

AEROVEE 2.1 TURBO **\$35.00** **ASSEMBLY and INSTALLATION**

Rev. L 06/30/2023 Applies to AeroVee's shipped with the Turbo Option

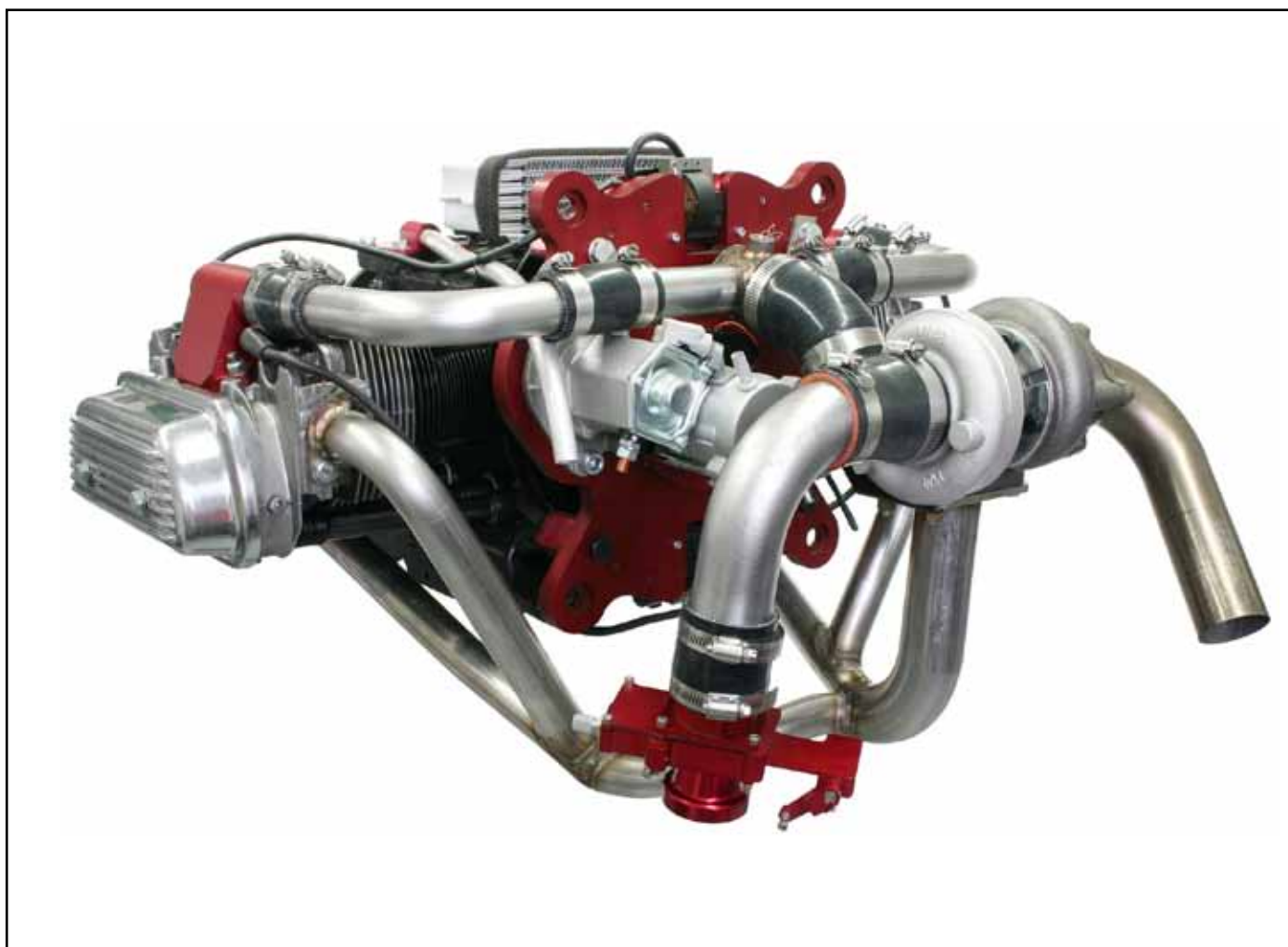


Photo for illustration only and does not represent the specific contents of your kit.

AeroConVersions

A Product Line of Sonex LLC

Contents

Your success is important to us. If you have any questions while assembling your engine do not hesitate to seek technical support by contacting Sonex, LLC.

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Disclaimer and Limited Warranty

THE EXPERIMENTAL AEROVEE ENGINE KIT IS SOLD "AS IS". NO WARRANTY IS EXPRESSED OR IMPLIED!

Sonex LLC makes every effort to assure the supplied components of the AeroVee Engine Kit meet high quality and durability standards, and warrants to the original purchaser that these components are free of defects in material and workmanship for the period of one year from the date of purchase. This warranty does not apply to damage due directly or indirectly to improper assembly, misuse, abuse, negligence or accidents, repairs or alteration outside our facilities, or lack of maintenance. Due to the experimental nature of the AeroVee Engine Kit, the end user is solely responsible for determining suitability of application, assembly, installation and operation.

Sonex LLC and its agents will in no event be liable for death, injuries to person or property, or incidental, contingent, special, or consequential damages arising from the use of our product.

Sonex LLC and its agents will not be responsible for any incidental or consequential damage including direct or indirect labor, repair, medical, or legal expense in any way attributable to the use of any AeroConversions, Inc. product or to the delay or inconvenience caused by the necessity of replacing or repairing any such item.

Engine Monitoring Instrumentation

Sonex LLC requires the use of the following cockpit-installed engine monitoring instruments in every engine installation: oil pressure, oil temperature, cylinder head temperature (1 minimum), and exhaust gas temperature (1 minimum). Failure to properly monitor your engine may result in severe engine damage which is not covered under this limited warranty.

EXPERIMENTAL USE ONLY

Not Approved for Certified Aircraft

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AeroVee Engine Kit Documentation

This manual is your primary document for the assembly and operation of your Experimental AeroVee Engine Kit. The included assembly DVD is an additional aide, but when there is a discrepancy between this manual and the DVD, the information in this manual takes precedence.

The manuals provided with the AeroVee kit are important documents and should be kept with your aircraft's documents.

Keep Your Packing Lists

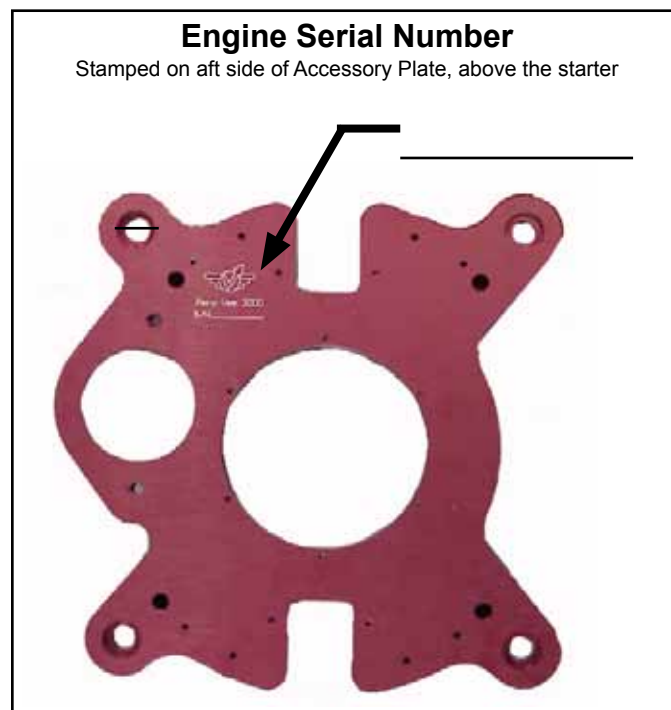
The packing list provided with each AeroVee kit lists the specific parts provided for that specific engine. Please reference your packing list for correct part numbers when ordering maintenance and repair parts for your particular engine.

In addition to the packing list secured to the outside of the engine kit boxes, a duplicate packing list has been attached to the back of the physical manual supplied with that engine.

Copies of (most) packing lists are archived by Sonex and you may request an electronic (PDF) copy. To get a copy, provide evidence you own the engine for which you are requesting the original packing list as well as the engine's serial number.

Engine Serial Number

The engine's serial number is stamped on the rear of the accessory plate, above the starter. It is also recorded on your packing list. Record your engine's serial number below.



AeroConversions Resources

AeroConversions continually improves and monitors its products. It is in your best interest to stay abreast of these improvements and implement them as needed.

