(850) 342-9929 LONG FW
updated 1/12/14

James Aircraft

Important Note:

Please read all instructions prior to starting your project and supplement our mounting instructions with a thorough understanding of Van's instructions contained within the builder's manual.

Also Note:

The inside of the cowl should be painted prior to engine run-up to avoid oil or water intrusion into the core. Epoxy paint is recommended.

If you are installing a plenum chamber, make sure that you fit the cowling to the airframe before fitting the plenum to the engine to verify proper alignment.

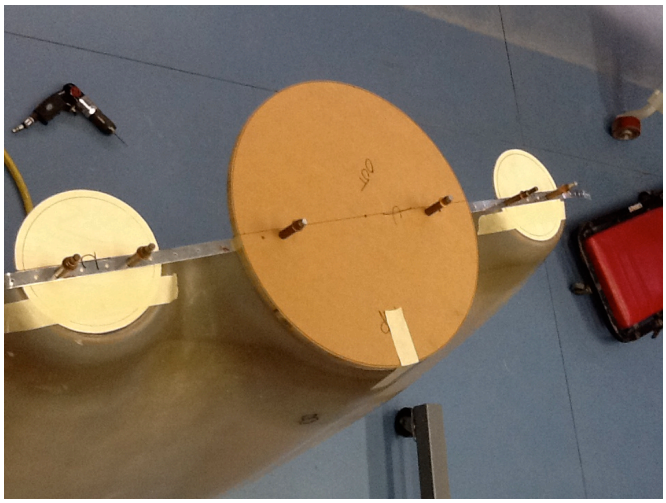
Cowl Kit Includes

2 Cowl halves
Oil inspection door
3 Aluminum inlet rings
Neoprene Rubber
Seal Cement
Fiberglass cloth
Cotton flock thickener

ADDITIONAL MATERIALS LIST

Flat stock aluminum approximately 0.032" thickness, roughly 5x8"
Aluminum duct tape
Proseal
Mill Spec 20257-5 (Aircraft Spruce: MS20257P5)piano hinge for lower half of cowl, (1) 3' length (on 4 cyl engines)
Mill Spec 20257-4 (MS20257P4)piano hinge for upper half of cowl, (1) 3' length (on 4 cyl engines)
Hinges for firewall attachment (as per Van's instructions)
Rivets (as per Van's Instructions)
Skybolt Fasteners (if used)
Mold release wax (good quality car wax will do)
Acetone
West System Epoxy or equivalent (Do Not Use 1:1 mixtures)
K&N model E-0995 air filter (available at Advance Auto Parts)
2" Dia. scat tube (for alternate air inlet nozzle connection to heat muff)
6" length of 3"Dia. "scat" or silicone hose
Hose clamps sized for intake ring and plenum inlets (sizes vary according to aircraft)

COWLING INSTALLATION INSTRUCTIONS



Trimming Cowl Bottom

Place the cowl halves on the floor, nose up. Place one aluminum inlet ring as a guide, on a piece of paper, leading edge down, and scribe a line around the circumference. Make two more patterns from cardboard. Fold the paper circle in half, lay it on top of the cardboard circles and draw a line across both, dividing them into equal hemispheres. Discard the paper template and carefully position the cardboard cutouts on top of the cooling inlets on the bottom half of the cowl. Position them so that the hemisphere lines are parallel when viewed from above and **verified** with a straightedge. With a straightedge aligned with the inlet hemispheres, mark a line across the spinner boss (flat area). Continue and complete a straight line to connect the inlets with the spinner boss. The segments of the line between these areas can be completed using a straight edge of flexible plastic. Be careful not to simply lay the plastic directly on the cowl or errors will result due to the compound curves, and the final line may not be entirely straight. There will be a small trim area below the hemisphere line. The trim area should be fairly level and minimal. The inlet openings should be well described.

Using the tool of your choice (a flat sanding board works well), remove the area below the line (leave the line). Do not open or trim the cooling inlets at this point. Leaving this until later may offer a needed option.

