How to Make Tail Wheel Donuts and Spacers

Or

Time to make the donuts!

Long-time Seabee mechanic, Ken Dayo, sent in the following article. Ken has helped a lot of Seabee owners and offers this do-it-yourself project to replace your tail wheel donuts and shims. Thanks Ken!

Aluminum shims:

The following shows how to form a flange on the inner hole of aluminum shims that go between the rubber donuts for the tail wheel shock absorber.

The Shims are made from .040" 2024-T3 Alclad aluminum sheet available from Aircraft Spruce or other aircraft supply houses. A 2' x 2' sheet is $22.99 (2025 prices) which should make 36 shims. The shock absorber uses 25 shims so you will need only one aluminum sheet for one set. After forming, the shims should at least be primed with a good waterproof primer (epoxy). They can be painted but they don't have to be.

Rough cut the aluminum shims out using a bandsaw or metal shear. Cut out 4" squares and then drill a 1/4" hole 2" from the edge. Then drill a 1/4" hole in the board 2" from the edge and press in a 1/4" pin. Clamp the board to the bandsaw. Now the aluminum squares can be spun around a 1/4" pin and cut to rough 4" diameter. Be sure to keep the protective plastic on the aluminum and cut them out with the plastic side down or else the aluminum will get very scratched. Cover the surface of the aluminum sheet with tape if there is no plastic on it.

The final size is approximately 3.85" in diameter. That dimension is not critical, but minimum variation from one part to the other is important because they want to fit into the forming tool without free play in order to have the formed flange come out the same height all around. You can bolt them all together through the 1/4" hole and turning 25 of them down to 3.85" all together. A lathe is not required, but nice to have, or the shims can be placed over a pin in another board, one at a time, and sanded to final diameter. The board can be slid up against stops clamped to a bench with a belt sander clamped to the bench at the correct distance. Only 25 shims are needed but it's nice to make a few extra ones. If you have a vertical belt sander use that the same way it's much easier.

Use a 1-1/8" hole saw to cut the center hole in the discs then Deburr them. This makes a shallow (about 3/32"-1/8" high) flange when pressed into the forming tool. A 1" hole will make a taller flange but it might need to have the aluminum annealed with a torch (propane) around the inner hole diameter in order to form the taller flange without cracking. A 1-1/8" hole is more than satisfactory.

Jig for cutting discs and donuts

Drilling large center hole (1-1/8") on a lathe

Spacers ready for forming

Forming tool:

The forming tool is made of a short piece of 1-1/4" electrical metal tubing (EMT-the thin wall stuff). Two pieces of 3/4" thick Oak (or Maple) and four 1/4" bolts with large washers and nuts. Two steel ball bearings are pressed through the hole to form the flange.

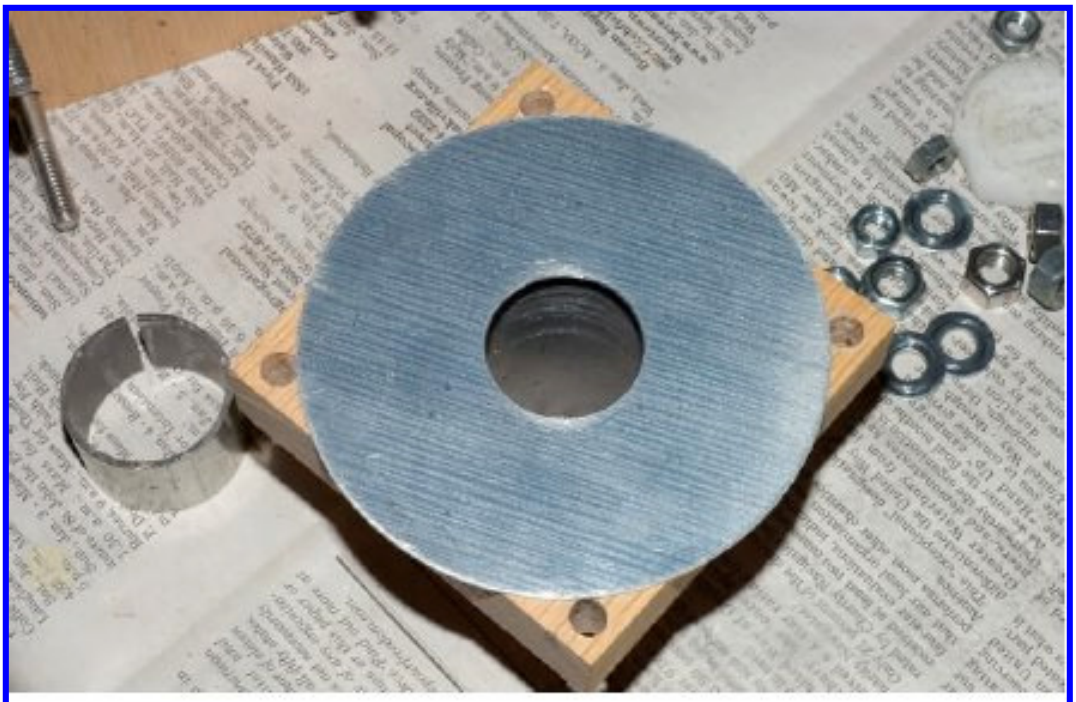
A piece of 1-1/4" EMT (Electrical Tubing) a few inches long is inserted into an Oak (or hardwood) board to make the forming tool. A 1-1/2" hole in the board made with a hole saw allows the EMT to be pushed in flush with the opposite face. Some trimming on the inside of the hole with the Dremel tool may be necessary but it must fit tight.

