

TITLE: **ROTOR HUB SHIMMING PROCEDURES**
DATE: **3-19-2003**
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MODEL(S): **EXEC 90, EXEC162F**
PART NUMBER OF THIS DOCUMENTATION: **D49-3**
PAGES INCLUDING THIS SHEET: **9**
ALSO ATTACHED:

The EXEC 162F Rotor System will require hub shimming at different intervals depending upon how smoothly you keep the rotor system adjusted. This section uses the "See-Do" concept like the Construction Manuals for clarification of the maintenance to be performed.

SERVICE NOTES:

1. The following tools are required to preform the hub shimming procedures:
 - 3/8" torque wrench in ft. lbs. capable of 30-35 ft. lbs.
 - micrometer in thousandths of an inch
 - 3/8" drive ratchet with 9/16" socket
 - 9/16" box and open end wrench
 - 1/4" punch with a 3" shank
 - steel hammer and/or plastic hammer
 - snap-ring pliers that will fit the holes on the snap rings
 - spring scale
 - set of allen wrenches or at least one 1/4" and one 1/8" allen wrench
 - a clamp that spans the distance across the teeter blocks and has 4" jaws minimum
 - one rotor hub shimming fixture. See page 59 in this manual for a drawing of the fixture with dimensions and specifications. This fixture is also available from RotorWay, part number E08-6000.
 - one dial indicator with a 4" reach that reads in thousandths.

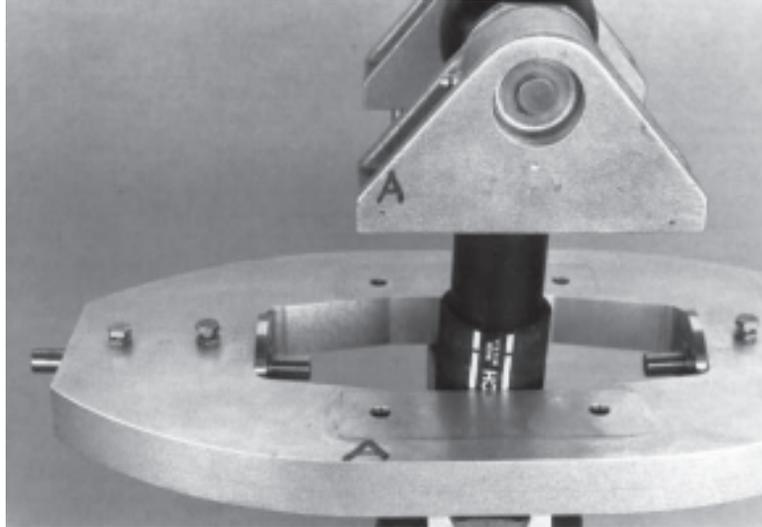
Photo #1: Tools required.



2. Start by removing the blades from the helicopter. Set the blades on their sides or on the leading edge. (Never set the blades on the trailing edge.)
3. Turn the hub so that the numbers stamped on the hub plate are on the pilot side and the hub is aligned fore and aft to the helicopter. It makes no difference which side of the helicopter the numbers are on, but it is good practice to establish a normal and routine procedure.
4. Next, mark the hub and pitch links with a marker pen so they can be put back on exactly the way they were removed. Mark the pitch links indicating which blade (master or slave) they attach to and also the up or down position. Then set aside.

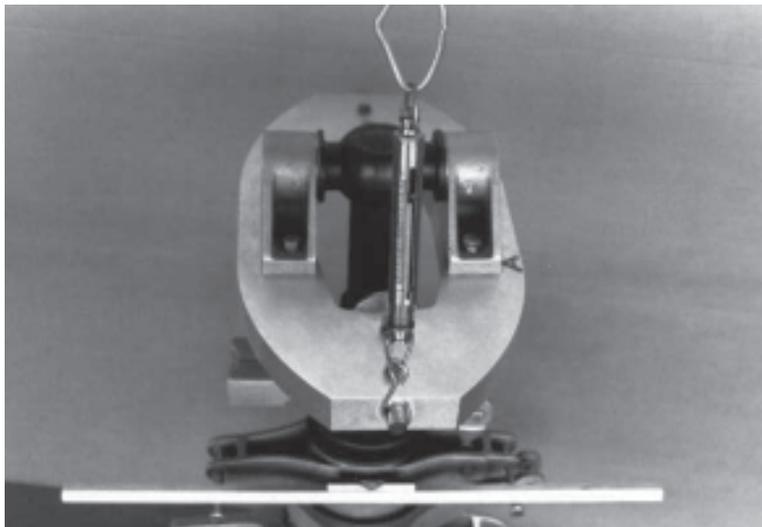
- Next using the same marking on the hub, mark the shaft in relation to the hub and the teeter blocks. See photo #2.

