

Instructions for Plenum & Inlet Installation.

1-17-2016

V2.1

General Work Process

The plenum and inlets are made to fit the Sam James long cowl and the 180 hp M1B parallel valve engine only. It will not fit the 320 or 360 angle valve engines. Other parallel valve clones may need modification. Before doing any work on the plenum, the cowl must be fitted. Do that in the standard manner.

The baffles can then be installed and trimmed for ½" clearance from the cowl. Look at the pictures/templates and modify the baffles according to the details.

The plenum cover can now be rough trimmed and test fitted to the baffles. It should fit tightly in place around the perimeter. It should have the same slope as the upper cowl (approximately 14 deg relative to crank) to ensure the front and rear flanges are square with the baffles. If all is well at this point, the inlets can be trimmed to fit.

Once the inlets are fitted, clecoed in, and in line with the cowl inlets, then the cover can be set in place and one hole drilled at each corner, and two in the front center baffle. The cover should fit snugly against top of the inlets. Once the cover and inlets are in place, and lined with the cowl inlets. It is ready drill all holes, cleco, install nut plates, and trim precisely to fit. This may occur in a circular process. Thinking is required.

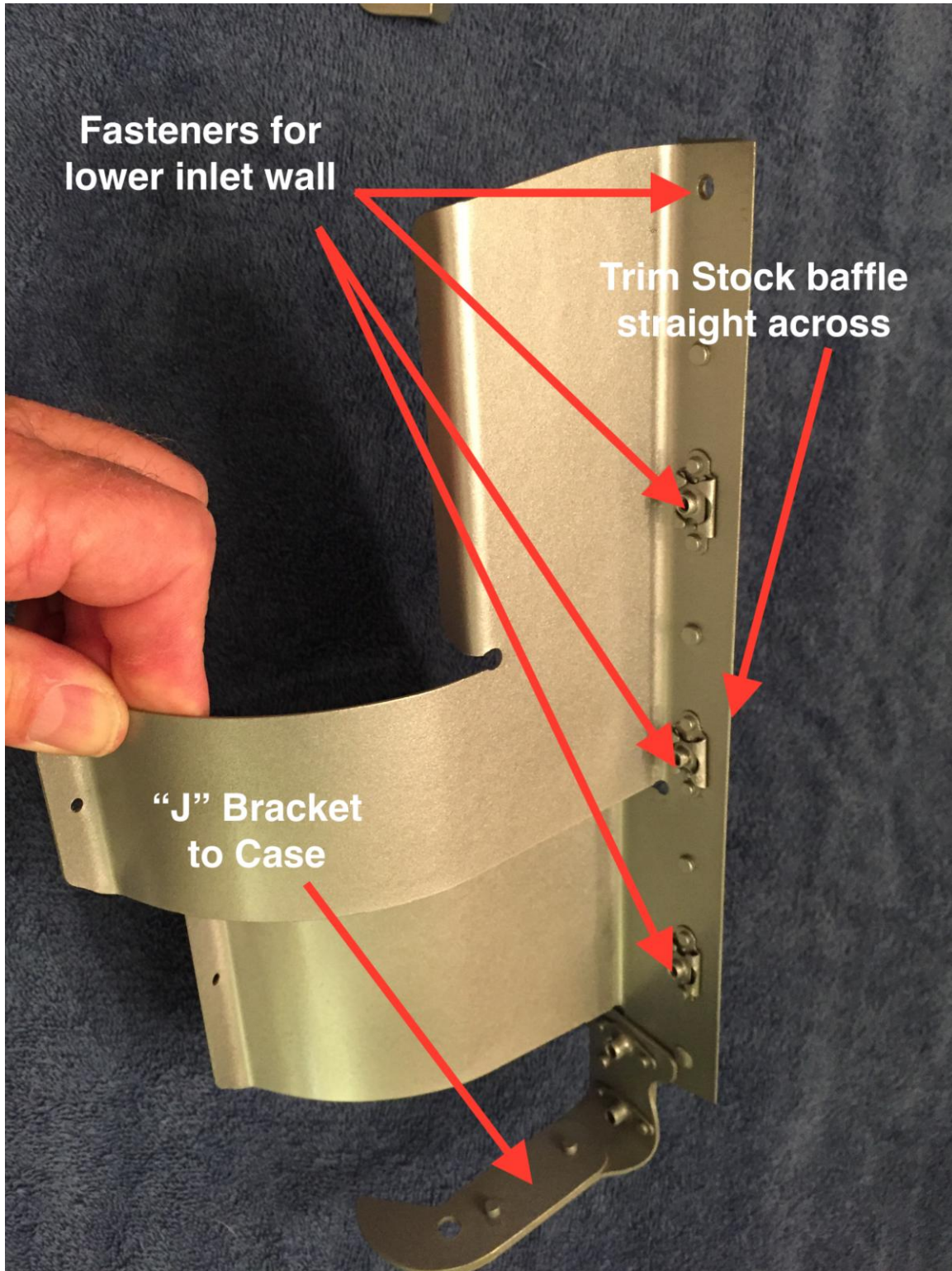
Baffle Installation

The rear and sides of the baffles are installed (generally) per Vans instructions. The forward center should be constructed from the included PDF templates. There are several small parts to be made, but none are difficult. Just take it in steps and think of the larger picture as you proceed. WAIT to cut the oil cooler opening until the plenum is fitted. This will allow placing it as high as possible without error. High placement gives the best possible cooling.

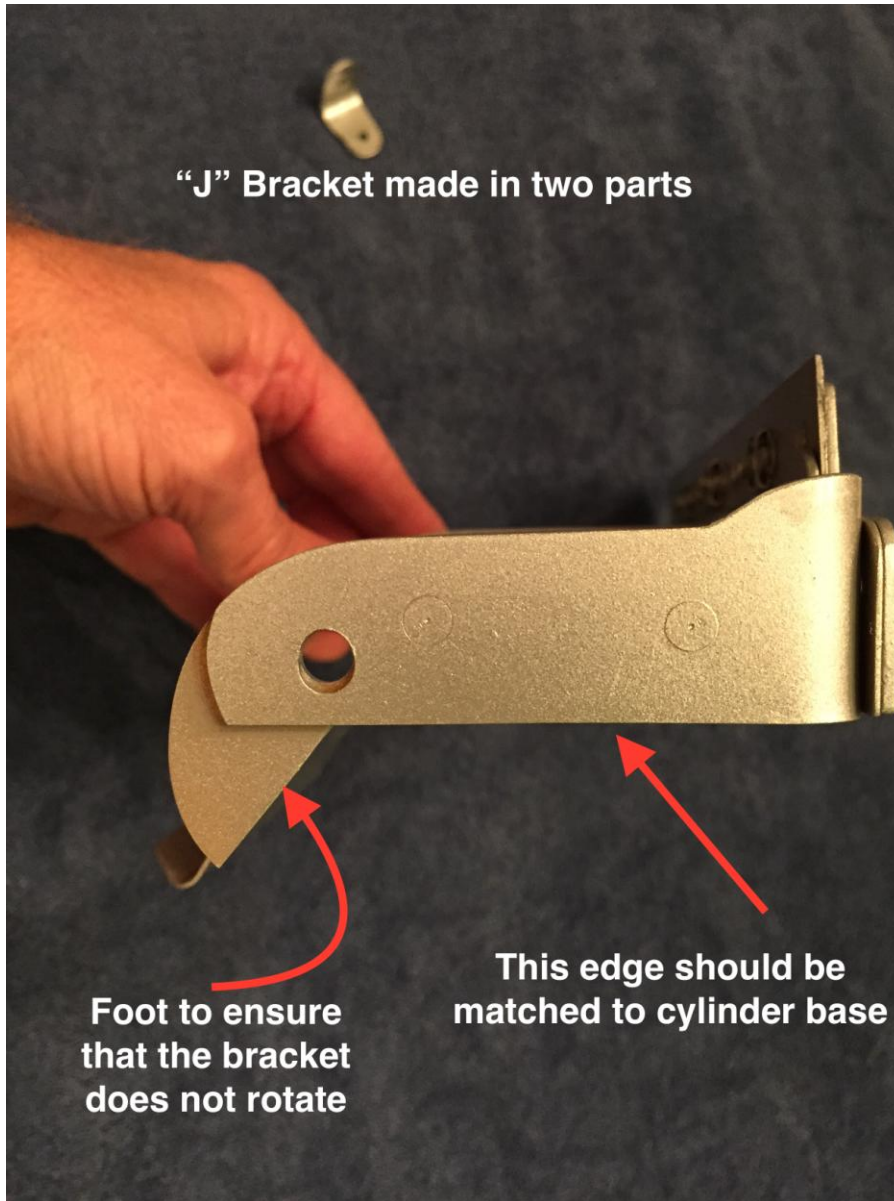
The corner pieces (a short length of angle) at the end of the head for the Vans design are on the inside but you will make a piece from aircraft grade angle to move this to the outside. The lines of fasteners for the outsides of the inlets are vertically aligned with the factory hole for the small angle piece. The front ramps at the front of the head are cut back substantially. Before cutting any original baffle material forward of the head, make modifications to the lower attachments to the case. They are necessary to prevent pressure in the plenum chamber from pushing the baffles forward. If this happens with a CS prop, there could be contact with the governor oil line and serious.