AeroConversions Website

AeroConversions, Inc. maintains a website which is continuously updated. Perhaps the most important part of the website for an AeroVee builder/operator is the **Service Bulletin** section. You are encouraged to periodically check for Service Bulletins which may affect the performance of your AeroVee engine.

The AeroConversion website is aeroconversions.com

Sonex Internet Discussion Group

Information on joining this list is located on the AeroConversions website at aeroconversions.com.

AeroConversions Tech Support

AeroVee owners can receive individual tech support. We encourage you to contact via the website.

AeroConversions' Service Bulletins

AeroConversions, Inc. is committed to providing quality products. We do this through the constant improvement of our AeroVee Engine Kit, and also by identifying parts or procedures which we feel require the attention of the existing AeroVee Engine Kit fleet.

When we identify parts or procedures which we feel require the attention of AeroVee owners, we issue a Service Bulletin.

Required Service Bulletins

A Required Service Bulletin, as the name implies, *must* be complied with. It may be a part or a procedure which we feel must be corrected for the continued use of your engine.

Upon compliance of the Required Service Bulletin, an entry must be made in your engine log book.

Required Service Bulletins are posted on the AeroConversions website, announced on the AeroVee Internet Discussion Group, and mailed to the address of record of each AeroVee Engine Kit owner. *It is your responsibility to keep us informed of any address or engine ownership changes, and to check the AeroConversions website for Required Service Bulletins.*

Optional Service Bulletins

An optional Service Bulletin is issue when we identify an area which we feel will contribute significantly to the reliability/longevity of the AeroVee engine. Optional Service Bulletins need not be complied with but we *strongly* encourage all AeroVee owners to implement the suggested change/upgrade.

Upon compliance of the Optional Service Bulletin, an entry must be made in your engine log book.

Optional Service Bulletins are posted on the AeroConversions website and announced on the AeroVee Internet Discussion Group. *It is your responsibility to check the AeroConversions website for Optional Service Bulletins.*

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Additional Resources

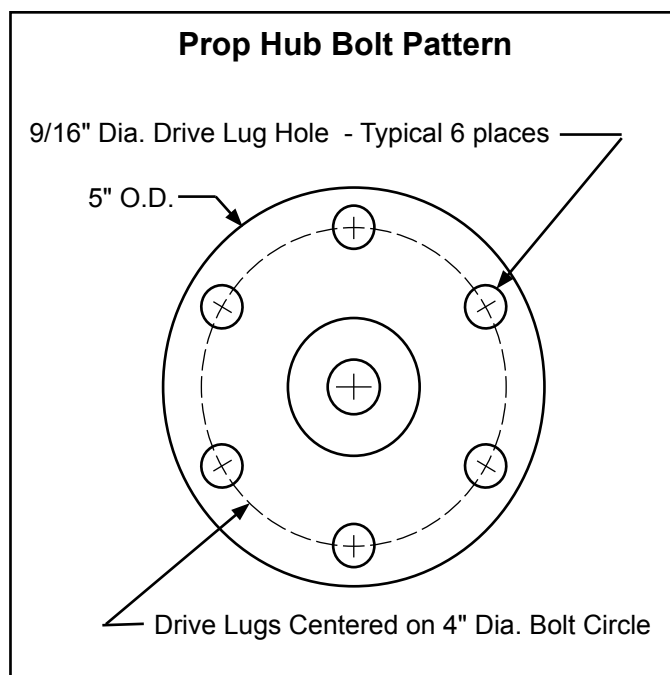
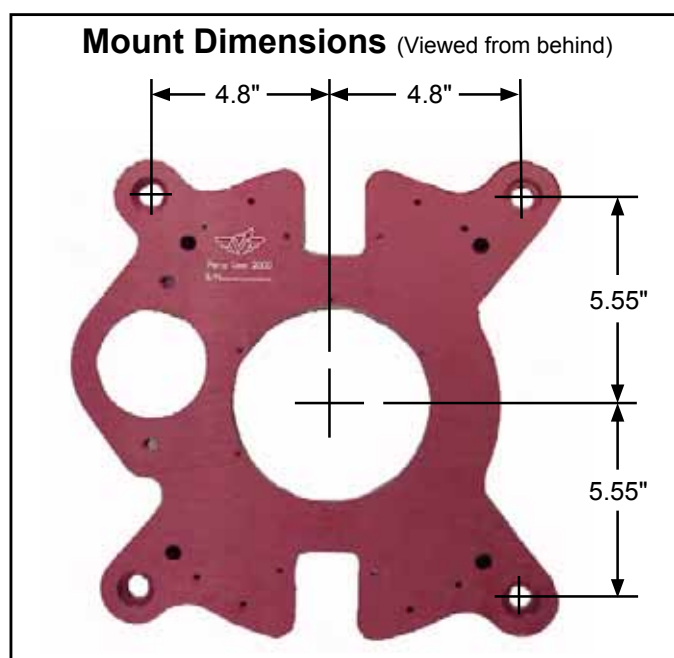
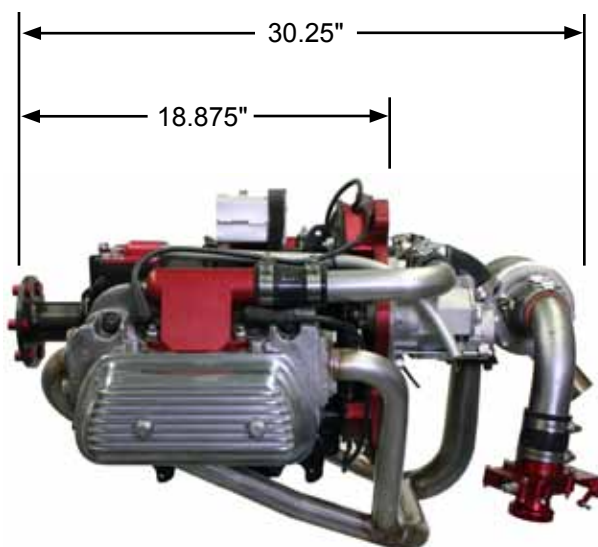
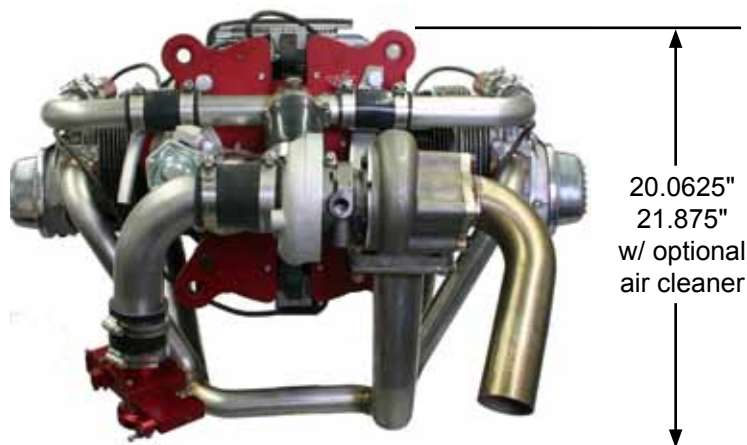
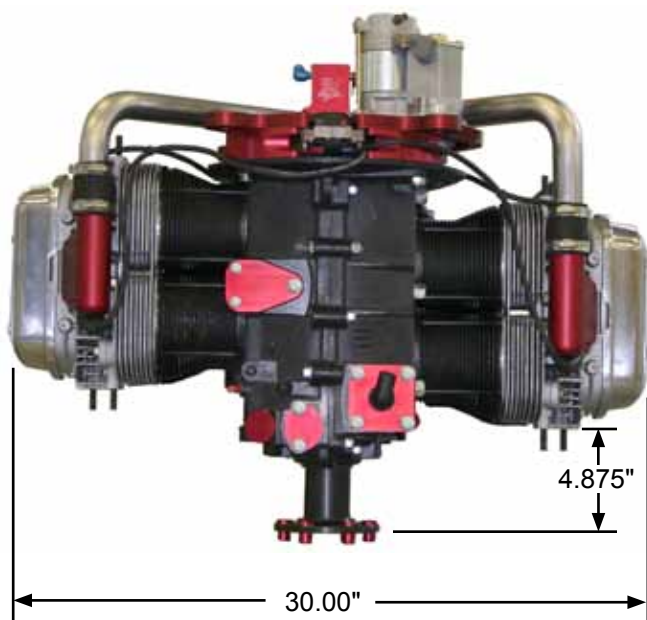
There are many books, magazines, and videos available for the assembly, maintenance, and operation of "Type 1"-based engines. We highly recommend "How to Rebuild Your Volkswagen Air-Cooled Engine" by Tom Wilson (ISBN 978-0-89586-225-9).

