

Chapter 3 Completing the Elevators

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3.1 Introduction

In this chapter you are going to complete the elevator closeout. The the elevator must be properly mated to the stabilizer, a trim tab must be built into the elevator and the elevator must be 100% mass balanced using lead in the mass balance areas forward of the hinge line at each elevator tip. The spar web and four ribs are pre-assembled into the elevator.

Steps to Completion

- Fit and install the counterweights in each elevator.
- Pre-fit and check the gap.
- Install the elevator travel stops.
- Set the elevator travel.
- Pre-fit the elevator to vertical stabilizer/rudder, or return to this section after the horizontal stabilizer is mounted on the fuselage.

Pre-fit

All parts in this chapter will need to be pre-fit prior to completing the instructions in that section.

A Word about Sanding and Cleaning

The steps described in the following pages refer to sanding, or sanding and cleaning specific surfaces. When we ask you to sand, or sand and clean we expect you to do each of the following steps every time.

1. Sand
2. Vacuum all sanded areas
3. Clean all sanded surfaces with Acetone

3.2 Parts List

Blueprints needed for this chapter include:

- 3059 – Horizontal stabilizer alignment tool

Elevator Travel Stops

#	Part Number	QTY	Description
1)	A2009	1	Completed elevator
2)	A2008	1	Completed horizontal stabilizer
3)	WTLD-EL	2	Elevator counterweights
4)	PH-250-8x10		Phenolic for travel stops



3.3 Construction Procedures

3.3.A Counterbalancing the Elevators

The elevators can be counterbalanced at this point of the construction phase or after the horizontal stabilizer has been mounted on the fuselage in *Chapter 17 Pre-fitting and Mounting the Horizontal Stabilizer*.

We recommend bonding in plenty of counterbalance weight at this point in construction. Then you can accurately balance the elevators after the horizontal stabilizer has been mounted and the elevators have been primed.



Make sure you pre-fit the elevator and the horizontal stab together. A pre-fit will help determine the required gap as it is explained on page 3.5.

Steps...

1. Raise the horizontal stabilizer 6" (150 mm) off the jig or workbench and level it.
2. Verify that the elevators can move freely without any binding.

You cannot balance an elevator that is *not* freely floating on the hinges.

Tip: Balance the left and right elevators separately. They will require different amounts of counterweight to offset the heavier left elevator that includes the trim tab.

3. Trim away just enough of the inboard face of the elevator counterweight arms to be able to slip one large lead weight into position.

Rest the weight as far forward as possible so the weight will provide the maximum counterweight potential.

The goal is to have an overbalance of lead as far forward as possible. Add enough lead so the L.E. of the counterweight arm hangs freely 1/2" to 3/4" (12 to 18 mm) below the 100% balanced position. The left elevator will use more counterweight to offset the trim tab weight.

Tip: All trim tab hardware must be installed prior to balancing the elevators.