Using a sanding board, carefully level the trim line laterally out to the outboard sides of the inlets. This operation will provide a forward end benchmark for trimming the cowl sides.

Note remaining flange strip tied into mount

The next step is to position the bottom cowl on the airplane. The cowl may be supported with a bench and some spacers beneath while a cargo ratchet strap works well around the firewall. Be careful not to distort the cowl by over tightening. The cowl should be positioned to be parallel with the spinner or spinner spacer facsimile Cut a ¼" x 4" piece of thin sheet aluminum and put a ninety degree bend in the last 1/8" of the 4" length. This will be used as a gauge to help determine trim length of the cowl at the firewall. Slide the gauge, bent end down, under the cowl until it drops off of the fuselage skin at the end of the firewall. Mark the gauge where it emerges from the trailing edge of the cowl. Withdraw gauge and transfer measurement to top surface of cowl. This will provide an accurate measure of the required trim length. Trim gradually until a correct fit is achieved; it's hard to add if you cut too much. Compare the thickness / height of the cowl and fuselage skin at top surface. If there is a difference noted, measure this, as a shim of the same thickness will be added beneath the hinge to bring these two surfaces to a flush position.

Beginning at the front outboard corners of the cooling inlets, move aft and mark the side edges of the cowl for level, parallel with the centerline of the airplane. Before cutting, lay the top half of the cowl on the fire wall and verify sufficient overlap. A drop light placed inside the cowl will help illuminate the division, top and bottom. Make the cut and follow it up with a sanding board to get a straight, even line.

Fasten the hinges to the firewall. Trim the cowl for length, at the firewall end. An initial tentative "short" trim will allow a second, more accurate finish cut. With the hinge pin installed, drill and cleco the hinge to the cowl. To reduce vibration or to raise position of the cowl relative to the fuselage skin, hinges may be bedded in pro-seal or fiberglass mat saturated with epoxy. If using other types of fasteners, mount according to manufacturers instructions.

Lay the top half of the cowling on the firewall. "Ratchet" straps can be carefully used to support and prevent side-sagging. If the sides are allowed to sag or are warped because of over-tightening straps, the final cut may not be accurate

Trim for length, using the same method as for the bottom half.

Place a lamp inside the cowl to illuminate the next step. Using the lower cowl half as a guide, draw a cut line on the upper half and then trim less than is indicated. Several more careful, gradual trimmings will yield the desired end. Taping the halves together with short lengths of aluminum duct tape may help to verify a good fit.

Install the left and right vertical hinge on the bottom cowl. Prior to riveting the firewall hinge to the cowl, make sure the surface is flush with the fuselage skin. If not, shim with either glass mat saturated with epoxy or aluminum shims (use Pro-seal between hinge and cowl).

Remove the cowl and install a M.S. 20257-5 hinge along the sides on the lower half of the cowling. With some cowls, it may help to grind the forward area of the hinge into an ellipse to assist fitting into the rounded section forward, near the cooling inlets. Place the hinge pin ¼" above the horizontal split line. After final assembly, this will eliminate any gap between the upper and lower cowl halves. Cleco, check, and rivet. Install hinge or fasteners on bottom, adjacent to lower exhaust outlet area.

Make sure all areas of the hinge are bedded evenly in a smooth, even, glass surface. The hinges may be bedded in pro-seal or epoxy.

Position lower half of cowling and slide in vertical hinge pins. It helps to sharpen the end of the pins prior to insertion. The lower half will now be self-supported. Slide in the horizontal hinge pin from the front. If you desire to install the pins in the "through the firewall method," follow instructions below through step 17. With the RV-4, the pin will hit the cheek.

