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Control Surface Repair and Rebalancing: When, How and What Sets the Limit

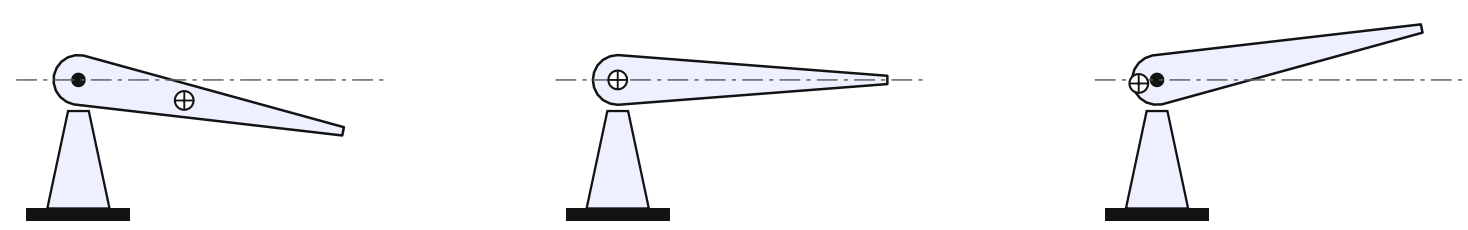
Under and overbalance · calculation · scale · balance beam · flight test

1 Identification

REFERENCE DRAWING — NOT APPROVED DATA · THE SRM ALWAYS GOVERNS

VIEW A

STATIC BALANCE ON THE STAND · THREE CONDITIONS



+ UNDERBALANCE
TE DOWN · TAIL HEAVY · NOT USUALLY ALLOWED

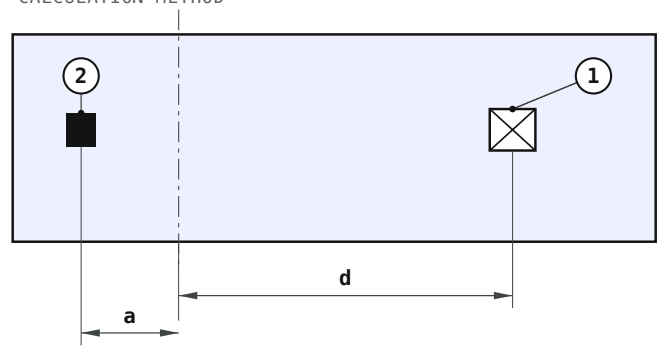
BALANCED
TE HOLDS THE LEVEL CHORD LINE

− OVERBALANCE
TE UP · NOSE HEAVY · MAKERS PREFER IT

ROUND MARK = CENTER OF GRAVITY OF THE SURFACE · DASHED = LEVEL CHORD LINE

VIEW B

PLAN · CALCULATION METHOD



d AND a FROM THE HINGE CENTER LINE, TO 0.01 IN

ARITHMETIC

FAA-H-8083-31B P. 2-37

NET WEIGHT dW = W ADDED − W REMOVED
MOMENT M = dW x d (IN-LB)
COUNTERWEIGHT Wc = M / a (ARITHMETIC ONLY)
IN TOLERANCE: THE MANUAL'S LIMIT, IN IN-LB
OUT OF TOLERANCE: THE MANUAL GIVES WEIGHT, MATERIAL, DESIGN AND PLACE OF THE COUNTERWEIGHT

TOLERANCE FIGURES ARE NOT PUBLISHED HERE
REPAINT AND TRAPPED WATER ALSO MOVE THE BALANCE
AC 43.13-1B 4-36 a, b, c

METHODS

THREE IN USE

CALCULATION: ON THE AIRCRAFT; WEIGHTS AND ARMS KNOWN
SCALE: OFF THE AIRCRAFT; SCALE IN HUNDREDTHS OF A LB
BALANCE BEAM: CESSNA AND PIPER; LOCAL TOOL, MANUAL DIMS

ORDER OF WORK

PUBLIC SOURCES

1 WEIGH AND LOCATE WHAT WAS ADDED AND REMOVED
2 CALCULATE, OR PUT THE SURFACE ON THE STAND
3 COMPARE WITH THE MANUAL TOLERANCE
4 ADD OR REMOVE WEIGHT ONLY AS THE MANUAL SAYS
FLIGHT TEST TO CONFIRM NO FLUTTER (AC 43.13-1B 4-36 a)

PARTS LIST

#	ITEM	RULE	SOURCE
1	Repair area	Weight added minus removed, at its arm d aft of the hinge line	H-8083-31B 2-37
2	Counterweight	Forward of the hinge line; lead or steel, larger aircraft other metals	H-8083-31B 2-38
3	Arm d	Hinge center line to the center of the repair, to 0.01 in	H-8083-31B 2-37
4	Stand	Level, still air, free rotation, tabs neutral, no friction	H-8083-31B 2-37
5	Plus sign (+)	Trailing edge below horizontal: underbalance	H-8083-31B fig. 2-60
6	Minus sign (-)	Trailing edge above horizontal: overbalance	H-8083-31B fig. 2-60

NOTES
1. Dimensions in inches. Do not scale: the SRM sets the values.
2. For reference. The applicable manual always governs.
3. Based on FAA-H-8083-31B · AC 43.13-1B.

