Chapter 17 Pre-fitting and Mounting the Horizontal Stabilizer

17.1 Introduction

In Chapter 3 you assembled the horizontal stabilizer. In this chapter the horizontal stabilizer is pre-fit to the cradle already formed in the bottom fuselage shell. Then we complete the mounting of the horizontal stabilizer by bonding it into place.

We recommend that the more points you use to align the horizontal stabilizer the more accurate its location will be. Remember that the horizontal stabilizer's incidence needs to match the incidence of the wings. We describe an additional alignment option using the wings in *Aligning to the Wings* on page 17.4.

Steps to Completion

- Pre-fit the horizontal stabilizer
- Align the horizontal stabilizer to the wings or use the optional method of aligning to the fuselage.
- Mark the horizontal stabilizer placement.
- Pre-fit the vertical stabilizer as described in Chapter 18 in 6.3.A *Pre-fitting the Top and Bottom Fuselage Shells* on page 6.4.
- Complete final pre-fit the horizontal stabilizer
- Prepare the mounting cradle for the horizontal stabilizer placement.
- Bond the horizontal stabilizer in place.

Construction Prep.

We recommend that you body work and primer the top and bottom surface of the horizontal stabilizer before mounting it to the fuselage; otherwise the horizontal stabilizer is primed and sanded later in the construction process from an upside down position.

WARNING: Do not paint the center area on the underside of the horizontal stabilizer This is the area that will be bonded to the fuselage.

A Word about Sanding and Cleaning

The instructions in this chapter refer to preparing a surface or preparing a bonding area. When we recommend preparing a surface or a bonding area, we expect each of the following steps to be completed every time.

1. Sand the area using 40-grit sandpaper.
2. Vacuum all sanded areas.
3. Clean all sanded surfaces with Acetone.

17.2 Parts Lists

All the parts used in this chapter have been previously assembled or used. No detailed parts lists are necessary.

17.3 Construction Procedures

This section contains the pre-fit instructions for the horizontal stabilizer

17.3.A Pre-fitting the Horizontal Stabilizer

The horizontal stabilizer is a symmetrical airfoil. The fitting goals for the horizontal stabilizer are:

- An incidence of -0.5°, L.E. down,
- Level the left and right tips to 1/8" (3 mm) level to each other,
- Must be horizontally centered to the fuselage's center line.

Based on the above criteria, the horizontal capstrip cradles may need to be adjusted.

Steps...

1. Identify the top from the bottom of the horizontal stabilizer.
   - The bottom has the drain holes through the internal ribs that you drilled in Chapter 3.
   - When the trim tab is installed, it will be on the left side.
2. Mark a center line on the horizontal stabilizer top at BL 0, running from L.E. to T.E.

   In order to properly center the horizontal stabilizer, you need an accurate center line. Use the center hinge and mark a center line on the upper skin.
3. Lay the horizontal stabilizer into position on the fuselage, aligning the center line with the fuselage center line.