With the lower cowling on, run the hinge pin from the front to the rear in the hinge until it hits the firewall….mark this spot. Drill a small pilot hole then enlarge it for a section of brake line that will be used to guide the pins from inside of the cockpit (don't use fuel line, it is too large in diameter). Cut a straight piece, long enough to go through the firewall from the first hinge eyelet and ½" back to the vertical bulkhead under the panel. This is the pin guide tube. Attach the pin guide tube to the bulkhead with a cushion clamp. Put some JB Weld around the protruding part of the guide on the forward side of the fire wall to keep it in place and seal the opening around the tube. To put the cowling on, insert the pins from the cabin and slide forward until they are in the first eyelet. Put on the top cowl and insert the pin.

Position the upper cowling and recheck fit. It should contact the hinge evenly along the full length of the hinge. Tape the sides together accurately and, reaching through the cooling inlets position the M.S. 20257-4 hinge in place, hinge pin installed, and drill and cleco the hinge to the upper cowl half. You may find that the -4 hinge is a slightly thinner material than the -5. If this is the case, you may need to shim between the hinge and cowl to insure pin alignment. A 5.5 oz. strip of fiberglass cloth (provided with cowl kit) will have an approximate thickness of .008. Aluminum shims may also be used.

The hinge may be ground to a narrower shape near the cooling inlets.

Recheck fit and rivet hinges in place.

A custom joggle flange about an inch wide, is required between the spinner and cooling inlets. This flange will secure the upper and lower halves together at this point.

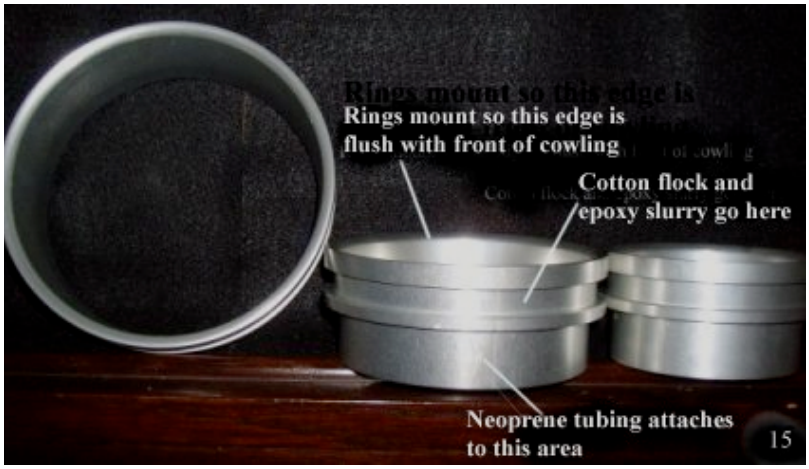
Remove cowling and, on the inside of the lower cowl half, sand the curved area between the spinner ring and cooling inlets, extending down about two inches. Roughen the area to remove all gloss with course paper. This will assure adhesion. On the top half of the cowl, apply a piece of aluminum tape on the inside, in the same area, extending up about two inches. Allow the tape to wrap around the lower edge to insure that the halves don't get glued together. The epoxy will not adhere well to this tape, but a coat of car wax on the tape helps for easy separation later. If you do not use the tape, apply at least five thick coats of wax.

Position cowl halves together and install hinge pins. The flange is going to be made from eight strips of the provided fiberglass cloth. Cut strips of fiberglass about three inches long and two and a half wide.

It will help to suspend the cowl from a ceiling or supporting overhead framework with small 'C' clamps at the firewall end. The flange area may be accessed through the cooling inlets to apply the glass strips. Check the alignment of the front surfaces of the cowl. Any misalignments may be temporarily corrected and held in place with small clamps, aluminum tape etc. Saturate the first layer in the prepared area and let it cure. Follow up for a total of eight layers of 5.5 oz. fiberglass. When this sets up, drill one counter sunk hole at the bottom of the concave depression in the top cowl for a #8 screw. Nut plates work well here. A putty knife will help separate top and bottom halves.

