

Important Notes:

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.

*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. Please verify whether a propeller extension is recommended for your cowling. Builders must verify adequate clearance between propeller blades and cowling prior to engine run-up. Some propellers may require longer propeller hub extension due to chord width.***

Cowl Kit Includes

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

INDUCTION KIT INCLUDES

- Parallel servo kit includes filter housing, back plate and transit duct..

ADDITIONAL MATERIALS LIST

- Flat stock aluminum approximately 0.032" thickness, roughly 5x2"
- 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)
- Hose clamps sized for intake ring and plenum inlets (sizes vary according to aircraft)
- For Airflow performance injectors: Approach clamp ring FM-100 or 200 required

Trimming and Hinges

Cowl Bottom:

- (1) In this step you will be marking and completing a tentative trimming of the front top edge of the bottom cowl and cooling inlets.
- (2) Place the cowl halves on the floor, nose up.



- (3)
- (4) Using one aluminum inlet ring as a guide, place it on a piece of paper leading edge down, and scribe a line around the circumference. Make two of these, cut out the circles and then make two more from cardboard. Fold the paper circles in half, lay them on top of the cardboard circles and draw a line across both at the hemispheres. Discard the paper templates and carefully position the cardboard cutouts on top of the cooling inlets on the top half of the cowl. Position them so that the hemisphere lines are parallel when viewed from above and verified with a straightedge. Mark this verified line onto the spinner boss (flat area) to continue this hemisphere line. Using a 'sharpie' type pen, mark a continuation of the hemisphere lines adjacent to the cardboard patterns of the cowl. The segments of the front sharpie line can be completed using a straight edge of flexible plastic. Be careful not to simply lay the plastic directly on the cowl as the geometry in this area will induce errors, 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.
- (5) Using the tool of your choice (mine is a rotary with a non- aggressive bit), remove the area below the line (leave the line). Do not open / trim the cooling ring inlets at this point. Leaving this until later may offer a needed option.
- (6) 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. 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. Do not over tighten the strap or the cowl will be distorted and possibly too tight around #1 and #2 cylinders. Cut a 1/4" 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 onto 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.
- (7) Referencing the trimmed front outboard corners of the cooling inlets, 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. Make the cut and follow it up with a sanding board to get a straight, even line.
- (8) Fasten the hinges to the firewall. Trim the marked over length on the firewall end of the cowl. An initial tentative "short" trim will allow a second, more accurate finish cut. With hinge pin installed, drill and cleco the hinge to the cowl, or if using "Skybolt" fasteners, drill and fasten to the aluminum plate. **Verify spacing of fasteners to clear cylinder heads.** Hinges may be bedded in pro-seal or epoxy.
- (9) Lay on the top half of the cowling to meet the lower half of the cowling. "Ratchet" straps can be carefully used to support and prevent side sagging. If the sides are allowed to sag the final cut may not be accurate. On **RV-8 cowl**, beware of over tightening. Angle valve engines fit very close.
- (10) Trim the rear vertical cowl sides and bottom using the same method as for the bottom half.
- (11) 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. Tape the halves together with aluminum duct tape (used in air conditioning).

- (12) Install the left and right vertical hinge. Prior to riveting the firewall hinge to the cowl, make sure the top surface is flush with the fuselage skin. If not, shim with either glass mat saturated with epoxy or aluminum (use Pro-seal between hinge and glass).
- (13) Remove the cowl and install a M.S. 20257-5 hinge on the lower half of the cowling. With some cowls, it may help to grind the front area of the hinge towards an ellipse to assist fitting into the rounded section forward, near the cooling inlets. Place the hinge pin $\frac{1}{4}$ " above the split line. After assembly, this will eliminate any side gap between the upper and lower halves. Cleco, check, and rivet. Install hinge or fasteners on bottom, adjacent to lower exhaust outlet area.
- (14) Make sure all areas of the hinge are bedded evenly in a smooth glass surface. The hinges may be bedded in pro-seal or epoxy.
- (15) Position lower half of cowling and slide in vertical pins. It helps to sharpen the end of all 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 in step 17. With the RV-4, the pin will hit the cheek.
- (16) 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 the aluminum brake line that will be used to guide the pins (don't use the 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 $\frac{1}{2}$ " back to the vertical bulkhead under the panel. This is now the guide pin tube. Attach the guide pin tube to the bulkhead with a cushion clamp. Put some JB Weld around the protruding part of the guide on the FWF side to keep it in place and seal the opening around the tube. When it comes time to put the cowling on, insert the pins from the cabin until they are in the first eyelet so they are perfectly lined up. Put on the top cowl and insert the pin.
- (17) Drill a hole. Install a short length of auto brake line (available at auto parts store) that will extend into the cockpit, terminating under the dash. This will provide a guide later when installing the hinge pin from the inside. With brake line in place, slide the hinge pin all the way in. Secure the guide in place with glass/epoxy to prevent shifting.
- (18) Position the upper cowling and recheck fit. It should contact the hinge evenly along hinge length. If all is okay, remove the cowling and place it on the floor. Tape the upper half to the lower half. Position the M.S. 20257-4 hinge in place, hinge pin installed, so you can drill and cleco the hinge to the upper half. You may find that the -4 hinge is a slightly thinner material than the -5, so you may need to shim between the hinge and cowl to insure pin alignment. Again, you could add (1) 8 oz. strip of fiberglass cloth (provided with cowl kit) or a piece of thin aluminum.
- (19) You may need to cut the width of the hinge down a little from $\frac{3}{4}$ " wide to $\frac{1}{2}$ " at the front.
- (20) Recheck and rivet. Use Pro-seal between the hinge and the cowling. Position and rivet the firewall hinge at this time.
- (21) Slide in all the hinge pins and check fit.
- (22) Mark and cut oil access door. Use a coping saw blade and a fine tooth hacksaw blade. Pull them backwards with a small pair of lock grip pliers. Minimum size for the door should be $4 \frac{1}{2}$ " x 5". Be careful because the piece you cut out will be the door. Alternately, you may tape a small square of trash liner or other plastic sheeting over the door area and use some of the included glass w/ epoxy to lay up a spare oil inspection door. Eight layers of the included 5.5 oz. glass will replicate the removed section.