AeroVee 2.1 Turbo

SPECIFICATIONS

Weights and Dimensions:

Weight (Less Oil and Exhaust):	
with Standard Pistons and Barrels.....	185 lbs.
Length.....	30.25"
Width.....	30"
Height.....	20.0625"



AeroVee 2.1 Turbo

SPECIFICATIONS

General Specifications (Subject to change without notice)

Power and Displacement:

HP @ 3400 RPM.....	100 HP
Static RPM @ WOT (with correct propeller)	3000 RPM
Bore	92mm
Stroke	82mm
Displacement.....	2180cc
Compression Ratios (Builder configured):.....	7:1 or 8:1

Ignition System:

Firing Order.....	See Photo
Spark Plugs.....	Autolite 4163 or equal
Spark Plug Gap:	
Top Plugs018"
Bottom Plugs032"
Timing:	
Primary Ignition (Magnatrons).....	Fixed @ 28° BTDC
Secondary Ignition (Electronic).....	18° BTDC
Ignition Module Gap (Primary Ignition).....	.010-.014"

Cooling and Lubrication:

Primary Cooling	Air
Secondary Cooling	Oil
Oil Capacity.....	3.00 US Qts.
Oil Type.....	See "Engine Oil" section for approved oils.

Fuel System:

Throttle Body	AeroInjector, ACV-C07S, 32mm
Approved Fuels:	
Aviation gasoline 91/98 minimum grade conforming to ASTM D 910.	
Automotive fuels are not recommended.	

Electrical System:

Battery Required (minimum)	12v @ 20 amp
Starter	Geared
Alternator.....	20 amp

Propeller Drive:

Propeller Drive	Direct (1:1)
Prop Bolt Pattern	6 holes, 9/16" dia., on 4" dia. center
Prop Drive Bushings590+/- .001" dia. x 7/16" long

Valve Setting:

Valve Setting (cold)	
Intake Valves008"
Exhaust Valves014"

Cylinder Identification, Engine Orientation, and Firing Order

Cylinder Identification

For assembly and maintenance, the AeroVee uses the cylinder identification numbers shown below.

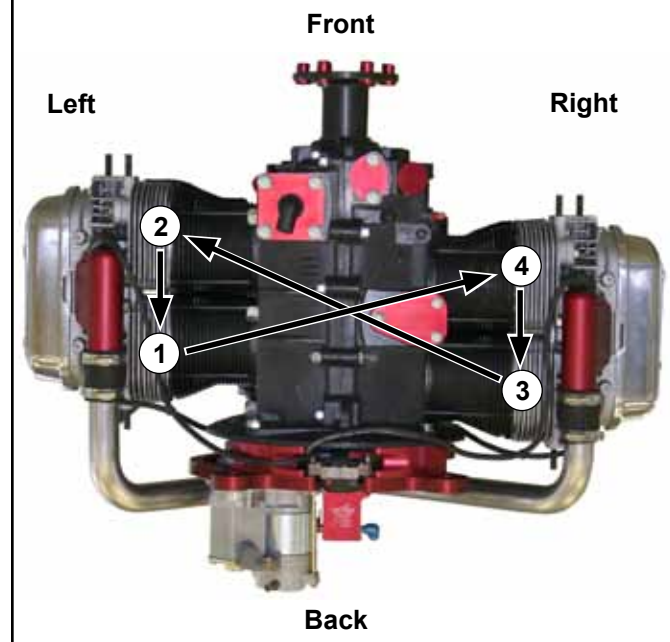
Engine Orientation

"Front", "Back", "Left", and "Right" are used as if the engine is installed in a tractor configuration and viewed from behind the engine, as shown below.

Firing Order

The AeroVee has a "wasted spark" ignition system which allows the spark plugs to fire on non-combustion strokes as well as combustion strokes. The arrows in this diagram illustrate the order of combustion.

CYLINDER NUMBERING, FIRING ORDER, and ENGINE ORIENTATION



Operating Limitations (Subject to change without notice)

Idle RPM	800-900 RPM
Cruise RPM	3200 +/- 200 RPM
Maximum RPM.....	4,000 RPM
Oil Temp. - Min.	(80 degrees for take-off) 160° F
Oil Temp. - Max.	240° F
Oil Pressure - Min.	10 PSI (hot oil, idle RPM)
Oil Pressure - Max.....	100 PSI
Oil Pressure@ Cruise	40-50 PSI
CHT @ Cruise.....	350°-375° F
CHT @ Climb (5 min.)	420° F
CHT Max.....	450° F
EGT Max.....	1400° F
MAP - Maximum for 2 minutes	40"
MAP - Maximum Continuous.....	35"
MAP - Minimum Take-off.....	40"
Post Flight Turbo Cool-Down	3 minutes at idle RPM



A Successful, Reliable Engine Installation Begins Here.

Protect Yourself

Always wear safety glasses

When using paint and chemicals, work in a well ventilated room and wear appropriate protective gear (gloves, mask, etc.).

The use of compressed air to clean parts is not recommended. Compressed air can send debris flying at great speed and cause serious injury.

Do not use flammable liquids near open ignition sources such as water heaters, furnaces, electric motors, etc.

Read, Understand, and Follow the Instructions

Read through each procedure before performing the individual steps.

Make sure you have the appropriate tools, parts, and consumables on hand. Some procedures cannot be interrupted while you track down that forgotten tool.

Photo References in this Manual

Photos in this manual are included to illustrate specific steps and may not accurately illustrate what an engine looks like during an actual build-up. **Do not add or remove parts based on the photographs in this manual.** The step-by-step instructions are your only guide for adding or removing parts during engine assembly.

Work Cleanly

Parts must be thoroughly cleaned with Mineral Spirits and in many cases, lubricated, before assembly. Remove rust-inhibiting coatings from each part.

The engine case and cylinder heads must be carefully cleaned and inspected to remove any metal chips which may remain from the machining process.

The use of compressed air to clean parts is not recommended. Compressed air can send debris flying at great speed and cause serious injury, as well as drive the debris deeper into crevasses.

Work Smartly

Parts should never be forced into position. If excess effort seems to be needed to assemble parts, STOP and investigate the problem.

NEVER apply concentrated heat (such as with a torch) to assemble or disassemble parts. Excess heat will damage parts and result in a potentially dangerous engine installation.

Part Numbers and Packing Lists

The packing list provided with each AeroVee kit lists the specific parts provided for that specific engine. Please reference your packing list for correct part numbers when ordering maintenance and repair parts for your particular engine.

In addition to the packing list secured to the outside of the engine kit boxes, a duplicate packing list has been attached to the back of the physical manual supplied with that engine.

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AeroConversions reserves the right to supply compatible, alternative replacement parts for any part of the core engine or conversion package. Such parts may appear different than the part originally provided in the kit or depicted in the manual, and may bear a different part number, but will be functionally identical or superior to the original kit-supplied component.

AeroVee 2.1 Turbo

Note: If you have the optional pre-assembled crank shaft (part number ACV-H01-20), skip to Step 10.



Tools Required:

- ___ Oven Heated to 450 degrees F.
- ___ Heat-proof Gloves
- ___ White Lithium Grease
- ___ 1/2" Impact Wrench with 19mm Socket
- ___ Locktite #242
- ___ Block of Wood
- ___ Hammer or Mallet
- ___ Torque wrench (80 ft-lbs capacity)

Parts Required:

- ___ Prop Hub, ACV-H01-16
- ___ Prop Hub Bushing and Washer, ACV-H01-17
- ___ Crankshaft, ACV-P01-98
- ___ Oil Slinger, ACV-P01-101

___ #1 and #2 Bearings from Main Bearing Set, ACV-P01-57
Note: Bearing #1 is the small cylindrical bearing, Bearing #2 is the large cylindrical bearing without flanges.

- ___ Retaining Ring, ACV-P01-64
- ___ Forward Woodruff Key, ACV-P01-99
- ___ Aft Woodruff Key, ACV-P01-104
- ___ Crank Timing Gear, ACV-P01-62
- ___ Bolt, ACV-Z01-74

Before You Begin

The crank assembly can be performed in two separate heating/chilling operations if you wish. During the first heating/chilling cycle you can install everything but the prop hub. You may then perform an identical heating/chilling cycle to install the prop hub.