Cut outs for nose gear leg may be accomplished with rotary tools or fine toothed saber saw. The cutout section can be hinged and reused to close the gap behind the nose strut. A bridge, to span the gear leg opening, at the trailing edges of the exhaust outlet area , is recommended to avoid potential flutter. Flat aluminum stock approximately 0.045" may be used for this purpose. Fasten the bridge to the flat glass flange area aft of the core.

Ring Installation



With all pins and screws installed, place the cowling nose up on the floor. Trim and gradually enlarge the air inlet holes until the aluminum rings slide through. Press a small bit of clay into the split line to avoid adhesion in this area.

Wax each ring (5 coats) and tape in place keeping top of ring *flush* with cowl external surface.

Mix up a slurry of epoxy and provided cotton flock to oatmeal consistency. With the cowling suspended from the overhead, reach through the inlet and press the mixture into the keyway in the ring. At this point, only enough to insure proper ring location is necessary. Allow the “first layer” to cure overnight and later, lower the cowl and remove the pins for easier access to the rings. Place the cowling on a bench and replace the rings into the newly created keyway and complete the job. Make certain that the rings are completely seated in the keyway prior to adding more epoxy.

Wipe away all residue prior to cure using acetone or alcohol.

Check to make sure the rings are still flush and let cure overnight.

The injection ring is installed permanently in the same fashion. No wax is used. Cut opening to allow flush fit. Sand adjacent areas. Add epoxy mixture.

The top rings are not bonded to the cowling so that they may remain in place when the cowling is removed. The rings have an attached flange for a hose clamp. The included neoprene is used to form a custom fitted tube, which is clamped to the ring and the cooling plenum for a complete seal. The tubes are formed using industrial strength neoprene cement (included). When forming the tubes, the nylon cloth face is outside the tube to resist abrasion from the clamps. The rubber is butt joined following glue package directions. When the cowling needs to be removed, the upper and lower halves are removed with the rings left suspended by the rubber tubes. This way you never have to loosen the hose clamps or disturb the seal on the neoprene.

For Repair or Modification

If any openings are required in the Para-glass core or to repair damaged areas, cut a clean margin around the perimeter of the opening or damaged area.

Mix an epoxy resin and force the mixture into the open spaces between the face plies. If necessary a thickening agent, such as cotton flock, may be added to the resin.

Fill an area approximately ¼” back from the edge of the opening and allow to cure. If an attachment flange is desired for fastening to another component, use a sharp tool to score the inside surface of the cowl.

Insert a knife or chisel between the face plies and sever the interconnecting weave. Remove the inner face.

Backfill the perimeter with an epoxy mixture and after curing, sand for a 45 degree angle feather edge.

Sand the surface adjacent to the perimeter approximately 1-1/2” each side of the bevel.

Clean residue with acetone and lay on enough layers of epoxy saturated glass to form a flange of sufficient strength. Mark cut out for opening allowing at least ½” flange area from the perimeter of the core area from the perimeter of the core. Prime and finish as usual.

Mk 3/4 filter assembly

*Before beginning assembly, purchase a K/N E-0995 filter. Be certain that you receive a newer version of the E-0995 filter. The older, now obsolete version has a steel base plate in the flange. The flange will not be flexible and is difficult to trim.
After "bagging” the filter against contamination, trim the perimeter of the rubber base to fit snugly inside of the filter housing., The filter housing may be used as a template to size the rubber flange. A metal cutting bandsaw blade shapes the rubber easily and a belt sander cleans up the perimeter nicely. Install the bagged filter for all fitting of components.
Airflow performance type servos (without the Bendix style, flat mounting flange) will require the FM approach ring for securing the filter kit to the servo. Please contact A.F.P. for this part.
*There are many possible combinations of sumps, engines and fuel servos. The backplate sent to you is one of two types available and will fit many of the possible combinations. If you find that the inlet of the filter housing is misaligned with the cowl, we have another backplate that is angle offset and will lower or raise the filter inlet by about 1-3/8ths. This works well with many cold-air type sumps. Try to decide about your situation before cutting parts. Any undamaged parts may be exchanged.