Make the center baffle from the templates first before cutting the ramps to ensure the ramps are not over cut and are matched. When cutting the ramps off, they can be cut even with the angle that goes across the front of the head, and blended with the center baffles.

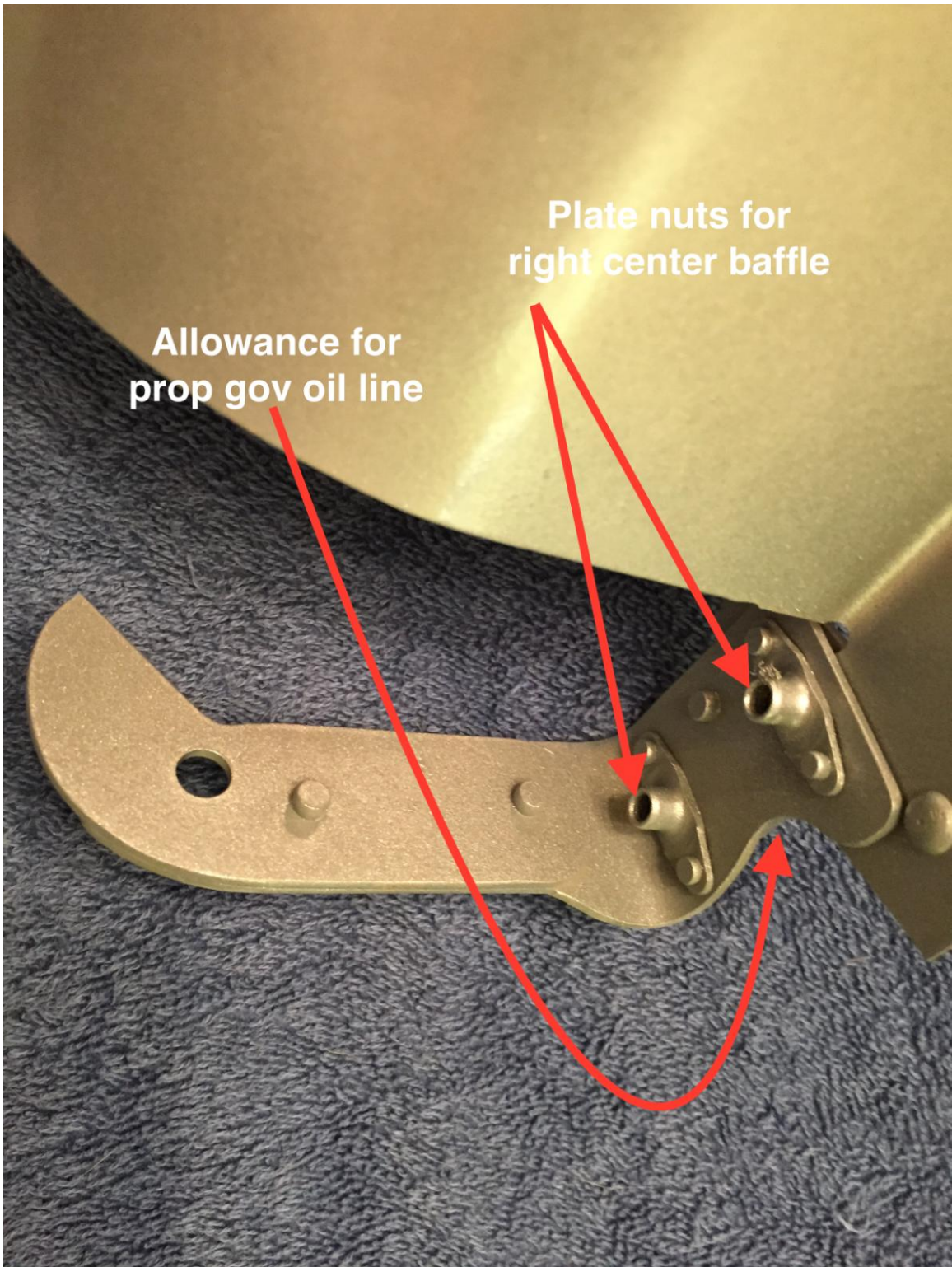
Let's look at the #1 forward baffle.