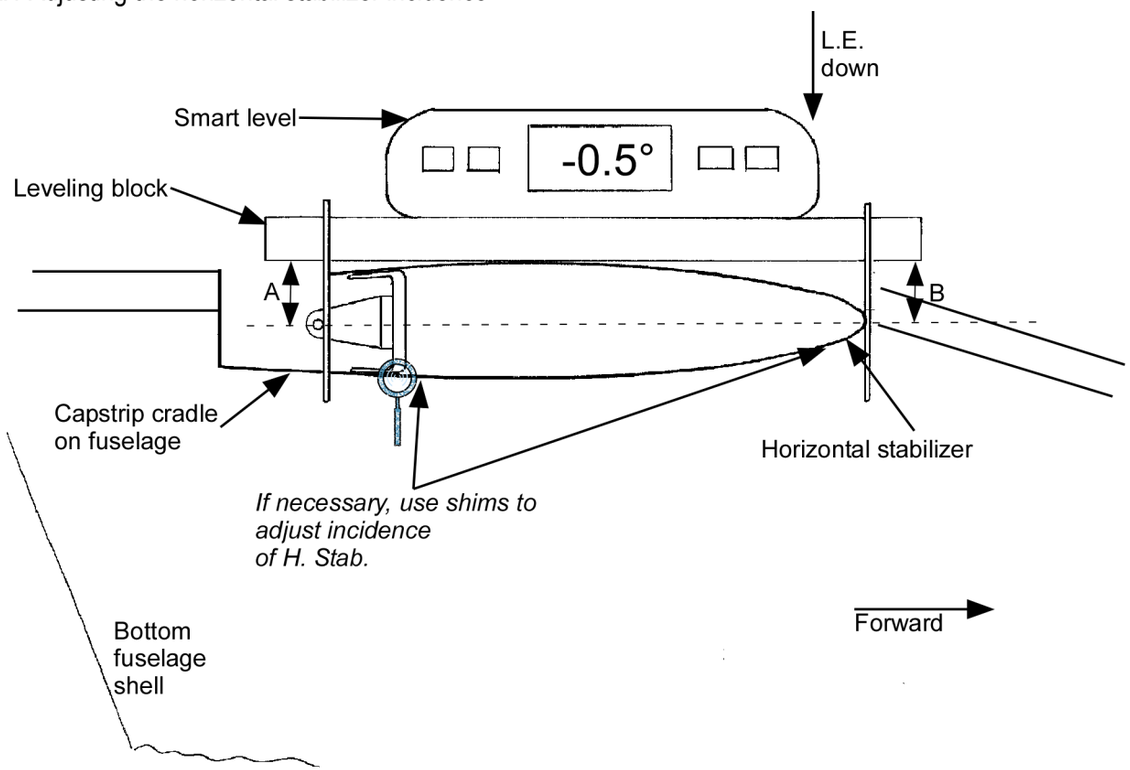
   See *Setting the Fuselage to Level* on page 6.5 for a description of marking the center line.
4. Use a Smart Level to attain a -0.5° horizontal stabilizer incidence.

   Make sure that points A and B in Figure 17.3.A.1 are equal distance from the leveling block to the center of the L.E. and T.E. of the horizontal stabilizer.

You may also want to verify the wing incidence at this time. See 9.3.E *Wing Incidence Templates* on page 9.15.

Tip: If necessary, use tapered tongue depressors as shims to adjust the horizontal stabilizer. For final shims you need to use fiberglass shims which can be created from scrap fiberglass leftover from wing fairings or other pieces. Wood shims are not approved structurally.

Figure 17.3.A.1 Adjusting the horizontal stabilizer incidence



5. Double-check your fore/aft placement.
   Verify that the L.E. of the horizontal stabilizer butts up against the forward edge of the fuselage cradle.
6. Level the left and right tips of the horizontal stabilizer
   Goal:
   - Try to level the horizontal stabilizer tips to within 1/8" (3 mm).

   A water level or a transit are good tools to check that the left and right tips of the horizontal stabilizer are level with each other. The best point to level to in the outboard areas of the horizontal stabilizer is the T.E. inside corner where the elevator will meet the horizontal stabilizer shown in Figure 17.3.A.3.

See Figure 17.3.B.1 to view a picture of the horizontal stabilizer resting on the capstrips, waiting to be leveled.

Next you will check the horizontal stabilizer's alignment. There are two options for aligning the horizontal stabilizer:

- Aligning to the wings – the preferred method since it is more accurate,
- Aligning to the fuselage – the alternative method if you don't have room in your shop for inserting the wings in the fuselage.

Continue with the alignment on the next page.