Please read the instructions above that are printed in blue. Please read all directions before doing anything else. If you have any questions please call to clarify.

There are three parts to consider: filter housing, transit duct and backplate.

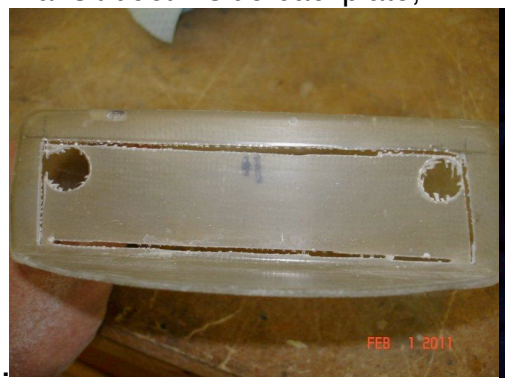
1. The taller cone shaped part is the **filter housing**. This part will contain the filter. The rubber filter flange will rest on the ledge about ¾” inside the housing, with the pointed end of the filter facing the smaller opening in the housing.
2. The part that resembles a bowl is the **back plate**. After proper trimming, it will slide into the filter housing and will press against the rubber filter flange, around the perimeter, and will hold the filter in place. The flat section of the backplate is where the alternate air door will be located after cutting an opening for the door.
3. The smallest part looks like a funnel, it is the **transit duct**. It will direct the airflow from the back of the filter to the inlet of the fuel servo. When it is properly trimmed, it will rest on the bottom of the bowl, rough side down, smooth side visible. The smooth side will face the filter when the backplate is inside the filter housing. The “flat plate” edges of the transit duct will need to be trimmed to fit precisely inside the backplate. The transit duct will also be gradually trimmed at the bottom (smallest point in the funnel shape). This will gradually lower the transit duct down inside of the backplate. The correct height will allow the flat perimeter edges, trimmed earlier, to rest down inside of the backplate, just below the top edge of the backplate. The top line of photos below shows how this fits together and where to trim