REVISIONS

REV	DESCRIPTION	YEAR
A	First issue	2026

The Aviation Point. Structural repair reference

TITLE			
Control surface rebalancing			
DRAWING NO. TAP-DWG-134	REV A · 2026	SCALE NTS	SHEET 1 OF 1
APPLIES TO Primary surfaces and tabs			

DO NOT SCALE DRAWING

After FAA-H-8083-31B pp. 2-36 to 2-38 and fig. 2-60; AC 43.13-1B par. 4-36; TO 1-1A-1 par. 1.7.1. Generic: the manufacturer's manual gives the balance values.

Conditions on the stand

Condition	What you see	Source
Underbalance, plus (+)	Trailing edge goes below horizontal: tail heavy. Not usually allowed; poor flight behavior	FAA-H-8083-31B p. 2-36, fig. 2-60
Overbalance, minus (-)	Trailing edge rises above horizontal: nose heavy. Most manufacturers advocate a nose-heavy surface, within their tolerance	FAA-H-8083-31B p. 2-36, fig. 2-60
Balanced	The surface holds the level chord line	FAA-H-8083-31B fig. 2-60
Static balance	The tendency to stay stationary when supported from its own center of gravity	FAA-H-8083-31B p. 2-36
Dynamic balance	Keeping balance while the surface moves in flight; weights placed correctly along the span, in most cases forward of the hinge center line	FAA-H-8083-31B pp. 2-36, 2-37

Educational reference only, not approved data. Always consult the applicable SRM, AMM, or AC 43.13-1B and your certifying authority.

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2 Allowable damage

Three methods of measuring the balance

Method	Where and what it needs	Source
Calculation	Can be done without removing the surface. Needs the weight removed and the weight added by the repair, and the distance from the hinge center line to the center of the repair, to the nearest 0.01 in. Net weight times distance gives inch-pounds; compare with the specified tolerance	FAA-H-8083-31B pp. 2-37, 2-38
Scale	Surface off the aircraft, on a stand and jigs; a scale graduated in hundredths of a pound; bubble protractor for neutral	FAA-H-8083-31B p. 2-38, fig. 2-64
Balance beam	Used by Cessna and Piper; a tool made locally to the dimensions in the maintenance manual; a sliding weight on the beam is moved until the surface balances, and the manual says where the balance point is and where to add weight	FAA-H-8083-31B p. 2-38

3 Repair

Worked example: calculation method

Step	Working	Result
Weight removed (damaged skin cut-out)	Weighed on a scale	0.021 lb
Weight added (patch, rivets, primer)	Weighed before fitting	0.074 lb
Net weight added, ΔW	0.074 – 0.021	0.053 lb, aft of the hinge line
Arm d, hinge center line to the center of the repair	Measured to 0.01 in	14.37 in
Moment M	0.053 lb × 14.37 in = 0.7616	0.76 in-lb
Tolerance	The aircraft manual's figure, in inch-pounds	—
If the manual asks for a counterweight 2.50 in forward of the hinge	M ÷ a = 0.7616 ÷ 2.50 = 0.305	About 0.30 lb as arithmetic; weight, material and place from the manual

1. Get the value from the manual.
2. Weigh what is removed and added.
3. Pick the method.
4. Set up the stand.
5. Read and compare.
6. Correct as the manual says; fly; record.

Key points

- **Rebalance** after any repair adding weight fore or aft of the hinge, and after repaint.
- **Tail heavy** (+) is not usually allowed; nose heavy (–) is preferred.
- **Moment** = net weight x arm, to 0.01 in; tolerance: the manual.
- **Weights:** only as the manufacturer instructs; flight test.

MAIN SOURCES · FAA-H-8083-31B, Aviation Maintenance Technician Handbook: Airframe, chapters 2 and 4 · AC 43.13-1B CHG 1, Acceptable Methods, Techniques, and Practices: Aircraft Inspection and Repair · 14 CFR Part 43 · TO 1-1A-1 / NAVAIR 01-1A-1, General Manual for Structural Repair

SCAN · OPEN THIS GUIDE
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