Figure 17.3.A.2 Leveling the horizontal stabilizer tips using a water level

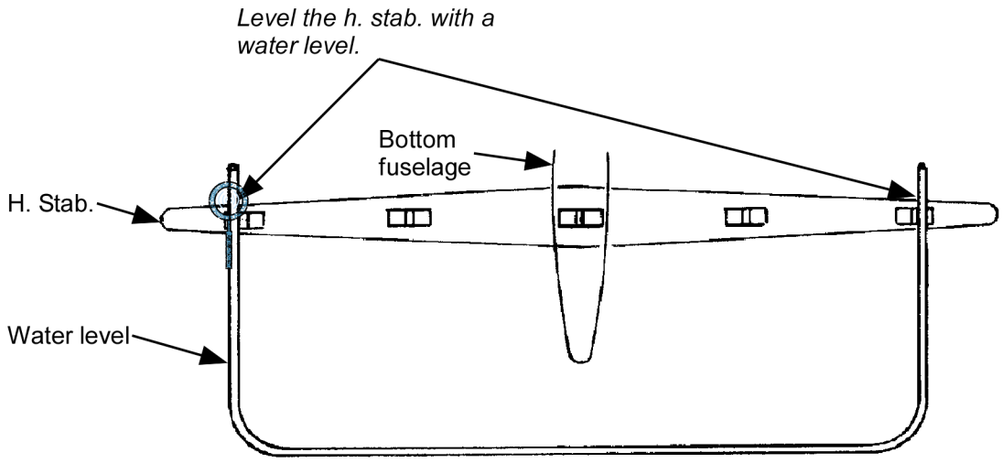
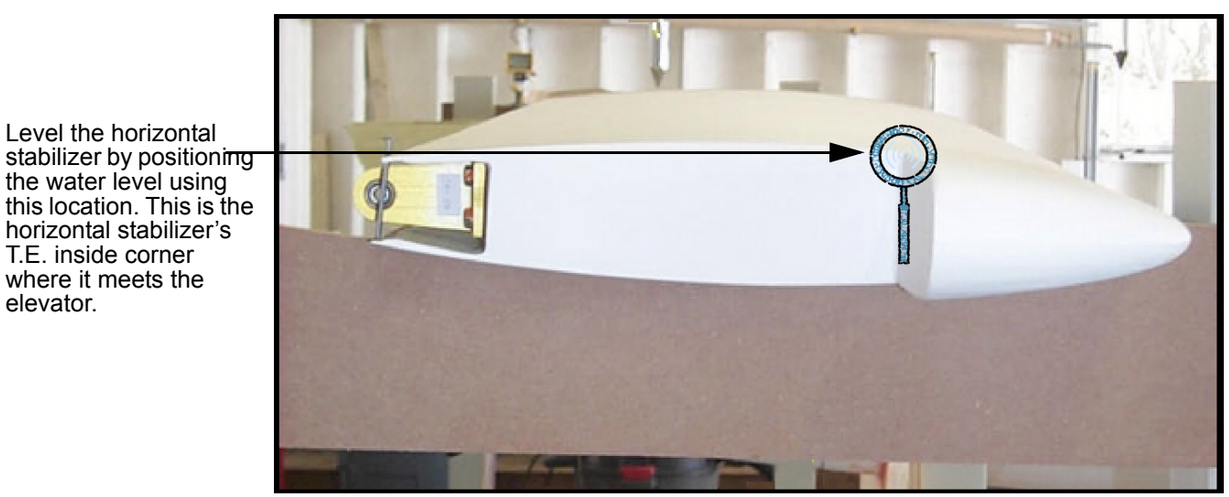


Figure 17.3.A.3 Detail view of the location for leveling the horizontal stabilizer



Aligning to the Wings

The preferred method of aligning the horizontal stabilizer is to use the wings. The more points you measure from for aligning the horizontal stabilizer, the more precise its location and angle.