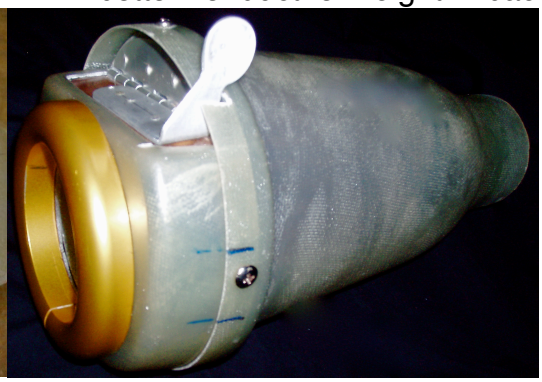
4. **Assemble Backplate:**To begin assembly of the MK3 kit, place the bagged filter inside the housing. Carefully sand a slight bevel on the outside edge of the backplate where it enters the filter housing sidewall. Do not reduce the length of the side walls, only produce a slight chamfer, if needed, to assist in slipping the backplate inside the filter housing. The back plate is sized to fit exactly within the filter housing when the back plate is properly shaped and sanded. When fitting the backplate into the filter housing, first place the rounded wall just inside the filter housing, then insert and press down on the flat area of the backplate perimeter. The parts should fit snugly but slide together smoothly. Mark a reference line on the backplate and filter housing when they are joined so you will always match them at the same point around their circumference while continuing assembly.
5. **Transit duct:** The vertical height of the transit duct, resting inside the backplate, is decided by the length of the duct. When the transit duct is properly located in the backplate, the bottom of the transit duct may rest close to (or on) the bolt heads that will pass through the backplate for attachment to the fuel servo. Prior to drilling holes through the backplate for attachment to the servo, ¼" nuts may be used to approximate the bolt heads while trimming the duct to fit inside the backplate. When trim fitting the transit duct, you do not have to locate the temporary spacer nuts exactly. Tape four nuts to a piece of paper at about the same spacing as the bolt pattern in your servo, and set them into the bottom of the backplate. You can move them around as you sand the bottom of the transit duct, gradually lowering the duct into the backplate. . Slowly trim as necessary to obtain the correct placement. Eventually, the transit duct will come to rest on the two spacer nuts nearest to the flat, alternate air door area. At this point, the top of the transit duct will be in contact with the top edge of the backplate. Slowly sand the "flat plate," semicircular perimeter of the transit duct until it slips snugly inside the backplate (see photo). This flat area will support the filter and keep the exit opening to the servo locked in correct alignment. When the duct is sanded correctly, the flat perimeter will be flush with and inside of the backplate sidewall (see top left photo). Depending upon fuel servo type, the duct may or may not contact the spacer nuts beneath the duct. The bottom of the trimmed transit duct, where it contacts the backplate, should be in full contact with the backplate all the way around the opening. If either the bottom or sides of the transit duct are not accurately trimmed, they can be built back up with some glass and epoxy and reshaped. (When using the optional "angled" backplate you may need to add to the bottom length of the duct.) If you don't get it just right, lay a piece of saran wrap in the backplate, place a bead of epoxy on the bottom of the duct and place the duct inside the backplate. When it cures, lift it out and reshape the part. **Do not cut the opening through the backplate to the servo until this part fits in place, as described.** When the opening is cut, it should appear to be a continuation of the duct discharge wall, with the transit duct **supported by the backplate**. The transit duct will not touch the fuel servo. All bolt heads will be contained within the space below the transit duct. The actual bolt head spacing (C-C) will be the same as the bolt spacing on your fuel servo.
6. **Alt air door:** On the flat part of the backplate, where the door will be located, measure in 5/16" in from the radius where the flat area begins (See Photo). Draw a perimeter line to size the door. The forward edge of the door will be located along the 90 degree back wall (see photo of door opening) Use a 3/8" **radius,** rather than square corners on the door opening. This radius on the door corners works best for internal clearances near the transit duct. Later, while fitting the hinge / door assembly you will gradually open the back wall to receive the hinge (see photo). Assembling this door is as simple as it looks. Nothing tricky, no surprises. Before cutting, holding the part up to a light source that will allow you to see through the glass, to confirm that the scribed door will clear the transit duct when opening. **If**

you find that, due to the door sizing, the door will not clear the transit duct, the duct may be lowered to contact the bolt heads or the door made slightly smaller. When the door opening smooth the the perimeter (opening and underside). Underlay a piece of .032 flat stock aluminum beneath the door opening and scribe a line to pattern the door opening. Cut outside of this line 1/4" and check your fit. This door will be slowly resized several times so don't waste a lot of time here. While resizing for final fit, the door and hinge will be clecoed in place. With the filter installed, slip the backplate into the filter housing and check for door swing clearance. Allow at least 1/8" clearance between the door and the transit duct sides.