Photo #2: Mark the hub plate, shaft and teeter blocks.



- Place the spring scale on the outboard pin and pull up or down until the hub plate starts to move. Read the scale and record the reading for later reference. See photo #3.

Photo #3: Measuring hub pressure with spring scale.



7. Place the "C" clamp across the teeter blocks so that the jaws clamp at the base, close to the center of the block (photo #4). Using the 9/16" socket wrench and open end wrench, remove the locking nut from the bolt. After the nut has been removed and washers taken off, place the box wrench on the teeter block bolts. Turn the wrench so that when you tighten the "C" clamp slightly, the wrench will begin to move easily. Tighten the clamp down by feel so that you find the spot where the wrench will move the easiest. Place a small amount of grease on the bolt threads and drive the bolts out through the hub plate with the hammer and punch. **CAUTION:** If the teeter block bolts do not move easily, some of the aluminum will be galled out of the hub plate holes. After the teeter block bolts have been removed, remove the "C" clamp. Remove the two remaining teeter block bolts from the other teeter block and set the hub plate on the counter balance just below the shaft knuckle. Be careful not to scratch or damage the hub plate. See photos #4 and #5.

Photo #4: Drive out the teeter block bolts.

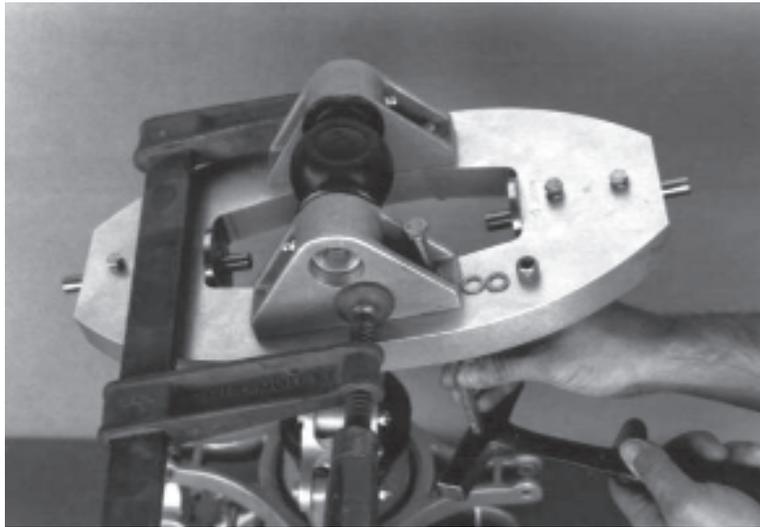
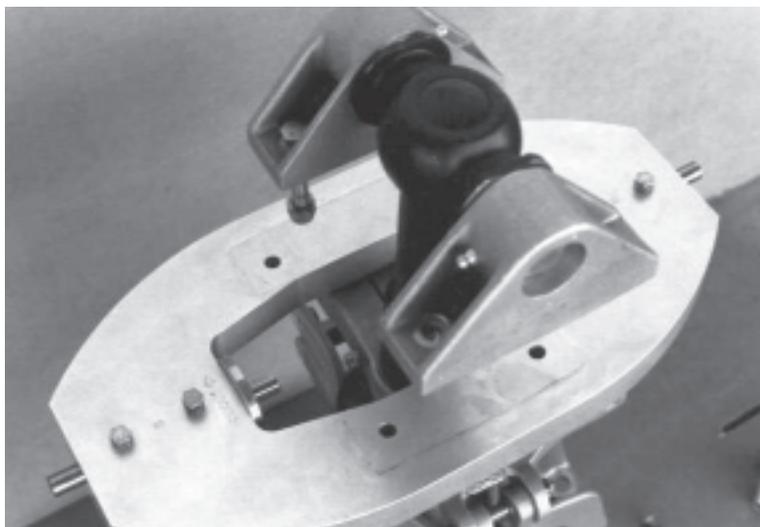
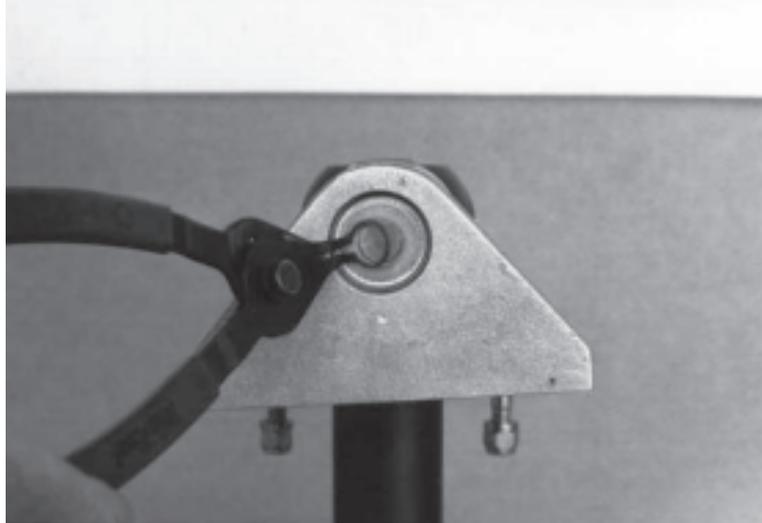