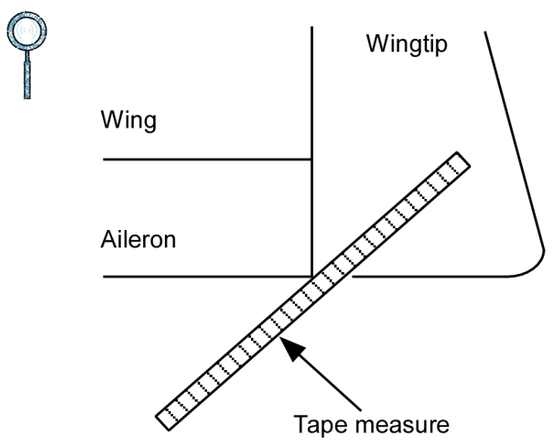
This option requires that the wings are temporarily inserted into position in the bottom fuselage. If you do not have the shop space, then use the optional alignment method on page 17.5.

Steps...

1. Measure the distance from the T.E. of the aileron where it meets the wingtip to the horizontal stabilizer's T.E. where it meets the elevator. The location is shown in Figure 17.3.A.3.
2. Adjust the horizontal stabilizer's position in its cradle until the left and right X distances are equal.

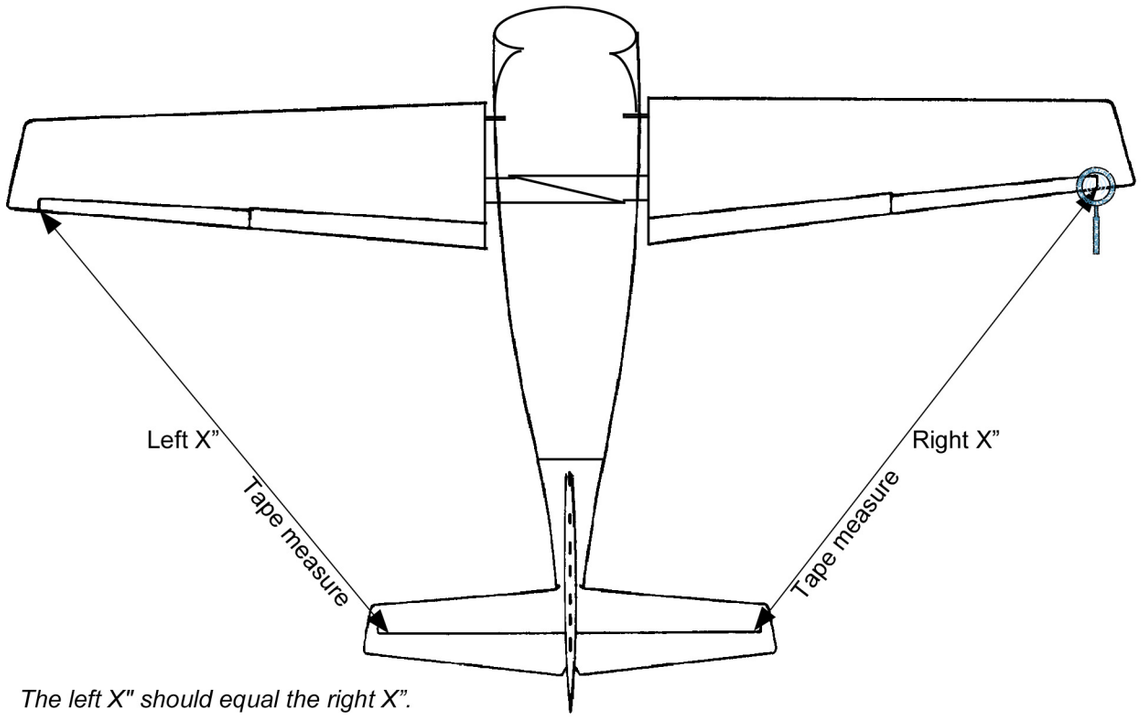
Tip: The incidence of the wings and the horizontal stabilizer also need to match.

Figure 17.3.A.4 Point to measure from on the wings



Now complete the pre-fit instructions for the vertical stabilizer in 18.3.B *Fitting the Vertical Stabilizer/Rudder Assembly* on page 18.4. Return to this section when you have finished the pre-fit.

