NOTE

The beam must be rebalanced for each individual control surface that is to be balanced.

(1) Place the beam assembly on the knife edge of one mandrel at the centerline of the beam assembly (in notch).

(2) Position the weight (fastened by a washer and bolt) along the beam assembly as required to allow the beam assembly to be balanced. Secure the weight in position by tightening the bolt. Washers may be added to the long screw (at the other end of the beam) to provide for fine balancing of the beam assembly.

Figure 2. Balancing of Beam Assembly

C. (See Figure 3.) Place the mandrels on a horizontal, flat surface in position to accept the control surface to be balanced and place the control surface on the mandrels as follows:

(1) Control surfaces with hinge bolts are to be placed on the mandrels such that the hinge bolt shank rests on the knife edge portion of the mandrel. Use either end of the mandrel as required.
FLIGHT CONTROL SURFACE BALANCING

(2) Control surfaces with a hinge pin are to be placed on mandrels to utilize the slot in the long end of the mandrels.

NOTE

The control surface is to be positioned on the mandrels such that no portion of the control surface contacts the mandrels except the hinge bolt or hinge pin.

D. (See Figure 3.) Balance the control surface as follows:

(1) Place the beam assembly on the control surface (as previously marked) and place the sliding weight on the beam assembly.

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Figure 3. Balancing of Control Surface

(2) Position the sliding weight to allow the control surface to be balanced (control surface chord to be parallel to horizontal, flat surface). Read the number on the scale directly below the center mark on the sliding weight. The number read is the moment of the control surface in inch-pounds. The moment must be assigned a + or - as follows:

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(a) Overbalance is defined as the condition that exists when surface is leading edge heavy and is defined by symbol (-). If the balance beam sliding weight must be on the trailing edge side of the hinge line (to balance the control surface), the control surface is considered to be overbalanced.

(b) Underbalance is defined as the condition that exists when surface is trailing edge heavy and is defined by symbol (+). If the balance beam sliding weight must be on the leading edge side of the hinge line (to balance the control surface), the control surface is considered to be underbalanced.

(3) Refer to the applicable Service or Maintenance Manual to determine if the control surface is within allowable balance tolerance and whether or not the control surface balance weight needs adjustment to reduce or increase the amount of weight.
FLIGHT CONTROL SURFACE BALANCING

*5180002-12
WEIGHT ASSEMBLY
WASHER AND BOLT

*5180002-5
SLIDING WEIGHT

*5180002-14
MANDRELS

*5180002-2
BEAM ASSEMBLY

*INCLUDED IN 5180002-1 FLIGHT CONTROL SURFACE BALANCING FIXTURE KIT.

FLIGHT CONTROL SURFACE BALANCING FIXTURE KIT
(PART NUMBER 5180002-1)

GENERAL NOTES

1. Balance control surfaces in a draft-free area.

2. Place hinge bolts through control surface hinges and position on knife edge balancing mandrels. Be sure hinge bolt shank rests on knife edge.

3. Make sure all control surfaces are in their approved flight configurations: painted (if applicable), trim tabs installed, all foreign matter removed from inside of control surface, elevator trim tab push-pull rod installed and all tips installed.

4. Place balancing mandrels on a table or other suitable flat surface.

5. Adjust trailing edge support to fit control surface being balanced while center of balancing beam is directly over hinge line. Remove balancing beam and balance the beam itself by moving the adjustable weight (fastened by bolt and washer). Fine balance may be accomplished by use of washers at long screw on end of beam.

6. When positioning balancing beam on control surface, avoid rivets to provide a smooth surface for the beam and keep the beam 90° to the hinge line of the control surface.
7. Paint is a considerable weight factor. In order to keep balance weight to a minimum, it is recommended that existing paint be removed before adding paint to a control surface. Increase in balance weight will also be limited by the amount of space available and clearance with adjacent parts. Good workmanship and standard repair practices should not result in unreasonable balance weight.

8. The approximate amount of weight needed may be determined by taping loose weight at the balance weight area.

9. Lighten balance weight by drilling off part of weight.

10. Make balance weight heavier by fusing bar stock solder to weight after removal from control surface. The ailerons should have balance weight increased by ordering additional weight and gang channel, listed in applicable Parts Catalog and installing next to existing inboard weight the minimum length necessary for correct balance, except that a length which contains at least two attaching screws must be used. If necessary, lighten new weight or existing weights for correct balance.
Balance limits for control surfaces are expressed for "Approved Flight" configuration. "Approved Flight" configuration is that condition of the control surface as prepared for flight of the airplane whether it be painted or unpainted.

"Approved Flight" limits must never be exceeded when the surface is in its final configuration for flight.

UNDERBALANCE is defined as the condition that exists when the control surface is trailing-edge heavy, and is symbolized by a plus (+).

OVERBALANCE is defined as the condition that exists when the control surface is leading-edge heavy, and is symbolized by a minus (-).
A balance in this range is "underbalance".

A balance in this range is "overbalance".

RUDDER

90°

SPIRIT-LEVEL PROTRACTOR

SLIDING WEIGHT

CENTER LINE

TRAILING EDGE SUPPORT

BALANCING MANDREL

LEVELED SURFACE

HINGE POINT

ELEVATOR
NOTE

This detail is applicable to ailerons which are attached to the wing with piano-type hinges.

*D minus 1.80 inches equals chord line of aileron. Make sure trailing edge is straight in area where 1.80-inch measurement is taken.
Balance aileron inverted, with trailing edge at point opposite cut-out for middle hinge .85" below hinge line horizontal plane.
# Control Surface Balance Limits for Early Model Airplanes

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*Some Model 170A airplanes were delivered with 1.75-pound lead balance weight in ailerons.*

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