Photo #5: Rest the hub plate on the counter balance.



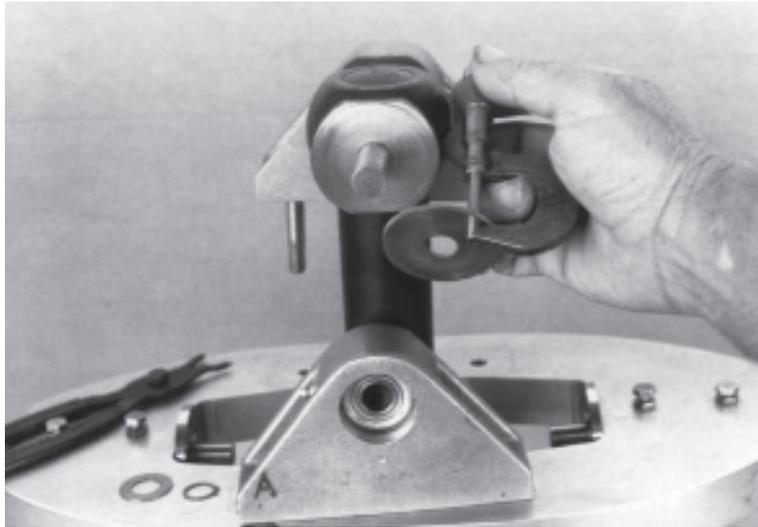
- Next remove the two snap rings and the large thin washer from the main drive pin. See photo #6.

Photo #6: Remove snap rings.



- Deburr the edge of the snap ring grooves and edge of the pin with 400-600 wet and dry sandpaper.
- With hand pressure or a light tap from a plastic mallet, remove the teeter blocks from the main drive pin. **CAUTION:** If shims come off with the teeter block, carefully put them back on the drive pin in exactly the same way they came off. Inspect the teeter block for any cracks and galling the shims may have caused.
- If the bearing replacement is necessary in the teeter blocks either by R.C.O. time or On Condition, follow the next steps. If the bearing is OK, skip the next sequence and go to step 12.
 - Clean teeter block in acetone or equivalent solution.
 - Heat block to 250 degrees in an oven and press the old bearing out of the block. The bearing should come out with light pressure.
 - Clean all mating bearing surfaces and place a small amount of Loctite #609 on both the outer race of the bearing and the inner hole of the teeter block. **CAUTION:** Do NOT let the Loctite get into the greased holes in the center of the bearing.
 - Reheat to 250 degrees and press the new bearing in place using a tool or spacer that will allow you to press on the outer race of the bearing and not the inner race.
 - Keeping on a flat surface, press the bearing until flat with the inside of the teeter block. Let cool and check the bearing for smoothness with your fingers.
 - Give the bearing 3-4 shots of grease through the grease fitting on the teeter block and wipe off excess grease. Repeat process for the other teeter block.
 - Remove the hub plate, inspect the condition and clean. Do not remove your identification markings.
- Next, carefully remove the steel and delrin shims from the main drive pin. Find a smooth spot on these parts and measure all shims together with a micrometer. (Remember not to mix the pilot and passenger side shims.) See photo #7.