Figure 17.3.A.5 Aligning the horizontal stabilizer to the wings



The left X" should equal the right X".

Aligning to the Fuselage

This option aligns the horizontal stab to BL 0 at the center line on the bottom fuselage.

Steps...

- Check that the horizontal stabilizer alignment is perpendicular to the fuselage center line.

  Goal:

  - Align the horizontal stabilizer to a 1/4” tolerance.

    An easy way to check this is to measure, using a 25' or a 7 meter tape measure, from the BL 0 mark at the top edge of the firewall to the horizontal stabilizer’s T.E. inside corner where the elevator meets the horizontal stabilizer See Figure 17.3.A.3.

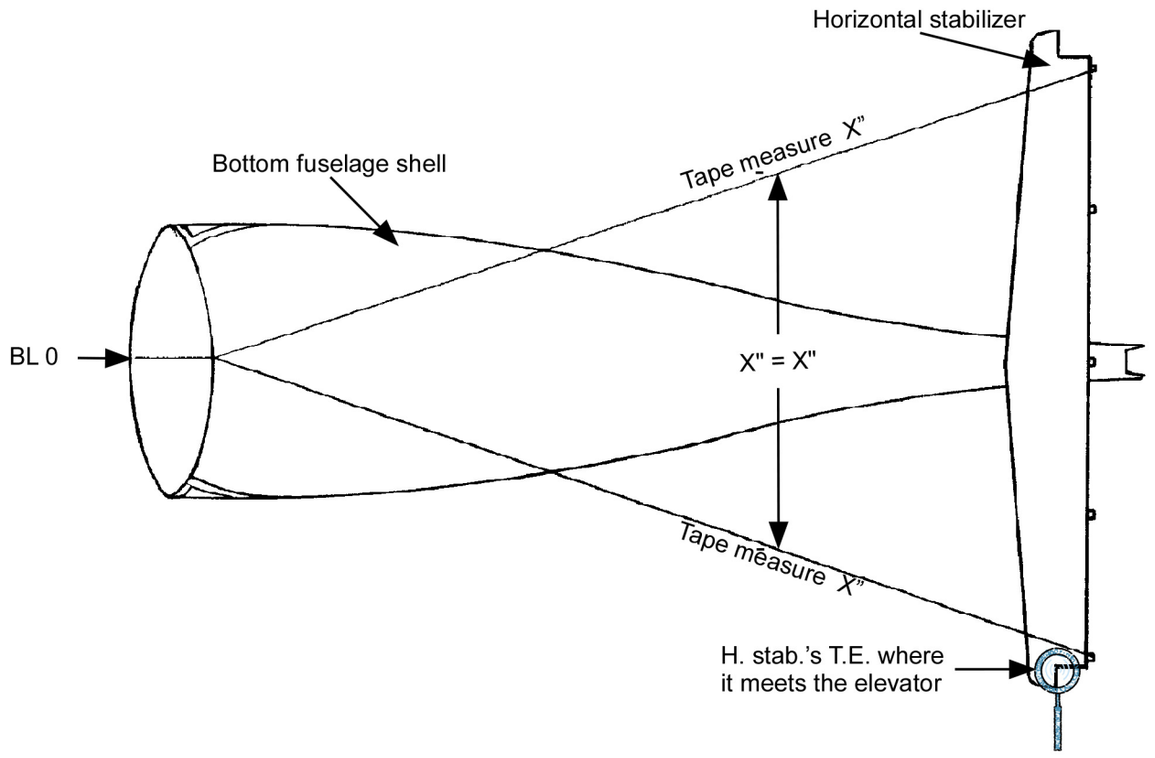
    X = measurement from BL 0 to horizontal stabilizer location.

    Left X inches (mm) must = Right X inches (mm).

  Compare the X” measurements and adjust the horizontal stabilizer accordingly, to the left or right.