Front flanges

- (1) This step is intended to produce a custom joggle flange about an inch wide, between the spinner and cooling inlets that will take a screw to secure the upper and lower halves together at this point.
- (2) Remove cowling and, on the inside of the lower cowl half, sand the curved area just outboard of the spinner ring from the split line edge and extending down about two inches. This will assure adhesion. On the top half of the cowl, apply a piece of aluminum tape on the inside, extending up about two inches. Allow the tape to wrap around the edge to insure that the halves don't get glued together. The thickness of the tape here is negligible, "ungluing" is an issue. The epoxy will not adhere to this tape. Apply a couple of coats of car wax on top of the tape for easy later separation. If you do not use tape, apply at least five thick coats of wax.

- (3) Position cowl halves together and install hinge pins. The flange is going to be made up of six strips of the provided fiberglass cloth. Cut some strips of fiberglass about three inches long and two and a half wide. In order to facilitate applying the strips to the inside of the cowl, in the prescribed area, it will help to actually suspend the cowl from a ceiling or supporting overhead framework. Small "C" clamps can be secured to the firewall end of the cowl and used to wire the cowl, nose down about 30 inches above the deck. Hang an overhead light. This will allow you to see, up through the spinner opening into the cowl and to easily reach through the cooling inlets to apply the glass strips. Check the alignment of the front surfaces of the cowl where they come together. Any misalignments may be temporarily corrected and held in place with small clamps, aluminum tape etc. Epoxy the first layer in the prepared area and let it cure. Follow up with five more for a total of 6 layers of 8 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.
- (4) 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, which will connect 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.

For Repair or Modification

- (1) If any openings are required in the Paraglass core or to repair damaged areas, cut a clean margin around the perimeter of the opening or damaged area.
- (2) 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.
- (3) Fill an area approximately 1/4" back from the edge of the opening and allow to cure.
- (4) Shape the perimeter of the opening with sandpaper to form a radius. Prime and finish as usual.
- (5) If an attachment flange is desired for fastening to another component, use a sharp tool to score the inside surface of the cowl.
- (6) Insert a knife or chisel between the face plies and sever the interconnecting weave. Remove the inner face.
- (7) Backfill the perimeter with an epoxy mixture and after curing, sand for a 45 degree angle feather edge.
- (8) Sand the surface adjacent to the perimeter approximately 1-1/2" each side of the bevel.
- (9) 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 1/2" flange area from the perimeter of the core.

Ring Installation (Horizontal opposed cowls only)

- (1) 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.
- (2) Wax each ring (3 coats) and tape in place keeping top of ring flush with cowl external surface.
- (3) Mix up a slurry of epoxy and provided cotton flock. Make a consistency similar to thick oatmeal (no slump). With the cowling suspended from the overhead, reach through the inlet and press the mixture into the keyway in the ring. This must be completed, at this point, only enough to insure proper ring location for later completion of the keyway. 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 (firmly) into the newly created keyway and complete the job.
- (4) Wipe away all residue prior to cure using acetone or alcohol.
- (5) Check to make sure the rings are still flush and let it cure overnight.
- (6) 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 directions. When the cowling

needs to be removed, the 2 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. The injection ring is installed permanently in the same fashion No wax is used. Cut opening to allow flush fit. Sand adjacent areas.