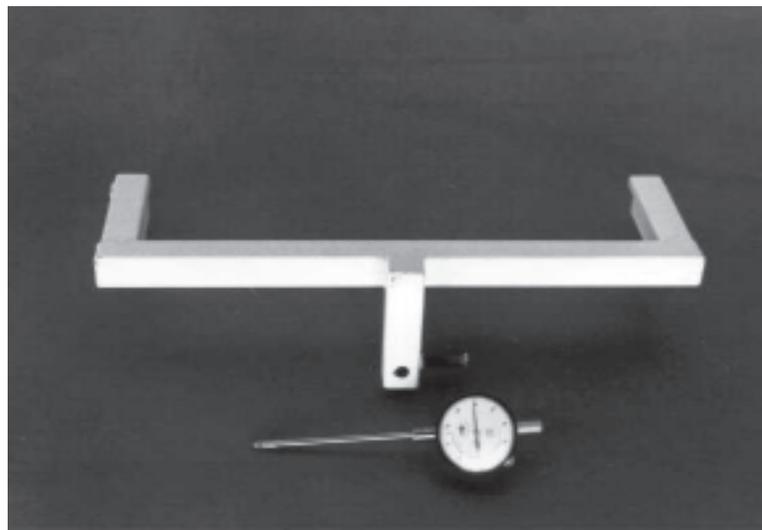
Photo #7: Measure the shims.



13. Remove the four (4) allen set screws on top of the shaft knuckle. NOTE: There are two (2) screws in each hole. Failure to remove all four set screws will result in damage to the main drive pin. Lightly tap the pin out with a plastic hammer.
14. Inspect the shaft knuckle hole and clean with acetone.
15. After cleaning all parts, align them in sequence for re-assembly as shown on print E49-2000.
16. Place a light coat of grease on the main drive pin and in the shaft knuckle hole. Install the new drive pin in the knuckle with the flats in the up position. Position pin so there is equal pin on either side of the knuckle. DO NOT insert allen set screws at this time.
17. Place the delrin shims on both sides of the appropriate stainless steel shim and measure with a micrometer. You should choose shims that will give you the same thickness as measured in step 12. Place a thin coat of grease on the outer surface of the shaft knuckle and on all shims.
18. Place the steel and delrin shims on the main drive pin. All shims should have a light coat of grease on every side. Do this to shims on both sides of the hub knuckle. Refer to print E49-2000.
19. Place the clean hub plate back on the shaft in the correct position according to your earlier marks. Refer to photo #2.
20. Place one teeter block on the main drive pin with the bearings closest to the knuckle. Checking to insure that the reassembly is the same as the disassembly (check your identification marks), align the holes with the hub plate and insert the bolts through the teeter blocks and through the hub plate. Torque the bolts to 24 ft. lbs.
21. Place the other teeter block on the main drive pin following the same assembly procedures.
22. Replace the clamp on the teeter blocks and tighten slightly as in Note 7 and photo #4. Replace the bolts through the holes with grease and using the clamp, align the holes. Use a plastic hammer to drive the bolts through the holes. (If the bolts drive hard, adjust the clamp pressure so that they go in with ease.)
23. Torque the bolts down to 24 ft. lbs. and remove the "C" clamp.

24. Rock the hub back and forth 15 to 20 times to set the shims and grease in their respective positions.
25. After reassembly, two objectives must be reached:
 - A. The hub must be on center of the main shaft.
 - B. The hub pressure must be between 8 to 12 lbs.
(This process is difficult to achieve on the first attempt).
26. Measure the hub pressure. Place a spring scale on the outboard pitch pin and pull up or down very slowly until the hub breaks loose and moves. Note the poundage of pull required.
27. Measure the hub to shaft center position by using the hub fixture shown in photo #8. See drawing on page 59.

Photo #8: Hub alignment fixture and dial indicator.