STOP Now complete the pre-fit instructions for the vertical stabilizer in 18.3.B *Fitting the Vertical Stabilizer/Rudder Assembly* on page 18.4. Return to this section when you have finished the pre-fit.

Figure 17.3.A.6 Horizontal stabilizer to fuselage alignment check



X equals the measurement from BL 0 (at top of firewall) to horizontal stabilizer to elevator inside corner)

X” from BL 0 to right horizontal stabilizer inside corner = X” from BL 0 to left horizontal stabilizer inside corner

17.3.B Marking the Horizontal Stabilizer Placement

Now that you have pre-fitted the horizontal stabilizer, complete the following steps to document the exact location.

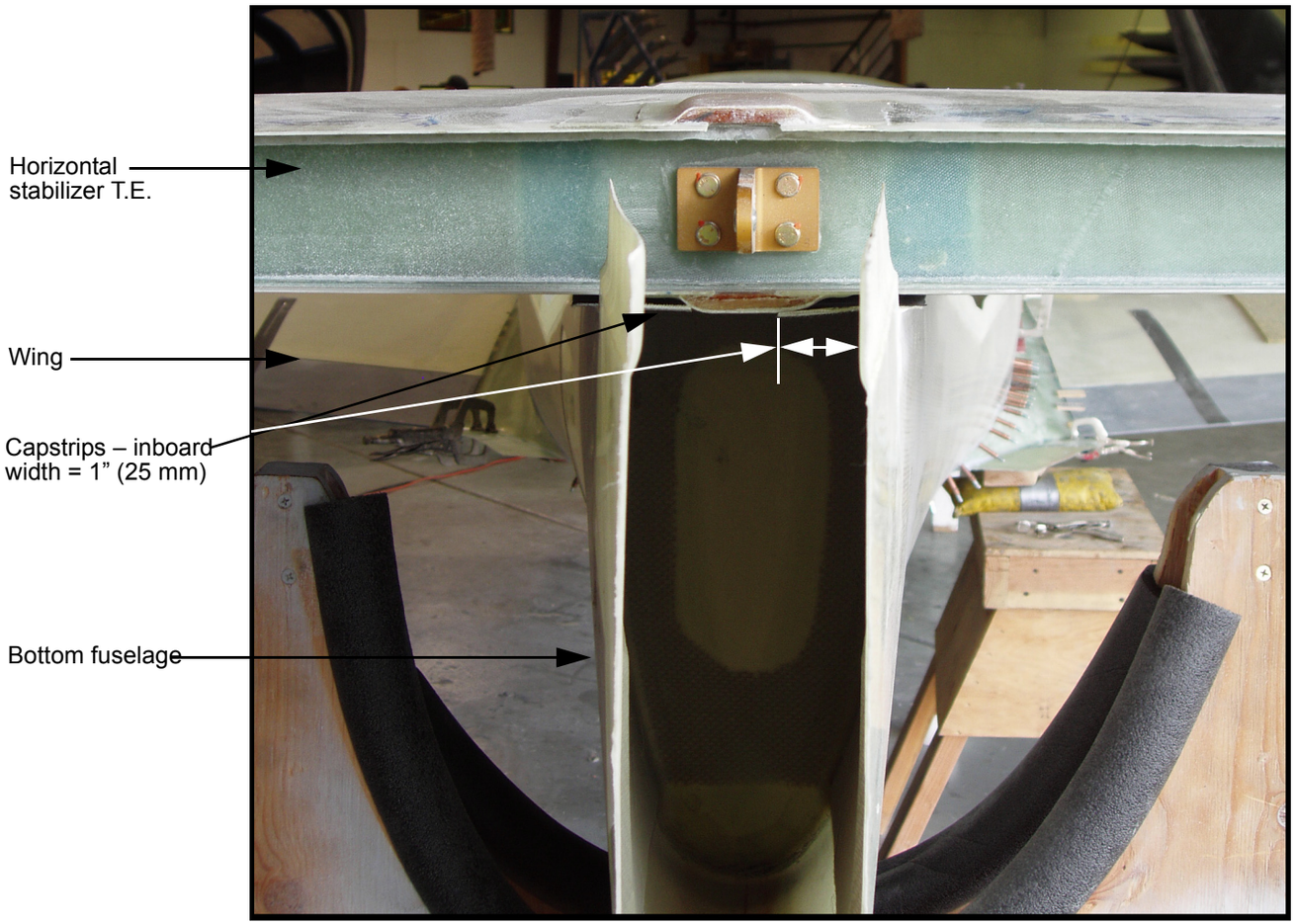
Steps...