CRANKSHAFT ASSEMBLY

Preparation:

- ___ 1. Inspect the bore of the Crank Timing Gear for burrs. If necessary, lightly polish it with fine emery cloth.
- ___ 2. Thoroughly clean all parts with Mineral Spirits.
- ___ 3. Remove the four (4) hex plugs from the crankshaft and thoroughly clean the crankshaft with Mineral Spirits. Re-install the hex plugs with Locktite #242.
- ___ 4. Test fit the prop hub. **The prop hub should NOT slide onto the crankshaft.**
- ___ 5. Place the cleaned crankshaft in a freezer at least 12 hours prior to assembly.
- ___ 6. Heat an oven to 450° F. Place the crank timing gear and prop hub in the oven and heat for 120 minutes.
- ___ 7. Apply an even coat of white lithium grease to the inside surface of bearing #1 and bearing #2 from the Main Bearing Set.
- ___ 8. Remove burrs from the edges of the woodruff keys.

Assembly Instructions:

- ___ 1. Install the Aft Woodruff Key into the crankshaft. Make sure it is fully seated.



- ___ 2. Slide bearing #2 (with an even coat of white lithium grease applied to the inside surface) onto the crankshaft with the machined dot (arrow in photo) toward the crankshaft's counter-weight.



IMPORTANT. Perform steps 3 through 10 near the oven. Once the parts are removed from the oven, work quickly but carefully to assemble the crankshaft. DO NOT FORCE PARTS ONTO THE CRANKSHAFT.

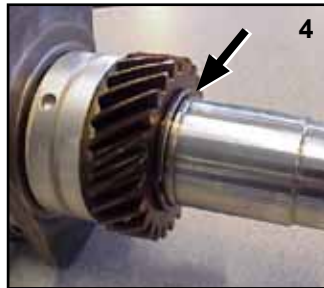
If a part does not go into place on the crankshaft, STOP. Do not force it on and do not try to remove it. Contact Sonex LLC before continuing.

AeroVee 2.1 Turbo

- ___ 3. Install the Timing Gear with the two machined dots (arrow in photo) facing away from bearing #2.



- ___ 4. Install the Retaining Ring in the groove in the crank.



- ___ 5. (Optional) Enlarge the oil supply hole in bearing #1 by up-drilling it with a #30 drill bit. Remove any burrs which may occur while drilling.

Note: Pre-assembled cranks are NOT up-drilled to #30.



- ___ 6. Slide bearing #1 (with an even coat of white lithium grease applied to the inside surface) onto the crankshaft with the machined dot (arrow in photo) toward the retaining ring.



- ___ 7. Slide the Oil Slinger onto the crankshaft with the curved (concave) side of the slinger facing the end of the crankshaft.

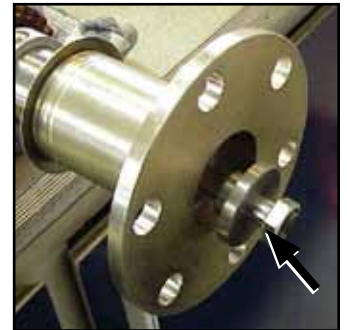
- ___ 8. Install the Forward Woodruff Key into the crankshaft.



CRANKSHAFT ASSEMBLY

- ___ 9. Align the keyway of the Prop Hub with the forward woodruff key installed in the crankshaft and tap the prop hub into place using a mallet and block of wood. The prop hub must be tight against the oil slinger.

Immediately install Prop Hub Bushing and Washer and Bolt (ACV-Z01-74). Use an impact wrench to tighten the bolt and push the prop hub against the oil slinger.



- ___ 10. After the prop hub cools to room temperature, remove the bolt (ACV-Z01-74), apply Locktite 242 to its threads, and re-install. Torque the bolt to 80 ft.-lbs.

AeroVee 2.1 Turbo

CAM ASSEMBLY

Tools Required:

- ___ Socket Wrench
- ___ 13mm Socket
- ___ Torque Wrench (20 ft.-lbs. capacity)
- ___ "Red" Locktite (High Strength Threadlocker)

Parts Required:

- ___ Cam Gear, ACV-P01-49
- ___ Cam Shaft (w/ hardware), ACV-P01-72

Assembly Instructions:

Note: The Assembly Lube provided with the cam gear will be used to lubricate the valve lifters in a later operation. Do not lubricate the cam shaft bolts as instructed on the assembly lube package included with the cam shaft.

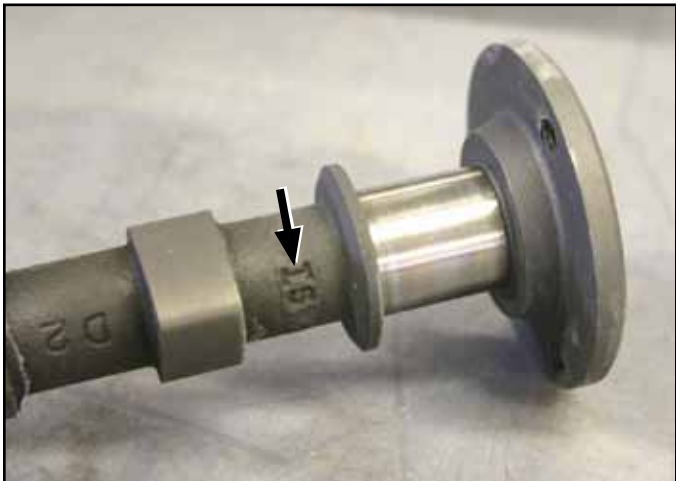
Note: Cam shafts are supplied with varying hardware, all of which is acceptable. Use the hardware supplied with the cam to attach the cam gear. This may include either:

Cam Bolts with integral lock washers.

Cam bolts and wavy spring washers.

Cam bolts and tab lock washers.

Note: While not common, slight interference between the cam and the connecting rods does occasionally occur. One cause of this interference is a raised edge around the numbers stamped in the shaft of the cam. Lightly polishing these numbers will remove the raised edge and eliminate a possible source of interference.



A raised edge around the stamped numbers on the cam can sometimes cause interference with the connecting rods.

- ___ 1. Align the machined dot on the face of the Cam Gear (arrow in photo) with the slot in the Cam Shaft. Apply Red Locktite to the bolts and install the bolts and washers (if provided).
- ___ 2. Torque the bolts to 20 ft.-lbs.



- ___ 3. If tabbed washers were provided with your cam shaft, bend the tabs against the bolt heads with a flat-blade screwdriver.



AeroVee 2.1 Turbo

Tools Required:

- ☐ White Lithium Grease
- ☐ Socket Wrench and Socket Set
- ☐ Moly Lube
- ☐ Torque Wrench (40 ft.-lbs. capacity)
- ☐ Feeler Gauge

Parts Required:

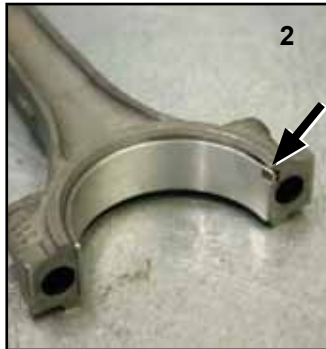
- ☐ Connecting Rods, ACV-P06-33
- ☐ Rod Bearing Set, ACV-P01-59
- ☐ Crankshaft Assembly

Assembly Instructions:

Note: Both parts of each connecting rod are marked with a unique number, identifying them as matched parts. The connecting rods *must* be re-assembled as matched parts, with the numbers together as shown in this photograph.



- ☐ 1. Remove the fastener from each Connecting Rod and carefully separate the two parts. Do not scratch or score the machined surface of the connecting rods.
- ☐ 2. Wipe the mating surfaces of the connecting rods and bearing halves so they are free of oil and dust. Install the bearing halves by aligning the tab on each bearing half with the anti-rotation notch in each connecting rod and pressing the bearing halves into place.



Note: The clearance between the rod bearings and rod journals must be between .002" and .0025". When assembling new parts, as provided in the AeroVee 2.1 kit, the proper clearance is often assumed. When rebuilding an engine using remanufactured parts, this clearance *must* be checked. Detailed instructions for checking this clearance are given in Tom Wilson's book "How to Rebuild Your Volkswagen Air Cooled Engine".

- ☐ 3. Apply an even coat of white lithium grease to the exposed surfaces of each bearing half.

CONNECTING ROD ASSEMBLY

- ☐ 4. The connecting rods are installed on the crankshaft with the bearing anti-rotation notches at the bottom of the crank. **Re-assemble the connecting rods as matched parts.**



The connecting rods are installed on the crankshaft in the orientation shown above and with the bearing anti-rotation notches down.