The "J" bracket modifies the stock bracket to create a fail-safe condition should the case screw come loose and allow the top to rotate into the governor oil line from internal pressure. The "J" bracket could be made from one piece if your metal working skills are superior. Make from .063" 2024. Be sure to allow a generous radius or 2024 will fracture when bending.



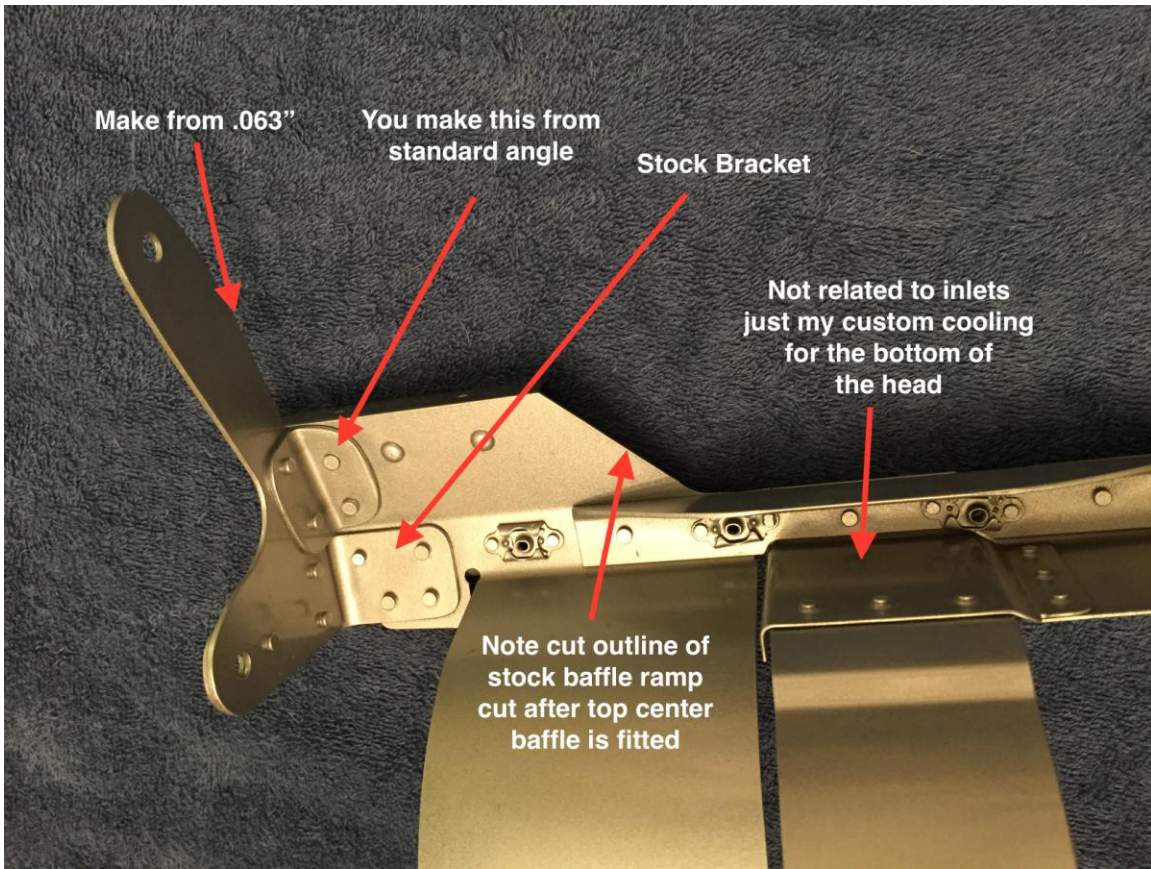
The stock holes in the top of the J bracket are used as locations for the center baffle plate nuts.