Figure 3.3.A.1 Elevator arm with counterweight

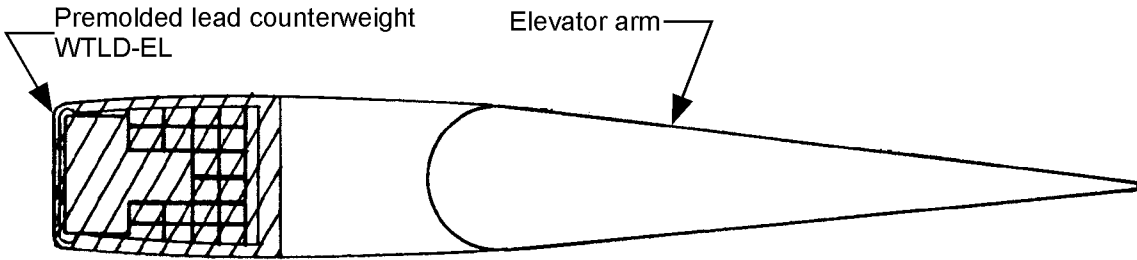


Figure 3.3.A.2 View of counterweight in elevator arm

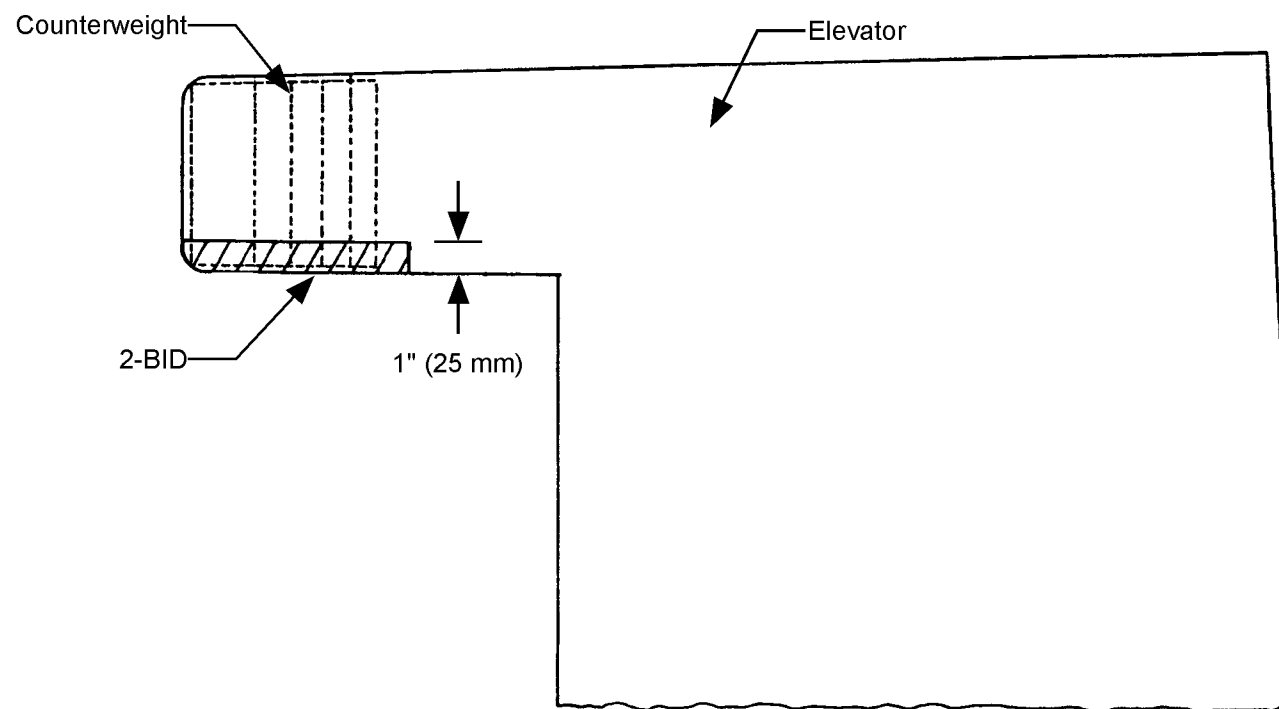


4. Add weight until you are satisfied that you have the appropriate amount.
5. Rough up as much of the inside surface of the elevator counterweight arm as possible.
6. Clean the area thoroughly with Acetone.
7. Pot the lead weights into the counterweight arm with an epoxy/flox mixture.
This is easier if you remove the elevator and set it on end by resting it against a wall or hanging it by the center bellcrank assembly. This way the epoxy/flox doesn't run out and the weights stay fully forward in the counterweight arm.
8. Allow the epoxy/flox to cure.

Steps after cure....

1. Sand the inboard counterweight face so the elevator moves freely on the horizontal stabilizer
2. Apply 2-BID to the inboard counterweight face, overlapping 1" (25 mm) onto the upper, lower and forward surfaces of the counterweight arm. See Figure 3.3.A.3.