- ☐ 5. Apply moly lube to the threads and torque each bolt in four steps:
 - ☐ first to 8 ft.-lbs.
 - ☐ then to 15 ft.-lbs.
 - ☐ then 24 ft.-lbs.
 - ☐ Then the final torque of 29 ft.-lbs.
- ☐ 6. Check each connecting rod for freedom of movement and .005" to .020" side clearance.

AeroVee 2.1 Turbo

Tools Required:

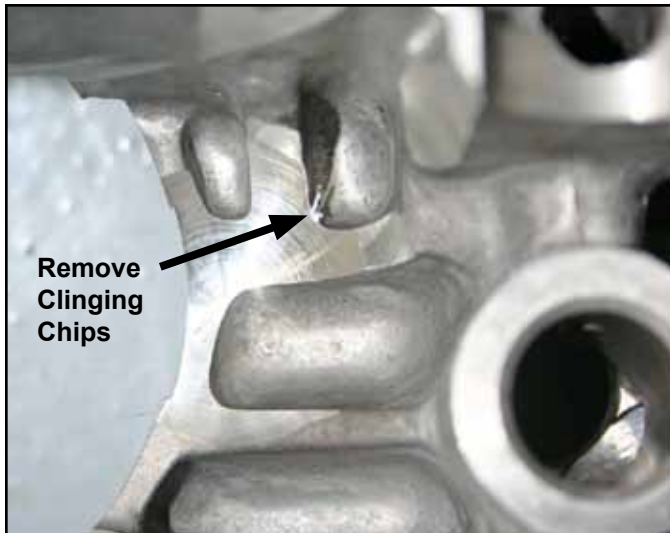
- ___ Flat Blade Screwdriver
- ___ Rubber Mallet
- ___ Fine File
- ___ White Lithium Grease

Parts Required:

- ___ Engine Case
- ___ 8mm Head Stud Kit, ACV-P01-86
- ___ Case kit, ACV-P02-12
- ___ Main Bearing Dowel Pins (Set of 5), ACV-P01-46
- ___ Valve Lifters, ACV-P01-48
- ___ Main Bearing Set (split bearings only), ACV-P01-57
- ___ Cam Bearings, ACV-P01-58
- ___ Gasket Set, ACV-P02-15

Preparation:

- ___ 1. Separate the case halves and thoroughly clean them with mineral spirits. **Remove all traces of metal chips and dust from the case.** Pay particular attention to removing metal chips which still cling to the edge of machined surfaces (see photo) and to casting slag inside the case which may dislodge in service.



Remove clinging chips and loose slag from the cases interior.

- ___ 2. Drill and tap a hole for a 1/4 NPT fitting 1.5" below the oil filler hole. See Section "Oil Line: Pump to Case" for additional information.

This photo shows a case already drilled and fitted with an elbow.



CRANK CASE PREPARATION

- ___ 3. If you are painting the case, now is the best time to do so. Mask off all machined surfaces, mating surfaces, and holes before painting.

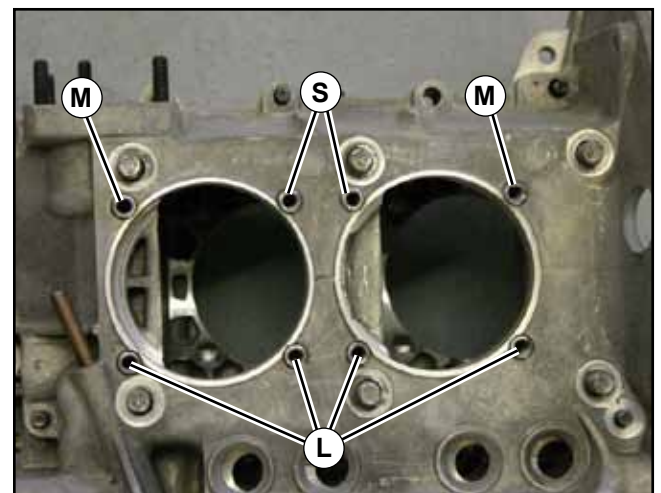
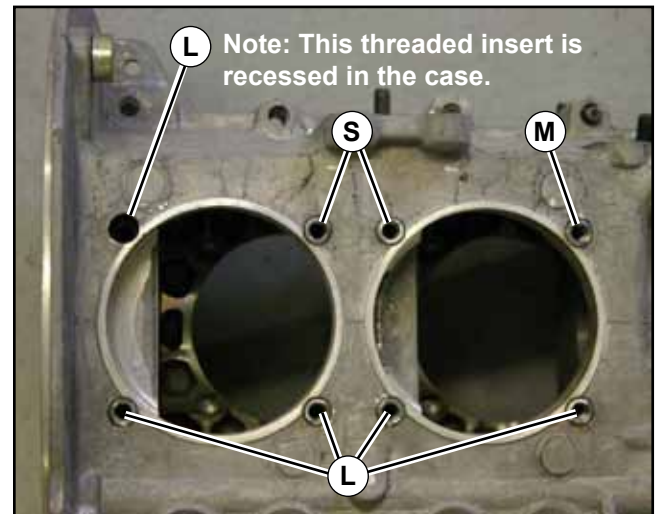
Note: We have had good results using "Barbecue Black" spray paint on the case and piston barrels.

Assembly Instructions:

- ___ 1. Install the head studs as shown in the photos below.

Cylinder Head Stud Placement

- (S) = Short Cylinder Head Stud (7-3/8" - 7-1/2" long)
- (M) = Medium Cylinder Head Stud (8" - 8-1/4" long)
- (L) = Long Cylinder Head Stud (9-5/16" - 9-3/4" long)



AeroVee 2.1 Turbo

- ___2. Lay the case on it's side so the oil pressure relief ports in the bottom of the case are accessible.



- ___3. Find the oil pressure relief plungers (2), springs (1 long, 1 short), metal gaskets (2) and retaining plugs (2) in the Case Kit.

Note: The remainder of the case kit may be discarded as it is not needed on the AeroVee.

- ___4. Insert the grooved plunger, lightly lubricated with motor oil, solid end first into the oil pressure relief port in the bottom of the case near the prop hub.

Note: The plungers must move freely in the passages. If they do not, clean the plungers with fine emery cloth until they do.

- ___5. Insert the long spring behind the grooved plunger.

- ___6. Place a metal gasket on a retaining plug and screw the plug into the relief port.

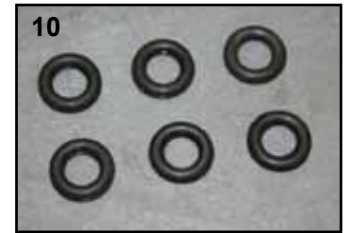
- ___7. Insert the non-grooved plunger, lightly lubricated with motor oil, solid end first into the oil pressure relief port in the bottom of the case near the flywheel.



CRANK CASE PREPARATION

- ___8. Insert the short spring behind the non-grooved plunger.

- ___9. Place a metal gasket on a retaining plug and screw the plug into the relief port.

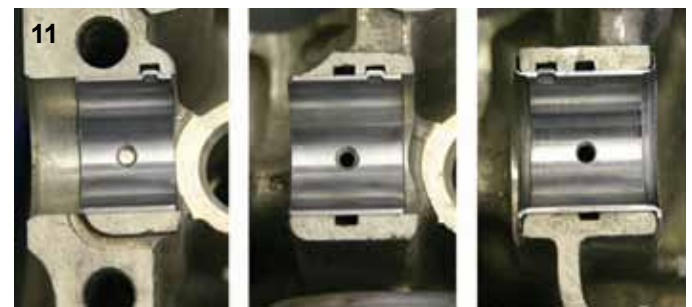


- ___10. Install the Main Bearing Stud Seals (Qty. 6) from the Gasket Set (ACV-P02-15). The seals slide over the 6 large studs in the right case half.



The Stud Seals slide over the 6 large studs in the right case half.

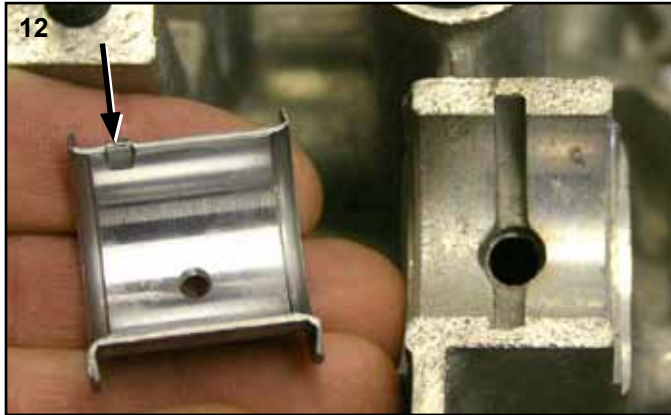
- ___11. Wipe clean the case journals and the back of each Cam Bearing and install the bearings in the left half of the case. The following photos show where each bearing is installed.