This fixture is easy to fabricate and will give you very accurate results. Place the fixture on the hub. Push the fixture up against the outboard pitch pins and hold the fixture down on the 3 rivet point contacts located on the bottom. Securely hold the fixture on the hub and rock the hub slightly back and forth until the needle on the indicator stops moving in a central position. Then zero the indicator. Carefully remove the fixture and place it on the other side of the hub using the same procedures. Repeat the steps and determine how far the hub is off center, if any, and which direction it needs to move. If all procedures were done correctly, you should not be any more than .002 to .004 off center and hub pressure will still be within tolerance. Make a note on paper and determine which teeter block should be removed to center the hub on the shaft. Change the stainless steel shims as necessary, following the procedures as previously outlined. The tolerance and specs that must be achieved are:

- A. Hub centering is within .001 T.I.R.
- B. Hub pressure should be 8 to 12 lbs.

When the hub is correctly centered and hub pressure is within the limits specified, final assemble the hub. See photos #9 through #13.

Photo #9: Hub alignment fixture.

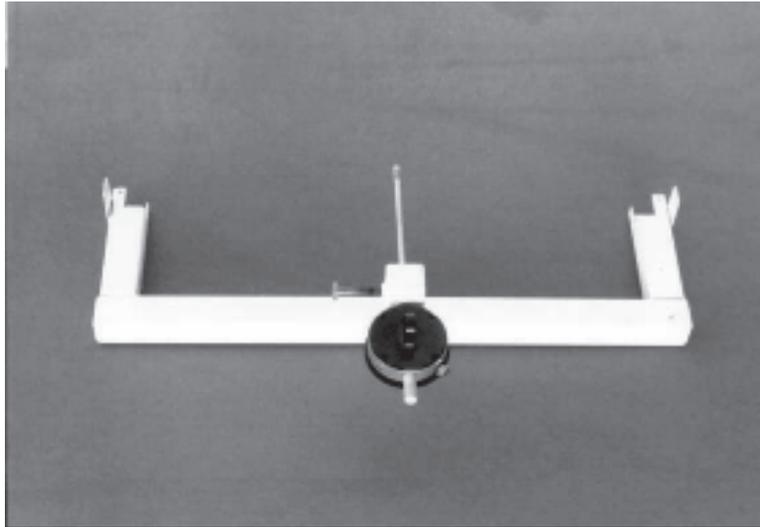


Photo #10: Hub fixture located on hub.

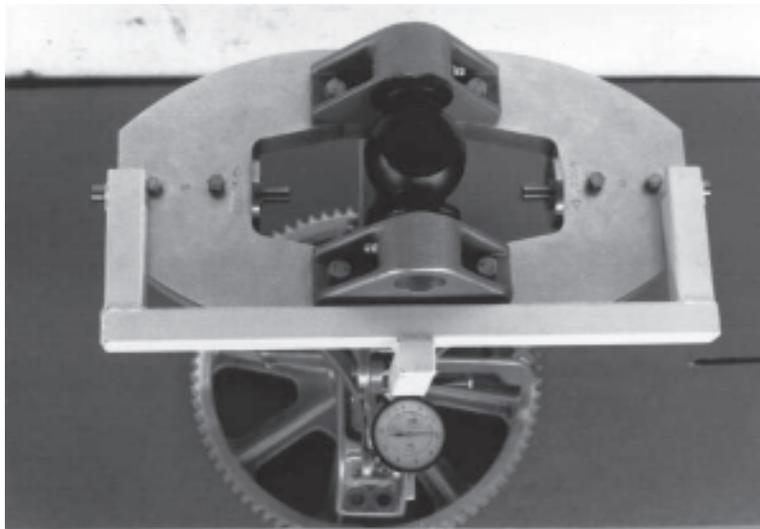


Photo #11: Proper placement of hub fixture.