Allowance for
prop gov oil line

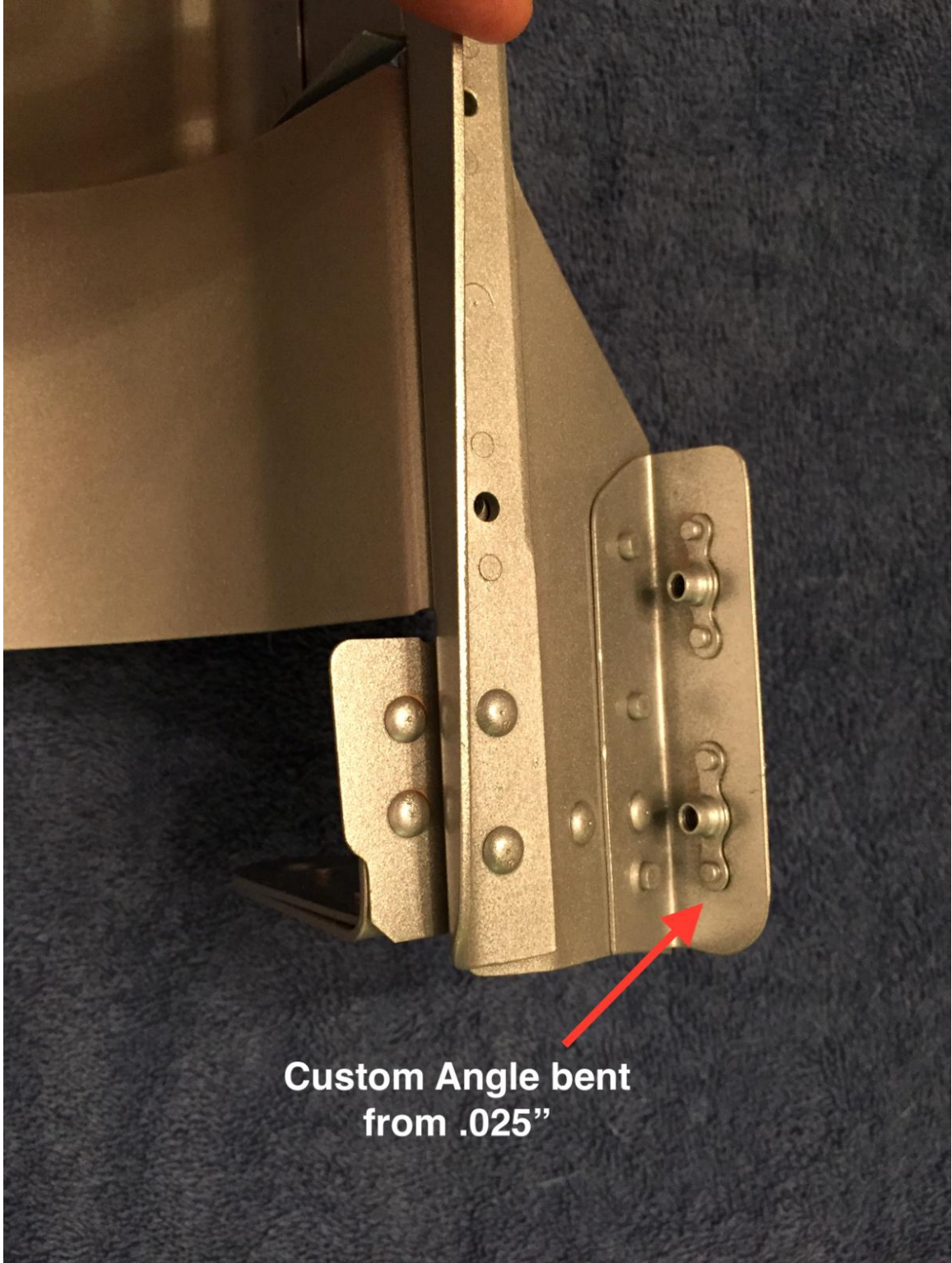
Plate nuts for
right center baffle

The #2 baffles are a little more complicated. Fortunately, there is an additional boss to enable locking of the inside baffle mount.



Tool Tip: Get this tool and cut a Phillips bit to half length. It will install in remove the most difficult Phillips screws without slipping. I would have wasted a dozen screws on the baffles alone without it.





**Custom Angle bent
from .025"**

Diffuser Fitting

Note that alternate (every other) hole in the stock angle are used to fasten the floor of each inlet diffuser. The flat section (of the diffuser) against the angle is relatively narrow, and if you look closely at the inside, there are two spots where you can see where the holes were in the buck to attach to the angle. These are a good starting point for alignment. I had a little trouble tightly fitting the diffuser to the angle. Be sure to check this carefully as this rail is the first place to begin drilling. It would be best to drill a hole near the center and fasten the diffuser with a 4-40 screw, then align it the inlet hole to the cowl laterally and then drill a second hole. The issue might be that the bottom of the diffuser does not lay flat on the baffle angle across the front of the head. Check it carefully, as it may push the diffuser vertically and affect cowl to plenum clearance. The layup process (along the bottom) has been modified, so it might not be an issue. If the diffusers are made from the molds, then it is already fixed. Once the bottom is tightly affixed, then align the inlet vertically with the cowl, and use a clamp to hold it tightly to the side baffle off the head. If it is held