The cam bearings are installed in the left case half as shown in these photos. The left photo is the rear (flywheel end) of the case, the right photo is the front (prop hub end).

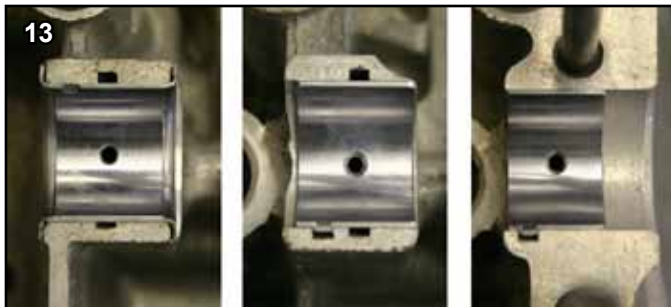
AeroVee 2.1 Turbo

- __12. The flanged cam bearing for the right case half must have its alignment tab filed off. File the tab off with a fine file.



File the tab (arrow) off the flanged bearing with a fine file.

- __13. Wipe clean the case journals and the back of each Cam Bearing and install the bearings in the right half of the case. The following photos show where each bearing is installed.



The cam bearings are installed in the right case half as shown in these photos. The right photo is the rear (flywheel end) of the case, the left photo is the front (prop hub end).

CRANK CASE PREPARATION

- __14. Test fit each Valve Lifter in a guide. The lifters must slide freely in the guides. If a lifter sticks, clean the guide with very fine emery cloth. After test-fitting, liberally lubricate each lifter with white lithium grease and install them in their guides.



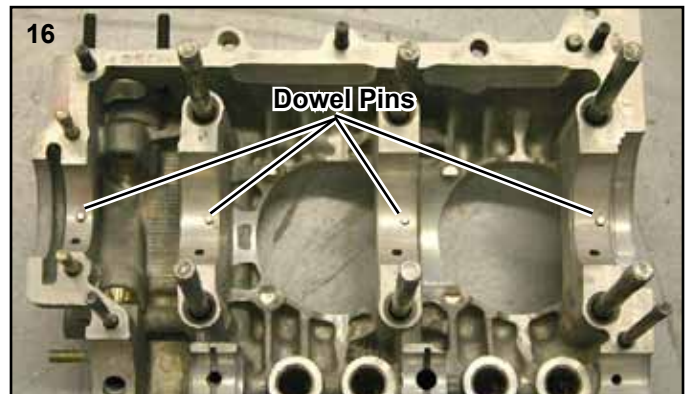
Test fit each valve lifter to assure smooth operation.

- __15. Test fit the Cam Shaft in each case half to make sure there is clearance between the lobes of the camshaft and each valve lifter. Interference between the cam shaft and a lifter must be investigated.

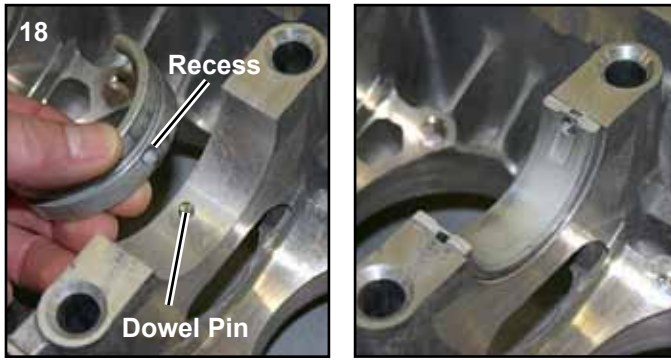


Test fit the camshaft to confirm there is clearance between the lobes of the camshaft and each lifter.

- __16. Install four (4) Dowel Pins in the right case half. Make sure they are fully inserted.



- ___ 17. Install one (1) Dowel Pin in the left case half. Make sure it is fully inserted.
- ___ 18. Install one half of the Split Main Bearing (from Main Bearing Set, ACV-P01-57) into the middle journal of each case half, carefully aligning the recess in the bearing with the dowel pin in the journal. A light tap may be required to properly seat each bearing half.



Align the recess in the bearing half with the dowel pin in the bearing journal and press the bearings in place.

- ___ 19. Apply an even coat of white lithium grease to all of the cam bearings and main bearings.

AeroVee 2.1 Turbo

CRANK CASE ASSEMBLY

Tools Required:

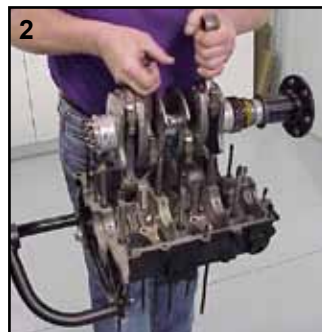
- ___ White Lithium Grease
- ___ "Red" Locktite (High Strength Threadlocker)
- ___ Torque Wrench (25 ft-lbs. capacity)
- ___ Torque Wrench (227 ft-lbs. capacity)
- ___ Rubber Mallet
- ___ Feeler Gauge Set
- ___ 13, 19 and 36mm Sockets
- ___ Permatex Aviation Form-A-Gasket #3 or Flange Sealant
- ___ Cam Assembly Lubricant

Parts Required:

- ___ Previously Completed Sub-Assemblies
- ___ Main Bearing Set, Bearing #4 (Flanged), ACV-P01-57
- ___ Flywheel Assembly, ACV-F01-02
- ___ Cam Plug, ACV-P01-35
- ___ Gland Nut, ACV-P01-42
- ___ End Shim Kit, ACV-P02-19
- ___ Gland Nut Washer, ACV-P01-44
- ___ ACV-Z01-75, Elastic Stop Nut, 12mm, Qty. 6
- ___ ACV-Z01-16 Bolts, Qty. 3
- ___ ACV-Z01-23 Elastic Stop Nuts, Qty. 15
- ___ ACV-Z01-26 Washers, Qty. 17
- ___ ACV-Z01-28 Washers, Qty. 6
- ___ Cam Screw Gaskets from Gasket Kit), Qty. 2, ACV-P02-15

Assembly Instructions:

- ___ 1. Apply a coat of white lithium grease to the inside of Main Bearing #4 and slide it onto the end of the crank shaft assembly. Make sure the dowel pin hole is toward the end of the crankshaft.
- ___ 2. Carefully set the crank shaft assembly into right case half. Make sure dowel pin hole in each bearing is aligned with the dowel pins in the case half, and the crankshaft assembly is fully seated in the case half.

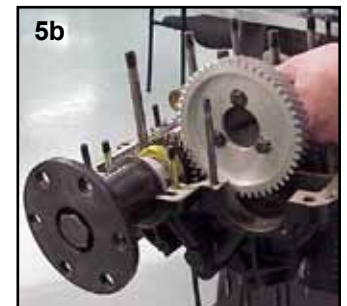


- ___ 3. **IMPORTANT!** Temporarily mate the case halves and rotate the crankshaft. While holding the connecting rods in their operational alignment, listen and "feel" for a knock which may indicate the case is interfering with the connecting rods. If interference is detected:
 - a. Disassemble the case halves and identify the location of the interference.
 - b. Remove crank assembly.
 - c. Taking care not to get grinding dust on other parts, remove case material to provide at least .045" clearance. Dremel-style motor tools work well for this operation.
 - d. Reinstall the crankshaft assembly and repeat step 3 until all interference is eliminated.

- ___ 4. Apply a small amount of cam assembly lubricant to each valve lifter.



- ___ 5. Align the single dot on the gear of the cam shaft assembly with the two dots on the gear of the crankshaft assembly and rotate the cam down into the cam bearings in the right case half. After seating the camshaft in the bearing, make sure the dots still align as shown in photo 5a.



- ___ 6. **IMPORTANT!** Make sure the main bearings of the crankshaft are still fully seated on the dowel pins in the case half.

AeroVee 2.1 Turbo

___7. Align the 8 holes in the center of the flywheel with the dowel pins on the end of the crankshaft. The hole pattern permits the flywheel to be installed in only one position.

___8. The flywheel is a tight fit onto the crankshaft. It must go on squarely. If it binds, remove it and lightly polish the dowel pins with fine emery cloth. Once the flywheel has been started by hand, complete the installation by tightening the gland with an impact wrench.



___9. Push the crankshaft towards the back (flywheel end) of the engine and, with a feeler gauge, measure the gap between the flywheel and the rear main bearing. Record this measurement in the "Shim Chart".