INDUCTION SYSTEM, CARBURETED
Please read all instructions prior to starting

Carburetor / Injector Kit Includes:

- filter housing, saddle base, back plate and transit duct.

ADDITIONAL MATERIALS LIST

- Flat stock aluminum approximately 0.032" thickness, roughly 5" x 2"
- Aluminum duct tape
- West System Epoxy or equivalent (Do Not Use 1:1 mixtures)
- K&N model E-0995 air filter (available at Advance Auto Parts or from James Aircraft)
- Hose clamps sized for intake ring and 3" scat tubing
- Hinge section 1.5" x 2" (Mil Spec: 20257-4 or equivalent)

The filter system works either in a ram air mode, with air flowing in through the front of the ram air inlet or through the alternate air inlet via a heat muff. A push pull cable will operate a "trapdoor" that will open to allow alternate, heated air in, while swinging down 90 degrees to close off the main, ram air inlet.

Assembly

- (1) Trim the alternate air inlet saddle to fit snugly on to the filter housing, approximately 1" from ram air inlet. You must leave some length in front of the saddle to attach a hose to the cowl inlet. Insure that the upper flat surface of the saddle base is not warped by a fit that is too tight. An aluminum plate will be screwed to the top of it later. Do not glass the saddle in place at this time.
- (2) Place the saddle piece onto the filter housing and mark perimeter lines on filter housing cone using the inside and outside of the saddle as a template. Cut an opening 1/8" inside of only the inner perimeter line.
- (3) Lay the saddle upside down on a piece of aluminum (.032 or approximate works well) and mark a pattern using the perimeter of the saddle. This is the deck for the alternate air nozzle.
- (4) Temporarily install the filter and back plate in place using small 'C' clamps around the backplate perimeter. This will allow you to check for adequate clearance between the filter tip and door during the next step, which will be to make the ram air, swinging trap door.
- (5) Size and position a 1.5" hinge, flat side up in the depression on the saddle base. Tape the hinge in place temporarily with aluminum tape.
- (6) Using provided template (page 12), cut a ram air "trap door" facsimile out of thin cardboard. Tape the paper door to the hinge and trim it around the edges gradually until it will seal the inside of the filter housing inlet when it is at ninety degrees from level with the saddle top plate. Eventually, at one end of the door swing, it should seal the alternate air inlet, allowing only ram air to enter the filter housing and, at the bottom of the swing, it should seal off ram air, admitting only hot alternate air.
- (7) Cut a partial door for a spacer, which will allow for the door to seal against the saddle top plate (see the drawing at bottom left of page 12 for a view of a "stacked assembly").
- (8) Place the alternate air deck, that you cut earlier, on the top of the saddle base and mark the shape of the swinging trap door on bottom of the saddle deck (see drawing pg 12). Do not cut beyond this line or exceed perimeter, as the swinging door must seal completely. Eventually, the opening will resemble the provided

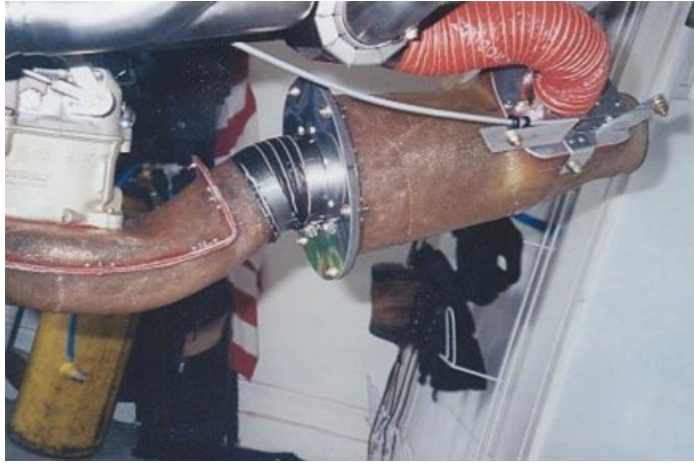
example, but it will vary, according to the direction you orient the alternate air inlet nozzle, according to the location of your heat muff.