in place, but springs out of alignment when released, stop drilling. When the holes are drilled to fasten the diffuser to the plenum, it will come back in line. If both diffusers are in place and all fasteners in the floor are snug, then it is time to begin with the plenum. Fasteners in the full perimeter of the diffuser are needed to be sure it is not warping, as it is pretty easy to do that. Just pay attention to that possibility. A tip for getting alignment of the diffuser with the inlet ring: Take the inlet ring and trace the inner diameter on a 1" thick piece of pink insulation board. Cut out the circle and then sand until circular and a snug fit within the ring. You can push it through to check alignment of diffuser inlet. Stop on drilling the diffuser here. You will come back to get the holes drilled for the forward baffles when we are sure that they are aligned to the cowl inlets.

Note: The inlets are too long to install with the rings in place when received. This is to allow custom fitting and not start out short. A way to mark the inlets for cut are to force them in alignment as close as you can without the inlet rings place. Upper and lower cowl in place and solid. Then take a shorty sharpie and use the formed in place locking ring as the datum along with the Avery parallel scribe to perfectly match/mark the inside of the inlet for cutting. Make only a 1/4" clearance first, as it will help with more precise alignment. Check alignment with every step as you fit, drill, cleco the parts across the front. You want people to look inside that inlet ring and see a perfectly aligned path for the cooling air. That is all they are likely to see of your hard work on the plenum, so make it look good!