___10. Complete the shim chart by subtracting .006" from gap recorded in step 9. This is the total thickness of shims you will use to set the proper end play.

___11. Clean the end shims with a mild solvent to remove the preservative.

___12. Select any combination of three to five shims which most closely equals the "Shim Thickness" determined in step 10.

Shim Chart:

Complete this chart to determine the total thickness of shims required. See steps 9 through 10.

Gap (see Step 9) = 0.____"
 Subtract .006" - .006"
 Shim Thickness = 0.____"
 Continue with step 11.



CRANK CASE ASSEMBLY

___13. Check your shim selection by sliding the shims, together with a feeler gauge, between the flywheel and the main bearing. You should have between .003" and .006" of end play.

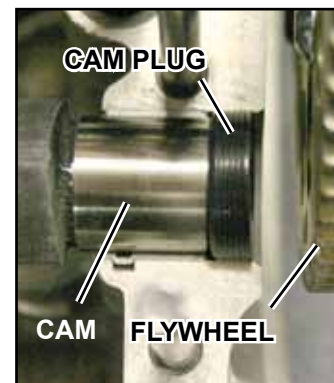
If necessary, adjust your shim selection to achieve the required end play of .003" to .006"

Set the shims aside for later installation.

___14. Remove the gland nut and flywheel from the crankshaft. It may be necessary to use a flywheel puller.



___15. Apply Permatex #3 sealant to the edge of the cam plug and install it in the cam plug bore at the flywheel end of the case with its closed (flat) end out.



ACV-P01-35

Metal plug with a single ridge. Used in cases with a "grooved" cam bore.

ACV-P01-34

Plastic plug with a ribbed diameter. Used with a "smooth" cam bore.

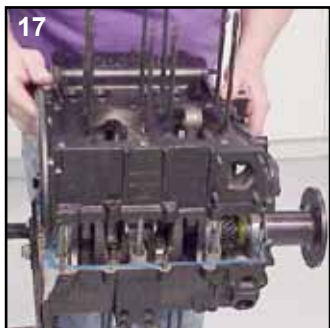
The type of cam plug used depends on the cases' cam lug bore.

AeroVee 2.1 Turbo

- __16. Apply Permatex Aviation Form-A-Gasket #3 or Flange Sealant to the mating surfaces of the case halves. Apply according to the product manufacturer's instructions. Apply sparingly.

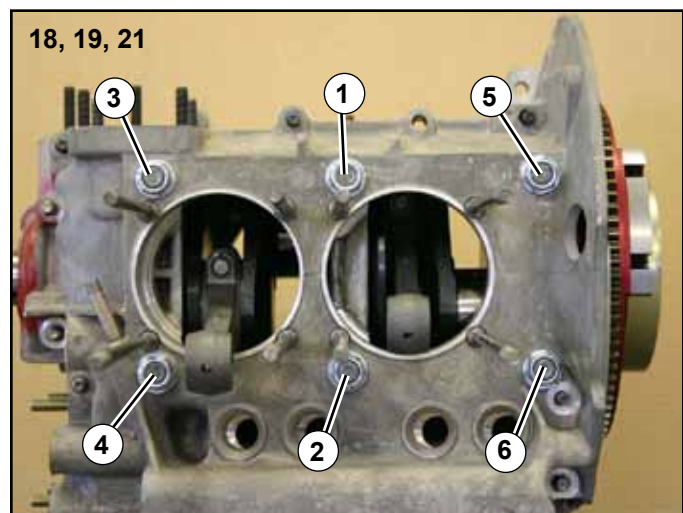


- __17. Note: While assembling the case halves, the lifters in the left half will want to slide out. This can be minimized by giving them each a heavy coat of white lithium grease.



Assemble the two case halves by placing the left half over the right half. Gently tap the left half with a rubber mallet to seat it against the right half of the case.

- __18. Place one ACV-Z01-28 washer and one ACV-Z01-75 12mm elastic stop nut on each of the six large studs. **Do not tighten the nuts at this time.**



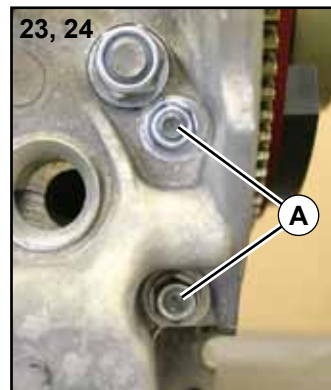
Torquing order for the six 12mm nuts. See steps 19 and 21.

- __19. In the order shown in the photo above, torque the 6 large nuts to 15 foot-pounds.
- __20. Check for free movement of the crankshaft. If interference is detected, identify the source of the interference (most likely poorly seated main or cam bearings).
- Note: If the connecting rods are not held near their normal operating position while checking for interference, you may experience interference which does not exist on an assembled engine.

CRANK CASE ASSEMBLY

- __21. In the order shown in the photo, re-torque the 6 large nuts to 25 foot-pounds. **Do not exceed 25 foot-pounds.**
- __22. Check for free movement of the crankshaft, as described in step 20.

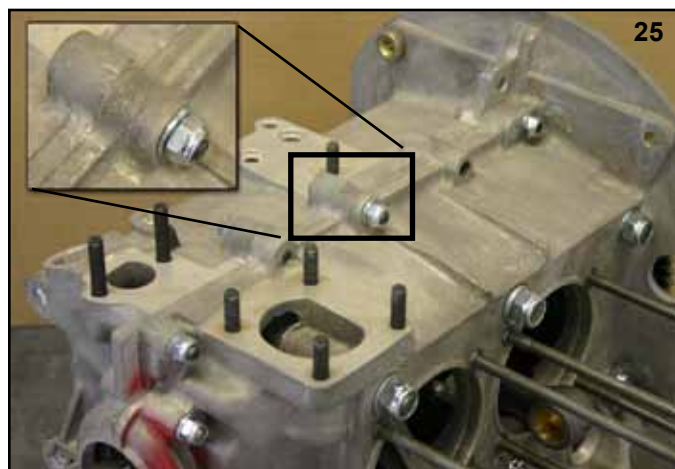
- __23. Apply Permatex Aviation Form-A-Gasket #3 to two (2) ACV-Z01-26 washers and place them over the cam shaft studs the lower left side of the engine.



The cam shaft studs (A).

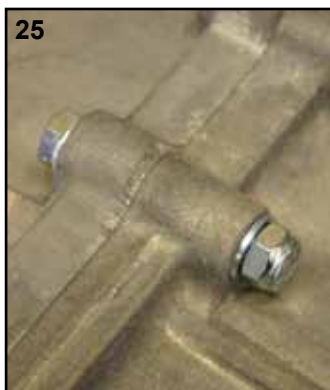
- __24. Install an ACV-Z01-23 stop nut on each cam shaft stud and lightly tighten.

- __25. Install an ACV-Z01-26 washer and ACV-Z01-23 stop nut on the remaining (10) studs on the perimeter of the case. Lightly tighten each nut.



There are 10 studs protruding through the case which serve to join to two case halves. Each must have a washer and nut installed (inset photo).

- ___26. Install and lightly tighten an ACV-Z01-16 hex head cap screw, two (2) ACV-Z01-26 washers, and an ACV-Z01-23 stop nut in each of the three through-holes which serve to join to two case halves. Minimal thread engagement is normal. Nuts will be flush with ends of screws.



- ___27. Torque the two cam nuts (from step 24) to 10 ft.-lbs.
- ___28. Torque the remaining case-assembly nuts (from steps 25 and 26) to 13 ft.-lbs. There is no defined order for torquing these nuts.
- ___29. Check for free movement of the crankshaft, as described in step 20.

AeroVee 2.1 Turbo

Parts Required:

- ___ Dual Oil Pump, ACV-T05-47
- ___ ACV-T05-69, M8x1.25 x 50mm Socket Cap Screws, (Qty. 4)
- ___ White Lithium Grease

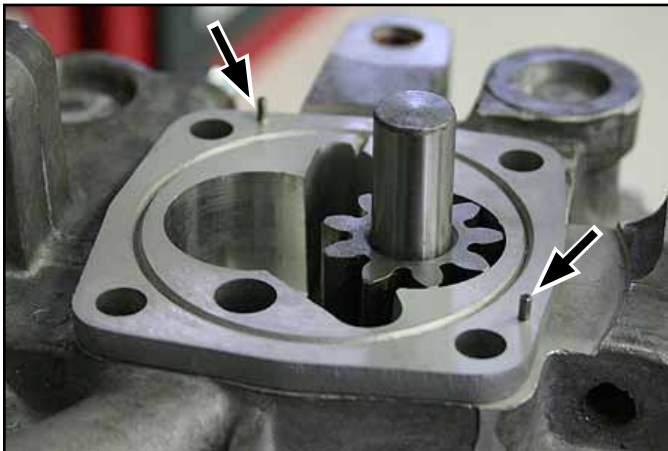
Assembly Instructions

Important: Disassemble the oil pump carefully and deliberately, paying close attention to the orientation and location of each component.