- (9) The aluminum alt air inlet deck can be attached to the saddle piece with six sheet metal screws (pre-drilled), three along each side, #4 screws work fine. Do not use rivets. For now, attach with only two screws until all parts are sized and fitted together.
- (10) The actuating arm that will open the door can be made from 1/8" mild steel. The final geometry of the arm will vary according to the placement of your actuating cable. Make a flexible template for the door actuating arm from cardboard or thin metal flashing, to work out the shape and bend required. Verify positioning of the inlet nozzle and actuating arm. Parts may temporarily held in place with hot glue, metal tape, etc. The alternate air inlet nozzle flange (the base where it attaches to the saddle deck) may be trimmed to facilitate actuating arm travel. Limit trimming to insure air seal around base of nozzle. When the engine is running, there will be no vacuum here unless the ram air door is closed, so keep the gap small just to prevent trash from entering otherwise. Parts may be waxed (to prevent adhesion) and sealed around the arm with RTV.
- (11) Ensure functional clearance of control arm and cable in relation to inlet nozzle. **Be certain that you have fitted the K&N model E-0995 filter inside the housing and insured clearance between the swing door and the end of the diffuser on the tip of the filter.**
- (12) When satisfied with fit, rivet actuating arm to door, door spacer and hinge. Attach hinge to alternate air saddle with counter sunk screws.
- (13) Rough sand sides of alternate inlet base and filter housing, extending approximately 1.5" down from saddle base, where possible, for resin adhesion. Position alternate air inlet base on housing, centering on cutout. Hold in place with a few thin strips of metal tape
- (14) Allow space at the front of the filter housing for an attachment of rubber tube seal at the 3" ram air inlet opening. (page 11)
- (15) Wet out one layer of included 8 oz. cloth with West System Epoxy or equivalent product. When first layer is cured (cool to touch) verify that everything works correctly and then add two more layers.
- (16) The alternate air inlet nozzle is sized for 2" scat tube.
- (17) Attach alternate air inlet nozzle to aluminum deck with rivets.
- (18)

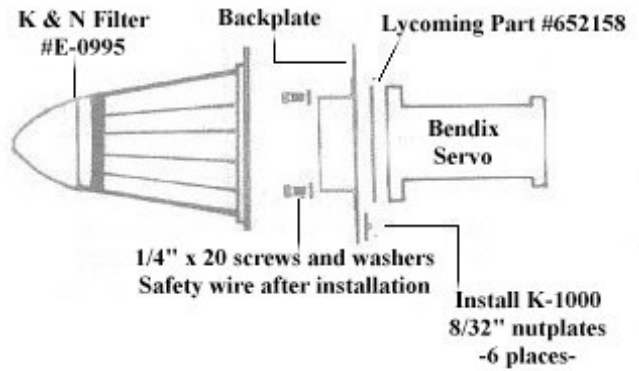
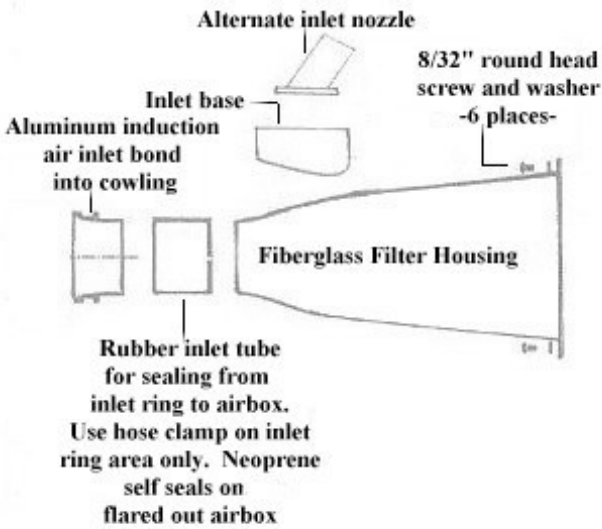
FILTER HOUSING REAR PLATE

- (1) The back plate, which sandwiches the filter into the filter housing, has a "pipe" flange exit about 3/4" in length. When using this kit for fuel injectors, the rear exit nozzle may be trimmed in length (to 1/4") and turned inward to nest inside of the filter itself. This allows for bolting the unit up to a four-bolt, flat servo mounting flange.
- (2) For carbureted engines or AFP injector servos, the backplate nozzle will face aft and attach to the inlet side of the carburetor sweep box with 3" scat hose. Areas of filter and filter housing flange may be trimmed to facilitate fit on some aircraft. Limit trimming to ensure proper air seal or use R.T.V. sealant, if necessary to seal openings.
- (3) The rubber base of the filter should provide adequate Gasket material between the bottom of the filter and the back plate to seal bolt heads when attaching filter housing to Bendix type injectors.
- (4)

Carburetor Inlet sweep Box
- (1) Using either a pre-cut gasket or transfered bolt / flange pattern, drill the box flange . Use washers for bearing displacement. Washers may require grinding in some areas for box clearance. Use a gasket and tighten nuts snugly but avoid over tightening.
- (2) A 1/8" hole should be drilled at the lowest point in the inlet sweep box to facilitate drainage of fuel.
- (3) **IMPORTANT: The four bolts holding the inlet box to the carburetor must be tab locked or drilled and safety wired. IMPORTANT!**



Note brackets



All patterns approximate; verify before cutting parts