Figure 3.3.A.3 A 2-BID applied to inboard counterweight face



3. Close out the edges of the horizontal stab in the counterweight area with 2-BID, 2-ply per side fiberglass prepreg.
4. Check the fit of the elevator by temporarily connecting the four hinges to the horizontal stabilizer. Use an alignment tool such as a stainless steel rod and run it through the hinge halves on the horizontal stabilizer and the elevators.

The elevator can now be carefully moved to its upward travel limit.

Gap guidelines:

- Keep about a 0.050" (1.25 mm) gap between the horizontal stab and the counterweight, and
- Make sure that the gap doesn't close up or open up when the elevator is moved up and down.

The end rib of the horizontal stabilizer is probably very close to being flush in the counterweight area. If it isn't, you can either flush out this face with micro or bond in a piece of Clark foam with 1-BID over it, or use a piece of 1/4" (6 mm) prepreg with the inside skin and core trimmed to slip into the cavity.

Gap check:

- If the horizontal stabilizer/elevator T.E. gap stays fairly even when you raise the elevator's T.E., your elevator skin placement is good enough.
5. Use micro to smooth out the inboard and forward faces of the counterweight arm.
Again, verify the gap doesn't close up when the elevator is moved.
 6. Sand a 3/8" (9.5 mm) radius along the forward top and bottom edges of the counterweight arm to lessen the drag when the elevator is trimmed out of neutral.

The elevator counterweight should now hang about 3/4" (18 mm) lower than the horizontal stabilizer. Final balancing will be described in a later chapter.