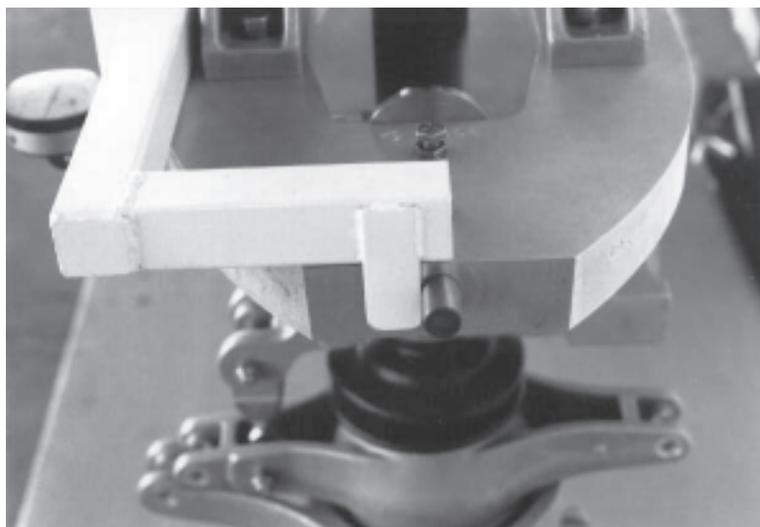


Photo #12: Dial indicator reading on center of main shaft.

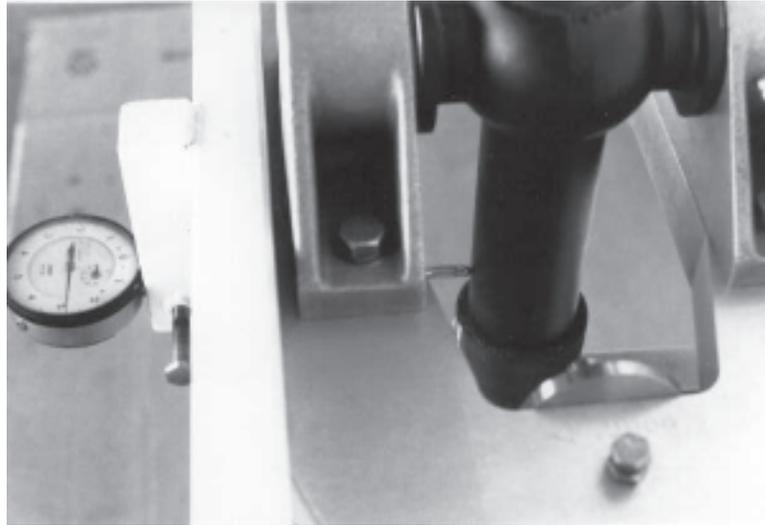
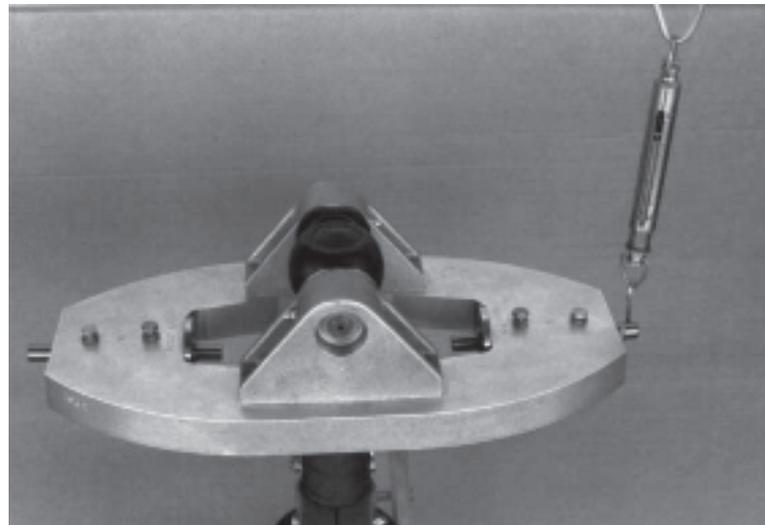


Photo #13: Reading poundage pull on hub.



28. Replace new large flat washers and snap rings on the main drive pin. **CAUTION:** Be sure you place the correct side of the snap ring towards the outside of the pin. Refer to the Construction Manual Tail Rotor section for the correct snap ring procedures.
29. After rocking the hub back and forth 10 to 15 times, replace the 4 set screws on the top of the knuckle. Tighten the first set screws against the main drive pin and the second set of screws against the first set of screws as a safety lock. (Do NOT use Loctite on these screws.)
30. Recheck the torque on the teeter block bolts and recheck the hub centering.

HUB SHIMMING FIXTURE DRAWING