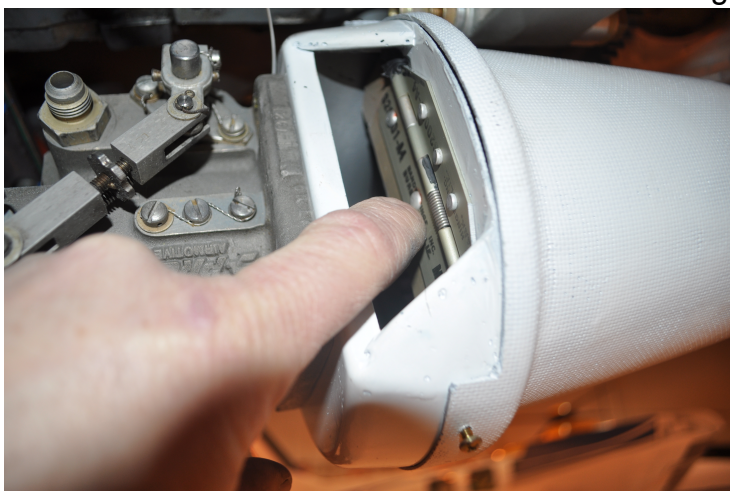
7. Remove a section from the hinge and install a set of door return springs. (See photo). Create the required control arm for your installation. This will differ according to your unique combination of components and required access, but the end goal is an arm that will swing the door open when you need it. 1/8" mild steel works well for a control arm. If cable actuation is the goal, cable retention brackets are made according to your specific needs. Use the photo for reference and arrange the parts with the door on the bottom of the stack, hinge next and then the control arm. Note that the control arm design should be designed and placed to allow maximum free range of motion, when actuated. Keep the arm relatively narrow at the area of contact with the filter canister to insure adequate travel (close to 90 degrees). Note (photo) that the hinge base is trimmed elliptically at the top corners to fit within the perimeter of the filter housing. The wide hinge serves to strengthen the backplate. Retaining “L” brackets can be installed at the ten and two o’clock position on the filter housing perimeter. These will contact the hinge, keeping it pressed against the filter base.
8. Springs provided are intended to be used along with a control cable. Alternate air doors operated only by “spring and vacuum,” without a control cable, have not been flight proven by James Aircraft. Each brand and type of injector has different airflow requirements. Alt-air doors not fully opened 90 degrees by a control cable may cause rough engine operation with some fuel servos. It is the builder’s responsibility to fully test any alternate air door, particularly those not operated by push / pull cable.
9. Use four -4 countersunk rivets to assemble the stacked door components. When the door parts are assembled, lay the free side of the hinge against the flat area on the back plate and gradually shape the door for fit. Make sure that the door seals flat around the door opening perimeter and is not contacting the transit duct when opening. About 1/8" overlap around the door opening for a final seal is sufficient.
10. Gradually remove material from the flat area where the hinge will be attached to the backplate until the hinge slips into place. The hinge pin is secured at each end by contact with the fiberglass at the end of the hinge pin opening. When the fit looks good, drill and cleco but do not rivet the hinge in place. If the final product does not seal precisely don't take it too hard. When the door is finished and fully functional, any areas that may leak can be sealed with RTV gasket seal. To accomplish this easily, apply a light coat of Vaseline or other parting compound (test it) to all areas where you don't want the RTV to adhere. Coat the edge of the door and apply a small bead of RTV to the inside area where the door will overlap. When cured overnight, you will have a tight, custom seal. Do the same thing anywhere a gap exists.
11. Bolt holes are to be drilled directly through the back plate. Use a template or a bright light to illuminate your bolt spacing through the backplate. The backplate is to be bolted directly to the servo with heads secured and safety wired. Use a gasket or thin bead of RTV on the flange to seal the backplate to the servo flange. When satisfied all is well, rivet the door assembly to the backplate.

12. A minimum of four nut plates are to be installed around the filter housing perimeter. Insure that spacing allows for the fitting of the transit duct, which will cover the nut plates, containing them inside. The area of the backplate above the hinge is to be held in place by 90 degree ‘L” brackets, fastened with a screw and lock nut. The bracket will press the backplate against the filter base snugly.
13. For attachment to airflow performance servos, use FM Approach Ring (purchase from Airflow performance) and secure as described above.
14. Please note that the opening through the backplate is not located on the centerline of the filter housing. This allows the unit to be located for best external clearance to starters, etc. along an eccentric axial rotation. Slight misalignments may be corrected by adding fiberglass layers to the back of the backplate and re-sanding, to form an offset angle.
15. 

16. Transit duct inside backplate, Trim bottom of duct for height in backplate
17. 


18. Begin alt air door FM200 Ring (AFP) installed, cable
19. 

20. Note bracing attachment



21. Bendix type installation, note spring actuated door without cable (builder modification).