Figure 3.3.A.4 Flushing out the face of the horizontal stabilizer

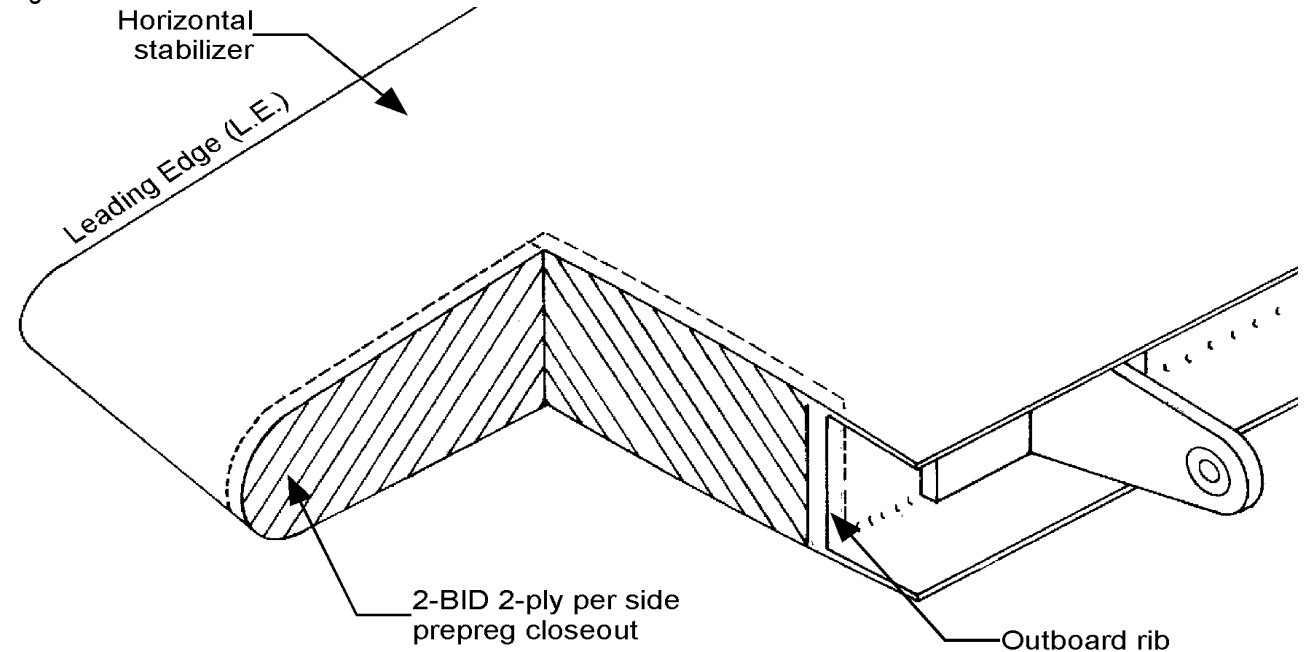
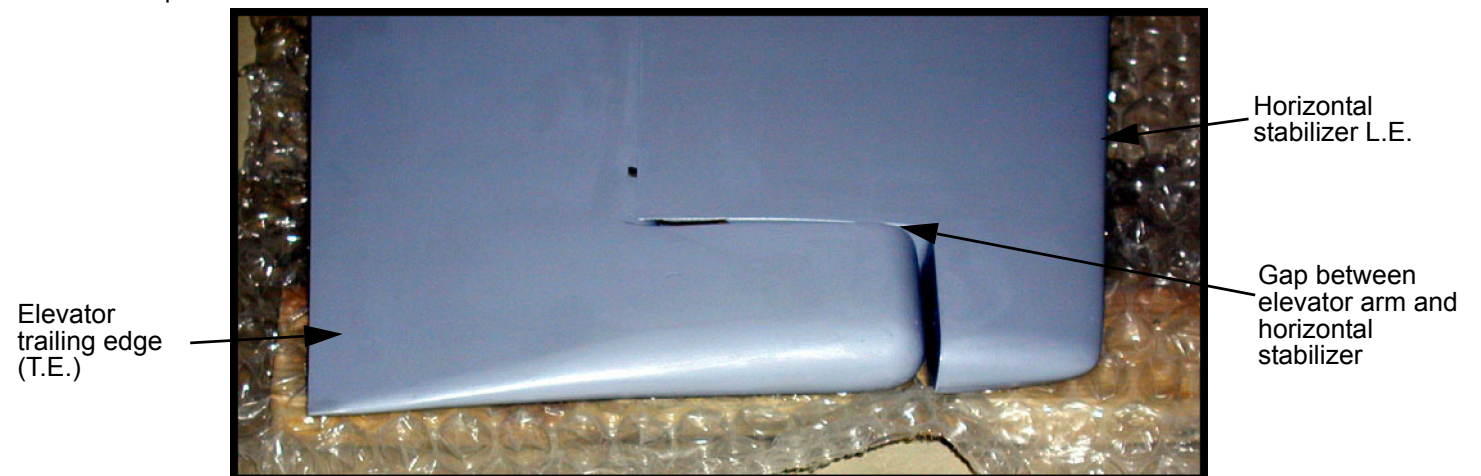


Figure 3.3.A.5 Gap demonstrated with elevator and horizontal stabilizer



3.3.B Setting the Elevator Travel

To provide the positive stops for the elevator you must install two pieces of phenolic to serve as the travel stops, one for up and one for down.

Setting the Travel

Using a Smart Level, set the elevator to the neutral position and zero the Smart Level.

- Neutral position – attained when the counterweight flange is flush with the horizontal stabilizer

Now set the travel using the Smart Level. Set 26° for the up position and 17° for the down position.

Tip: You can use the blueprint pattern gauge if you don't have a Smart Level. See the section 3.2 *Parts List* on page 3.2 for the blueprint number.