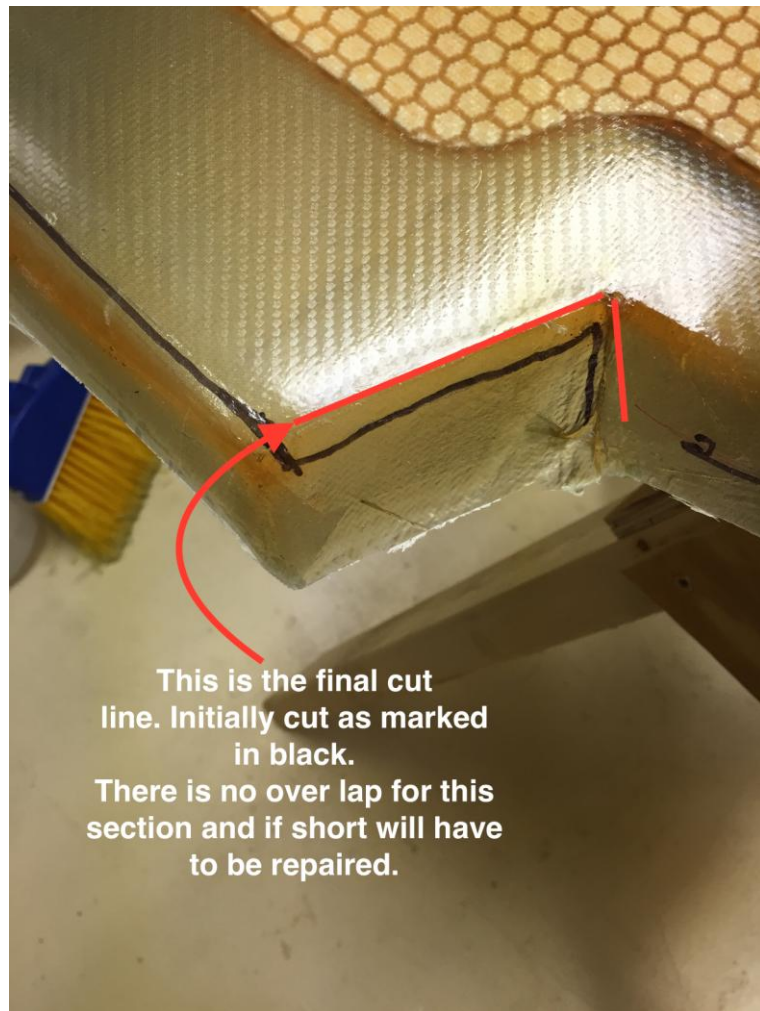
Plenum

The plenum has extra flashing around the perimeter from the molding process. Read through and look at the photos as some of the dimensions are tight and 1/8" off can leave a gap that will need filling.

The flange around the perimeter should have at least 3/4" flat area. The edge radii are different, but do your best. This is most easily cut with a diamond or carbide disc in a Dremel. Permagrit makes a nice cutoff disc as well as flat and round sanding tools. They last forever on fiberglass.

If your cover has an imprint of the weave of the fiberglass, just sand it lightly all over with 220 wet-or-dry and paint with epoxy primer and re-sand.

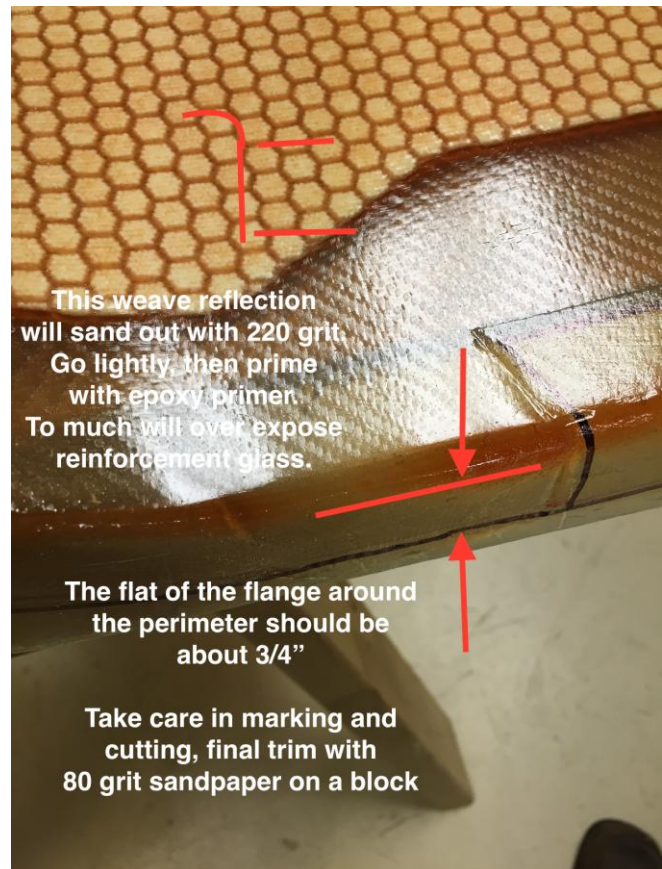
There is one edge that is more critical. Note the photo to the right. Optionally, a custom angle, or a corner layup of fiberglass can be used to seal this area.



