

Work continues on the edge prepping of the leading edge ribs. 3 more to go for sanding so it was all done in an hour.

I took the time to make some pictures about the fluting process.

In the next image, you can see why you need to flute the ribs. The left rib in the picture is shown as you receive it from "the mothership".

The right rib shows how it should look like after fluting.

The ribs are cut at Vans' plant on a CNC machine into a flat aluminum sheet or plate. They are then formed over a template. During this forming, the web of the ribs will bend due to the stress that the bends of the flanges make on the aluminum.

This is completely normal but it will give you some extra work to prepare the parts before they can be installed on the airplane.

The whole purpose of this fluting is to make sure that the rib is straight and that the prepunched holes line up with the prepunched holes in the leading edge skin.

Without fluting, it is simply impossible to cleco the rib on the skin.



Fluting is done using a fluting plier. The pliers regular flat jaws are replaced with some jaws that allow making a notch in the rib flanges.

Fluting is not an exact science. It requires some "feeling" and practice to do it well.

The straight flanges will need little notches, the front of the rib in the heavy bend will need deeper notches. You adjust the depth by turning the vise grip screw and applying more or less force. Don't use

too much force the first times. You'll get better and will develop a feeling on how much of a notch is needed for bringing the web straight. It is better to have a sequence of small notches then having one deep notch in the middle of the part.



How can you ensure you did it the right way ?

Make sure you make the flutes in the middle between two prepunched holes. This will ensure full mating contact between the prepunched holes of skin and rib.

To find out how much is enough, lay the rib with the flanges on a flat workbench (web up) and look at the bend of the flanges. They should lay flat over the entire surface of the bench. There should be no wobbling when touching the web. There should be no gap between the workbench and a part of the flange as you could see in the left rib on the first picture. You will soon find out that the front side of the ribs is quite challenging.

If you notched to deep, don't worry. Just use the hands seamer to squeeze the flutes back gently. Avoid doing this multiple times.

When the fluting is finished and the piece is straigh, you will also

need to adjust the flanges to make them stand perpendicular to the web.

If you don't do this, the flange surface will not mate properly with the skin and there will be a gap between flange and skin. This is an absolute no-no.

The way I make the flanges perpendicular is using an Aristo triangle. I lay the rib (this time web down) on the workbench and test the triangle over the entire length of the flange (only where the prepunched holes are).

I determine the direction the flange needs to move and then use a plastic mallet, hands or hand seamer to adjust.



Once the flanges are perpendicular, misery o misery... recheck your fluting flatness of the flanges. By working on the flanges, the notches will almost certainly have changed and flattened needing little adjustments again with the fluting pliers.

Be patient in this process, doing a better job now will save a lot of time and frustration when you will need to install the ribs. When the ribs are truly straight, you will not have to apply force when installing cleco's.



So far for the fluting process.

One more rib was left to do. This is the inboard most rib of the leading edge. This rib has no prepunched holes.

Once the leading edge is installed on the spar, you will need to insert this rib and squeeze a joint plate between the rib and the skin. Since all this is installed by measuring from the assembly, there are no prepunched holes.

How to flute the rib then ?

Well easily, just lay the rib over another rib and copy the location of the prepunched holes. Even safer is to insert the rib temporarily in the leading edge skin at the exact location and use a sharpie pen to mark the location of the holes through the prepunched holes in the

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skin. I used the first method as my leading edge assembly was not yet installed at this point and I really wanted to finish all prep work first.



Some weeks ago, I found out that I messed up the tie down bracket (installed it upside down leaving larger offset on the bottom side and the actual correct one on the top side).

I re-ordered the piece from Vans and started reinstallation.

Couple of problems here.

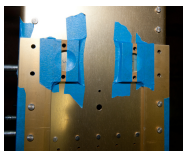
- the spacers are already drilled and have exact locations
- the spar is not rivetted with the main ribs into a skeleton so accessibility is poorer then before.
- special care to be taken not to enlarge any holes by re-drilling

All this means I will have to clamp the already finished components really carefully.

I started as described with marking the top right corner of the tie down brackets per the dimensions on the plan. Then pilot drilled and final drilled it #12 for the AN3 bolts

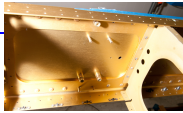


Then positioned the already completed spacers using bolts on the spar and taped them in place. Then removed the bolts.



Then used the already drilled holes via the spar and through the spacers to matchdrill the tie down bracket.

As I continued making new holes, I ran some sacrifice AN3 bolt in there and installed them temporarily with lots of washers and a 1032 nut. The washers make sure that the nylon in the nut does not engage so I'm not ruining the nuts with this temporarily installation. This worked very well and I will do this again in the future.



When all holes were drilled, removed the tie down from the spar and reattached the spacers on the tie down bracket with AN3 bolts. I started off in with the spacers upside down and fortunately found out while drilling the first 2 nutplate rivet holes. I reinversed them and had to enlarge 1 hole. Not badly and the rivet will squeeze here on the nutplate (exact size) and the spacer (also exact size). The tie down holes serve only as pass-through so I expect the rivet to expand here a little and fill the holes. I may go for the next number length when installing. The nutplate will be locked in place by the AN3 bolt that fits in it. The rivets in the nutplate ears only serve as holders and to prevent the nutplate from spinning as the bolt is installed. There are no actual strong forces being applied on these rivets in the nutplate ears.



And then finally, the long awaited assembly of the leading edge skin and ribs.

The cradle is really usefull for this. Some people have lots of problems getting the ribs in place. Mine were easy.

First install the top side front to rear. These go in easily if you did the fluting well.

The other side is more difficult and goes much easier with an extra pair of hands pushing and holding the ribs down as you insert the cleco'. Also start from the front to the rear. Once you get one in, the rest is easy.

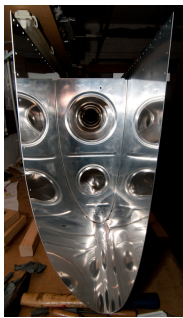


Classic shot of the leading edge assembly with the ribs installed.

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Enlarge the next picture to see how well the rib flanges mate with the skin surface. This is where the fluting and straightening process really pays off.



Final event of the day, install the leading edge assembly on the spar of the right wing.



This is truly impressive once installed. The wing is really tall. I don't have enough cleco's so I had to remove many from the left wing skins. I'll have to order some extra ones from avery tools next time I go to the US.

Final act of the day, draw a centerline on the inboard leading edge rib. I use this technique often. The steel ruler bends well and with some croco cleco's you can hold it easily in place to connect the measured dots.



Just to see how it looks, I inserted the rib in place.

Leading edge right wing - 23/12/2011 - 6h

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I'll do the drilling next session. I need to study the plans first.