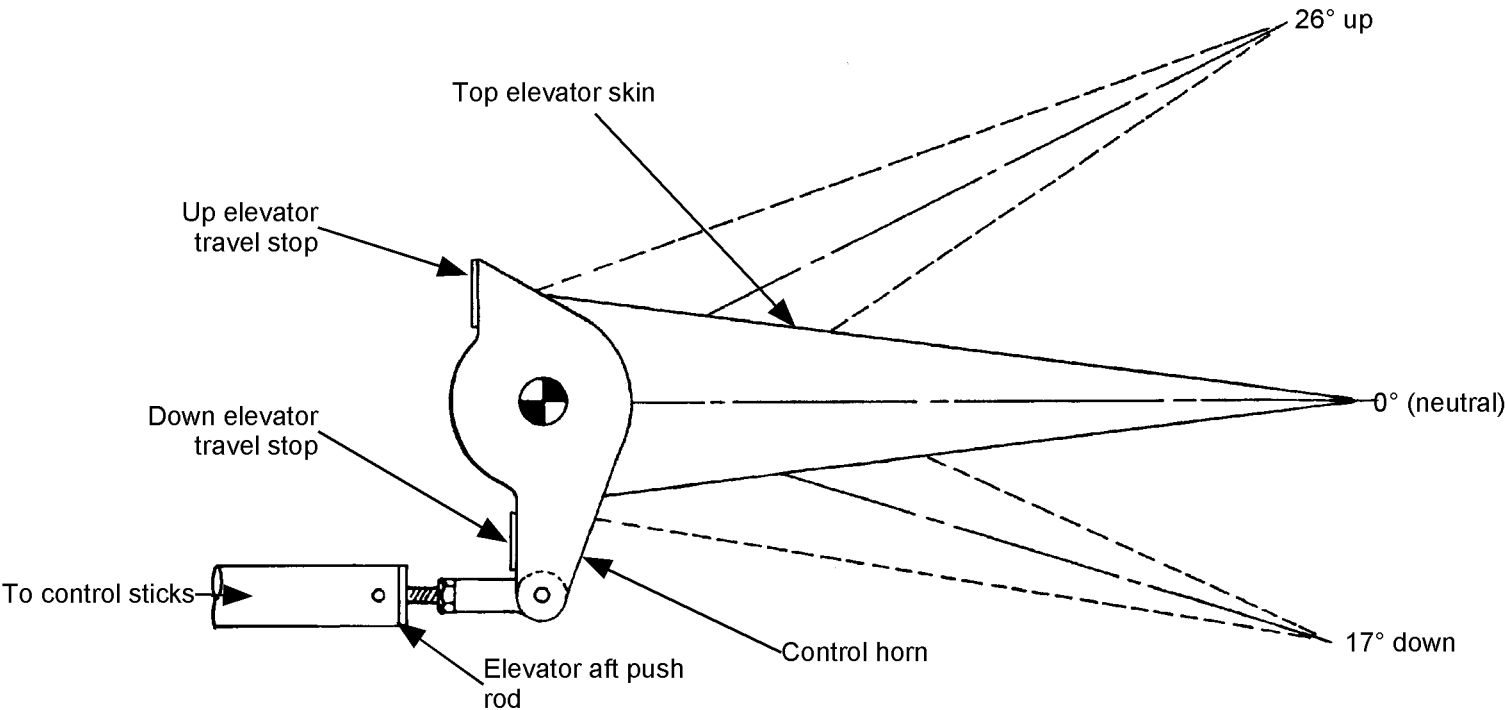
Installing the Travel Stops

Steps...

1. Raise the elevator to its full upper travel limit of 26°.

Tip: You will need to notch the T.E. of the horizontal stabilizer to attain full elevator travel. Do not notch any more than is necessary to get the proper deflection.

Figure 3.3.B.1 Elevator travel stop profile



2. Cut a 1/4" x 3" x 2" (6 mm x 75 mm x 50 mm) piece of phenolic.
3. Sand both sides of the phenolic thoroughly with 40-grit sandpaper. Also sand the bonding surfaces of the horizontal stabilizer
4. Install the phenolic using epoxy flox.
At the same time, form a fillet around all sides of the phenolic for the 4-BID.
5. Install the 4-BID to secure the phenolic.
6. Create the elevator "down stop" exactly as you did the "up stop".