1. Note the location of and the number of shims required to hold the horizontal stabilizer in position.
2. Make a few reference marks where the horizontal stabilizer joins the fuselage so you can easily relocate it into position.
3. Make an outline of the fuselage sides on the bottom surface of the horizontal stabilizer.
4. Remove the horizontal stabilizer from the fuselage.

Final Placement Check

Place the horizontal stabilizer back into position on the fuselage and realign it using the procedures in 17.3.A *Pre-fitting the Horizontal Stabilizer* on page 17.2 through page 17.2, steps 1-5.

Figure 17.3.B.1 Fuselage cradle capstrips for the horizontal stabilizer



17.3.C Bonding the Horizontal Stabilizer

Now you can bond the horizontal stabilizer into the mounting cradle. Later you will add additional BID tapes to secure the horizontal stabilizer to the fuselage but these are not added until the vertical stabilizer is built. Refer to Chapter 18 for building the vertical stabilizer.

Steps...

1. Perform another test run of fitting the horizontal stabilizer into the fuselage cradle to assure yourself that the cradle fit is okay and your alignment is satisfactory.
2. Use instant glue to bond a couple of small wood pieces to the bottom surface of the horizontal stabilizer. Snug the wood pieces up against the sides of the fuselage as shown in Figure 17.3.C.1.

   This will help keep the horizontal stabilizer from drifting out of alignment while curing.
3. Make a few reference marks to help locate the horizontal stabilizer in the fore/aft direction.

Preparing the Mounting Cradle

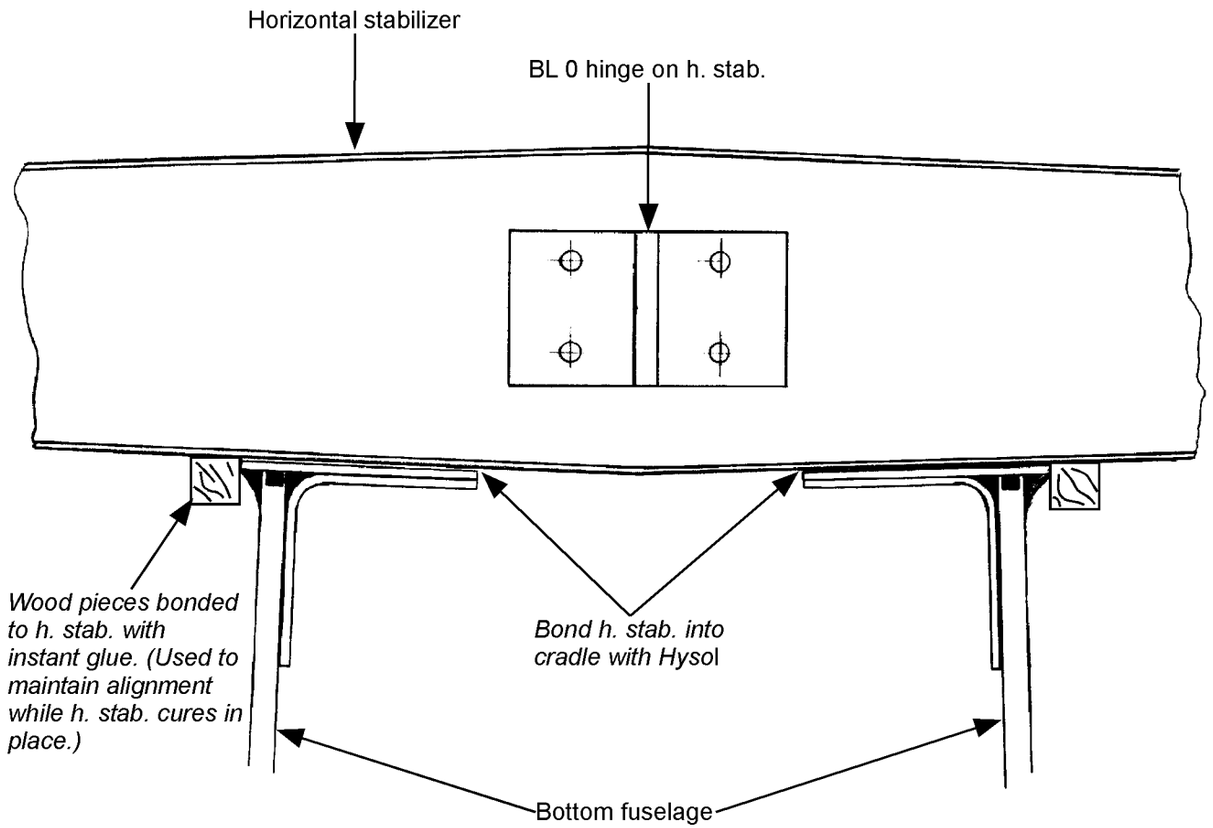
Steps...