The dimensions of the 1-1/4" EMT are a little over 1-1/2" O.D. and a little over 1-3/8" I.D. The inner edge of the EMT is quarter-round radiused across the full thickness of the tube to provide the bend radius for the aluminum shims. This can be done with a lathe or by hand with a file or Dremel tool.

The other "clamping board" has a 1-3/8" hole in the center. A short metal spacer is inserted in the 1-3/8" hole to keep the 1-1/4" ball bearing centered. The spacer is made from a short piece of the 1-1/4" EMT tube with a 3/8" wide slit cut out of it so it can be squeezed to fit the 1-3/8" hole.

Forming tool parts. Large tube must fit tight.

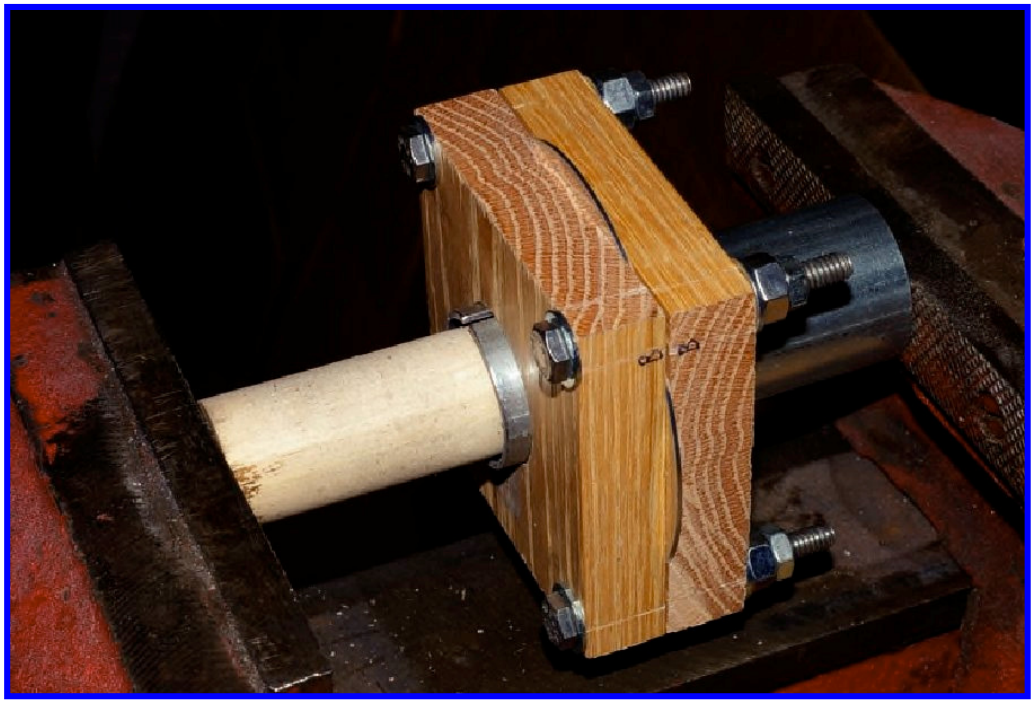
Hose clamp used for closing the gap on small tube. Remove when in place.
(flush with the blank spacer)



Disc in place ready for clamping in forming tool (top photo)
Slit spacer removed ready for 1-5/16" ball AFTER the spacer is removed (bottom photo)

Disc clamped in forming tool (top photo)
1-1/4" ball in place ready for first forming step (bottom photo)

Forming tool with dowel pusher. Note depression in the dowel. 1-1/4" ball is shown.