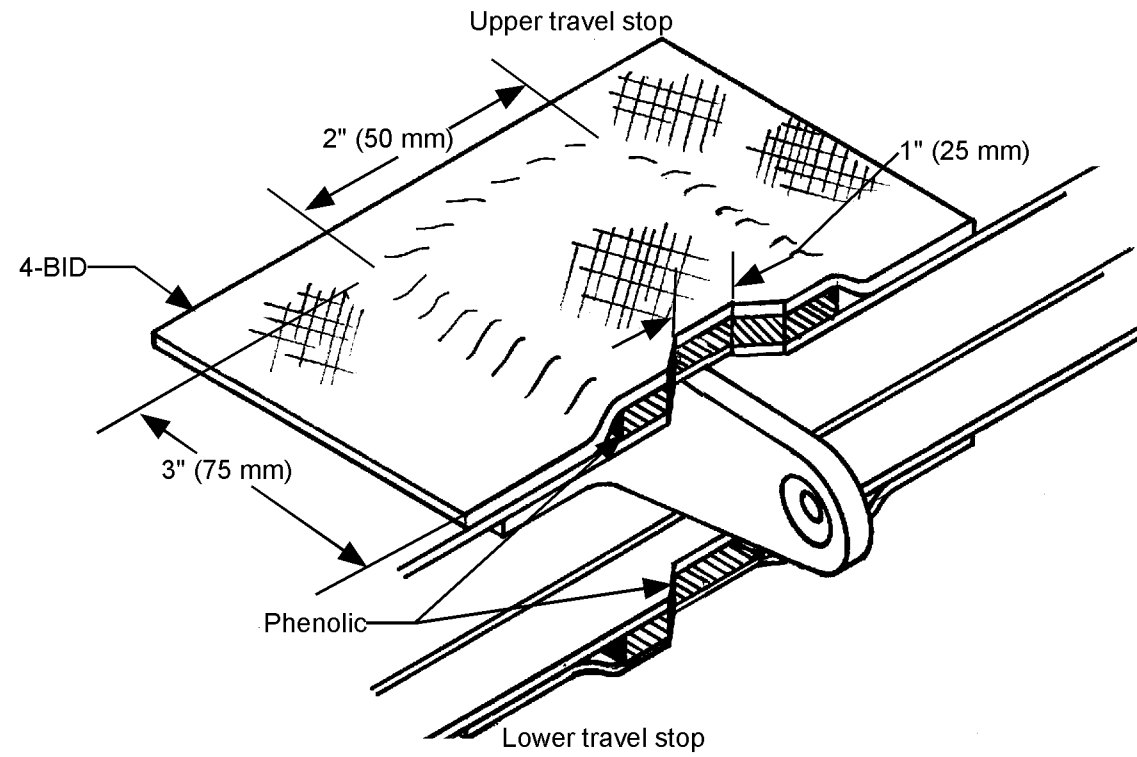
Trimming the Travel Stops

Now you need to trim each travel stop so the elevator will stop at the correct degree of travel.

1. Raise the elevator to its full upper travel limit of 26°. If this is not possible, set the travel by grinding a notch in the phenolic until the elevator can obtain 26°.
2. Rotate the elevator to its full down position and make sure it obtains 17°. If necessary, notch the phenolic down stop to obtain 17°.

This completes the trimming of both travel stops.

Figure 3.3.B.2 Making the elevator's up stop



3.3.C Trimming the Elevator to Rudder/Vertical Stabilizer Surface



The fit of the elevator to the vertical stabilizer/rudder is checked after the horizontal stabilizer is mounted on the fuselage.

Make sure you return to this section after the elevators are installed on the airplane. At that time the final trim of the inboard edges of the elevators can be completed.

Steps...

1. Move the rudder and elevator through all possible travel combinations.
2. Trim the inboard edge of the elevator skin, top and bottom, so there is always 3/16" (4.75 mm) of clearance between the elevator and the rudder/vertical stabilizer surface.

Figure 3.3.C.1 Trimming the inboard edge of the elevator skins