This portion of the trim provides the greatest margin. First just cut along the edge. It can be cut back when fitted with the diffusers to provide a one-inch overlap.

The diffusers are fit relatively tightly with the baffles. When fitting the plenum it will over lap down the outside corners. This will push out the baffle. The flange can be sanded down to a taper and then all the fasteners are installed and snug, the resulting gap will be small. If it does not suit you, then a notch can be cut out of the flange so it does not fit between the diffuser and the baffle. I think either way will work. If it gives you trouble, email me.

In case you are wondering, this is a photo before post cure, the resin darkens at about 220F, it's normal.



Now that the cover is rough trimmed fit it into the baffles, it will be tight, so make a $\frac{3}{4}$ " wide X 4" shoehorn from .032" to fit it within the baffles. Push it aft and make sure all the flanges have no gap and the rake angle is right. Since the inlets are not in at this point, it is time to trim around the center baffles more carefully so the cover will slide down over the diffusers.

When you know the flange geometry, you cut the oil cooler hole and use it to fit the plenum tightly in place. Verify the rake is correct or the plenum front and rear flanges won't match the baffles.

This is a good time to mark the approximate drill pattern, but only drill 2-3 #40 holes for clecos to ensure the plenum is reinstalled in the exact same place. I used the aft left corner as my first drill as it was easy with the oil cooler hole to reach up and clamp it in position. The next one was the aft right. Make sure the plenum arc intersects the baffle to maintain the $\frac{1}{2}$ " clearance to the upper cowl.

Put the diffusers in place fasten tightly down to the cross angle. It is better to use the 4-40's as clecos might not hold it down against the angle closely enough. I installed one cleco on the side baffle to the side of the diffuser on each side with the hole aligned, of course. Make that hole low enough so the plenum can squeeze in without having to remove it. Now is the possible pain. Diffusers in place, screws on bottom, cleco on the sides and center baffle wall not attached. Sit the plenum on, cleco the back push it down over the diffusers. I used a 1" overlap of the plenum over the diffusers. The angles won't match well until the diffuser is cut to this dimension. With diffuser cut, hold up the diffuser in line with the inlet rings and drill the upper line of holes between the diffuser and plenum, clecoing as you go. If the inlet matches the ring at this point, and the plenum fits snugly to the front baffle, then drill a few holes in the front baffle to secure alignment. Does the inside of diffuser match the center baffle? If so, drill the holes for that area. Generous availability of c-clamps, and vice grip c-clamps will help get all tightly in place.

If it does not fit well - - at this point all the dimensions of the plenum and diffusers are tight fitting to the baffles, so .060" off will through it off, taking some care with trimming (repeat as needed) for a better fit will lead to the best result.

Stepping back and looking at the clecoed assembly you will notice that the overlap of the plenum over the diffuser, at the side baffles might I leave the baffle sticking out. You have a couple of options. 1. Cut off the plenum so there is no sandwich, or 2. taper the plenum flange by sanding the inside at that area until it looks good. Tapering to a knife edge seemed to work. Oddly, I did one of each. I recommend #2, if it works. Also, there are small gaps in the corners of the diffuser that can be filled with RTV later. The outer diffuser cleco will have to be installed inside the diffuser or the cowl won't fit back on. This happens a lot.

Check the clearance to the upper cowl by making a dozen cones from clay and placing them in a strategic grid on the plenum. I used a dial caliper to measure each one.

Drill all holes, install nutplates and finish the process from here. I used #6 stainless screws for the perimeter and #8 screws for the attachment of the center baffles.

I used a strip of .032" and attached the nutplates to stiffen the attachment of the diffusers to the baffles.

If you have trouble or some additional photographs would help, let me know via email. I really hope it goes well and makes a nice tight installation without the need for modification, which was the design intent.

Bill Lane