Forming tool in vise. Push the 1-1/4" ball all the way through.

Clamp the aluminum shim between the oak blocks. When drilling the holes for the 1/4" bolts in the blocks, begin with them slightly offset toward the center of the large holes and enlarge them so there is no play between the bolts and the aluminum shim.

Install the slit EMT spacer in the 1-3/8" hole and apply wax to the 1-1/4" steel ball and insert into the hole for the first forming operation. Use a hose clamp to squeeze the slit EMT closed. When the slit EMT is touching the aluminum shim loosen the clamp so it fits tight. See photo above.

Cut a hollowed out depression in the center of a wood block or dowel to use as a pusher. A 1-1/4" closet hanging dowel works perfectly. Press the steel ball through the hole in the aluminum using a vise or heavy hammer. The ball must go all the way through the forming tool.

Remove the slit EMT spacer with the hose clamp and press the waxed 1-5/16" steel ball through the large hole. It is not necessary for the ball to go all the way through the disc this time. Stop when much resistance is felt on the vise (about one turn). This will provide a nice flange about 1-1/2" in diameter, 3/32" high.

Rubber Donuts:

The rubber donuts are made from 70-durometer neoprene (very hard) and can be made from 3/8" thick sheet material available from McMaster-Carr, Rubber Sheet Warehouse and other suppliers. One foot long, 36 inches wide x 3/8", 65-70 Durometer, Black, 2500 PSI Tensile Strength, -20° F to 180° F. This makes 36 donuts. About $85 in 2025.

The rubber donuts can be cut to rough shape similar to cutting the metal shims, with a bandsaw and a center pin to spin the rubber around. Cut the rubber into 4" squares and then drill a 1/4" hole 2" from one edge. A small notch needs to be cutout of the board to allow the blade to be 1-13/16" from the blade. Cut out a 3-5/8" diameter piece of plastic sheet (from a milk container or similar) and add a 1/4" hole in the center. Put the rubber on top of the plastic so that it is easier to spin it around while pressing it down flat while cutting. If your rubber sheet is curled because it came off a roll, then place it concave side down while cutting so the edge being cut is flat against the work surface. A 1/4" wide coarse tooth wood blade works better on the bandsaw than a fine tooth metal blade. The large center hole can be drilled with a 1-3/8" hole saw rubbed with candle wax. When using the hole saw, place the rubber concave side up so the edges need to get pushed down flat on the work surface. This helps to keep the rubber from pressing against the sides of the hole saw and binding up.

If you happen to have a spare tail wheel "barrel" (RPN 1125), use it to check your shims and donuts for size. The shims are placed in the barrel flange side toward the front. Install the shock absorber like this: first donut then shim then donut then shim, etc. until they are packed in tight. Reinstall the tail wheel mechanism and check for proper tracking (90°-95°). Adjust as necessary (see Service Bulletin #17).

Forming Tool Materials:

.040" 2024-T3 Alclad aluminum sheet (2' x 2' sheet makes 36 shims)
4 ea. 1/4" x 2" bolts, nuts and large washers
8" 1 x 4 Oak or Maple (hardwood)
6" 1-1/4" EMT, Electrical metal tubing
1.25" (1-1/4") Steel ball bearing
1.3125" (1-5/16") Steel ball bearing
1-1/4" diameter wood rod (closet hanging rod works good)
1-1/4" hole saw
1-3/8" hole saw
1-1/2" hole saw
Drills and file
Dremel tool with sanding drum
Vertical belt sander
Plastic sheet for padding the discs (milk jug plastic)
Metal shear (for slicing 4" wide aluminum) not required but nice
Bandsaw
1-1/2" hose clamp
Vise
A candle (for lubricating the balls and hole saw)