1. Prepare the surfaces of the cradle capstrips.

   This prepares the mounting cradle for bonding to the horizontal stabilizer.
2. Prepare the bottom surface of the horizontal stabilizer where it will be bonded to the cradle capstrips.
3. Prepare a batch of Hysol (approximately five ounces or 140 grams) and apply a thin film to the bonding areas of the horizontal stabilizer and the cradle capstrips.
4. Mix a little flox into the Hysol and spread a thicker coat, mounded at the center, onto the cradle capstrips.

   Don't go overboard on the Hysol, your horizontal stabilizer should conform to the cradle to within .020" (0.5 mm)).

Figure 17.3.C.1 Bonding the horizontal stabilizer to the bottom fuselage capstrips



Final Mounting of the Horizontal Stabilizer

Steps...

1. Place the horizontal stabilizer into position on the fuselage. Weight the horizontal stabilizer with one shot bag (20 lbs (10 kg)) on each side of the cradles.
2. Realign the horizontal stabilizer for the final time using the procedures described in 17.3.A *Pre-fitting the Horizontal Stabilizer* on page 17.2 through page 17.2.
3. Adjust the alignment if necessary by inserting a small fiberglass shim between the horizontal stabilizer and the cradle to raise a certain point.

   Make sure you have squeeze out of any excess Hysol.
4. Recheck the horizontal stabilizer alignment after ten minutes.

   The Hysol may have settled which can slightly change the alignment.

Make sure nothing bumps or alters the horizontal stabilizer while it is curing.

Steps after cure...

1. Remove the weights after the Hysol has cured.
2. Prepare the area where the bottom surface of the horizontal stabilizer meets the outboard sides of the fuselage.
3. Apply micro radii where the bottom surface of the horizontal stabilizer joins the outboard sides of the bottom fuselage.
4. Apply 2-1/2" (65 mm) wide, 2-BID strips to secure the bottom surface of the horizontal stabilizer to the bottom fuselage sides.

The top surface of the horizontal stabilizer will be secured to the vertical stabilizer later in construction. See Chapter 18, 18.3.I *Closing the Vertical Stabilizer/Rudder Assembly* on page 18.29.

Figure 17.3.C.2 Securing the bottom horizontal stabilizer surface to the bottom fuselage