Be particularly watchful for the two small alignment pins between the two pump halves, as they can drop out.

Note: All photos were taken with the flywheel end on the workbench and the prop hub pointing up.

- ___ 1. Install the oil pump gasket, lightly coated with motor oil, under the oil pump housing and align pump housing with oil galley ports in the case.



The pump body is installed in the case. Pay particular attention to the two small alignment pins (identified here with arrows)

- ___ 2. Tap oil pump housing into place with a plastic mallet.
- ___ 3. Liberally grease both of the pump's gears.

- ___ 4. Place the secondary pump gasket, lightly coated with motor oil, on the pump.



- ___ 5. Make sure the two alignment pins are installed on the pump body.

DUAL OIL PUMP INSTALLATION

- ___ 6. Install the secondary pump. Make sure the lug of the driven gear engages the slot in the cam.

Note: Any "alignment" marks on the pump gears can be ignored.



- ___ 7. Confirm that the gears are liberally coated with lithium grease.

- ___ 8. Place the cover gasket, lightly coated with motor oil, on the secondary pump and secure the pump cover with the four mount bolts torqued to 14 ft-lbs.



AeroVee 2.1 Turbo

Tools Required:

- ___ Needle-Nose Pliers
- ___ SAE 30 Motor Oil
- ___ 1" Utility Brush
- ___ Permatex Aviation Form-A-Gasket No. 3 Sealant
- ___ Rubber Mallet
- ___ Ring Compressor
- ___ Vise-Grips
- ___ Micrometer Caliper

Parts Required:

- ___ Crank Case Sub-Assembly
- ___ Big Bore Piston and Cylinder Kit, ACV-P02-14
- ___ Barrel Shims, .090, ACV-P01-39
- ___ Barrel Shims, .040, ACV-P01-40
- ___ Barrel Shims, .060 (2 sets), ACV-P01-41
- ___ Super Tin, ACV-P06-71

Assembly Instructions:

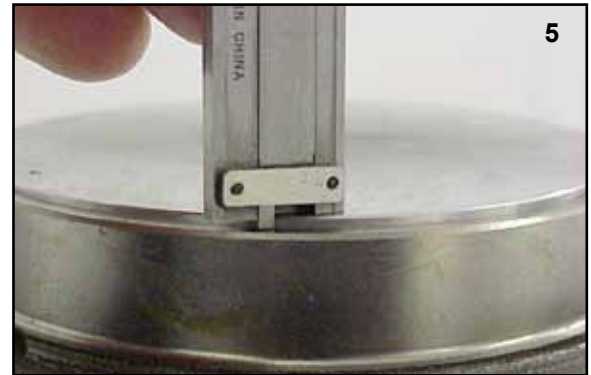
IMPORTANT: Pistons and pins have been matched to within 5 grams. Keep each piston and pin together as a set.

- ___ 1. Remove a piston ring from each piston and slide it squarely inside it's matched cylinder, near the bottom of the cylinder. Measure the gap between the ends of the ring - it should be between 0.012"-0.022". Re-install the ring on the piston.
- ___ 2. Re-install the piston into the cylinder using a ring compressor.
- ___ 3. Slide one piston and cylinder assembly into place on the crank case. Install the piston pin and make sure the cylinder is well seated.
- ___ 4. Bring the piston to Top Dead Center.

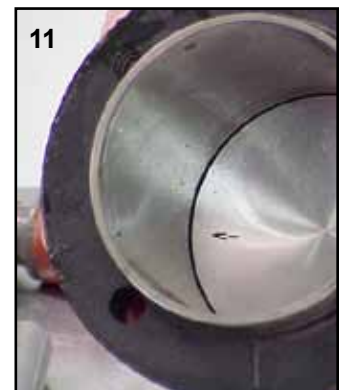


PISTON & CYLINDER ASSEMBLY

- ___ 5. Measure the deck height (distance between the top of the piston and the top of the cylinder). If the piston is below the top of the cylinder you have a positive (+) deck height. If the piston is higher than the top of the cylinder, you have a negative (-) deck height. Use your measured deck height to determine which cylinder shims are required from the chart on the next page.



- ___ 6. Remove the cylinder and piston assembly from the case.
- ___ 7. Apply a light coat of motor oil to the outside of each piston and the inner wall of each cylinder.
- ___ 8. Install the cylinder shims (as required, see chart on next page) onto each cylinder. Align the shims so they match the reliefs in the cylinder for the case studs.
- ___ 9. Apply Permatex Aviation Form-A-Gasket No. 3 Sealant to the shims and base of cylinder.
- ___ 10. Rotate the crank to bring a connecting rod to top dead center - this eases installation of the piston and cylinder.
- ___ 11. Note: The arrow on each piston face points to the flywheel end of the engine.



Partially slide the cylinder over the head studs. Push the piston out the bottom of the cylinder just far enough to attach the piston to the connecting rod with a piston pin, and secure the pin in place with a snap ring on each side of the piston pin.

Note: The snap rings were included in the piston/cylinder box.



AeroVee 2.1 Turbo

- ___12. Remove excessive sealant and tap the cylinder with a rubber mallet to seat it in position.
- ___13. Repeat steps 10 through 12 for the other cylinders.
- ___14. Install the super tin (below) under the cylinders and cylinder head. It "snaps" in place with the dividing rib between the cylinders and the cylinder head. See photo at right.



CYLINDER SHIM CHARTS

These charts identify the shims needed to achieve the desired compression ratio based on your engine's measured deck height (See step 5). Compression ratios are based on the 55cc cylinder heads provided with the kit. **Choose the correct compression ratio for the type of fuel you will be using.**

For future reference, record your measured deck height here: _____

7.0:1 Compression*

For use with automotive gasoline with a posted (R+M)/2 of 90 or greater conforming with ASTM D 4814. Also compatible with aviation gasoline 91/98 minimum grade conforming to ASTM D 910. Slightly less power output than 8.0:1 compression ratio.

Measured Deck Height (+/- .005")**	Head Gasket	+	Cylinder Shims Needed:	=	Total Shims
-0.08 to -0.10	.06		.09 + .09 + .06 + .04		.34
-0.05 to -0.07	.06		.09 + .06 + .06 + .04		.31
-0.01 to -0.04	.06		.09 + .06 + .04		.25
0.00 to +0.01	.06		.09 + .04 + .04		.23
+0.02 to +0.03	.06		.09 + .04 + .04		.23
+0.04 to +0.05	.06		.06 + .06		.18
+0.06 to +0.07	.06		.09 + .04		.19
+0.08 to +0.10	.06		.06 + .04		.16

* Actual compression ratio will be between 6.9 and 7.1 to 1, based on 55cc heads (as supplied).

**"+" means piston is below top of cylinder, "-" means it is above the top of the cylinder. See step 4.

PISTON & CYLINDER ASSEMBLY



The super tin is installed under the cylinders and cylinder heads. Friction keeps it in place.

8.0:1 Compression*

For use with aviation gasoline 91/98 minimum grade conforming to ASTM D 910. Not compatible with auto fuel. **Use of a lower grade fuel will result in high temperatures, detonation, and damage to the engine.**

Measured Deck Height (+/- .005")**	Head Gasket	+	Cylinder Shims Needed:	=	Total Shims
-0.10	.06		.09 + .09		.24
-0.09	.06		.09 + .06		.21
-0.08	.06		.09 + .06		.21
-0.07	.06		.09 + .04		.19
-0.06	.06		.09 + .04		.19
-0.05	.06		.06 + .06		.18
-0.04	.06		.06 + .04		.16
-0.03	.06		.06 + .04		.16
-0.02	.06		.09		.15
-0.01	.06		.09		.15
0.00	.06		.06		.13
+0.01	.06		.06		.12
+0.02	.06		.04		.10
+0.03	.06		.04		.10
+0.04	.06		.04		.10
+0.05	.06		---		.06
+0.06	.06		---		.06
+0.07	.06		---		.06
+0.08	---		.04		.04
+0.09	---		.04		.04
+0.10	---		.04		.04

AeroVee 2.1 Turbo

Parts Required:

- ___ Cylinder Head Nuts and Washers, from ACV-P01-86
- ___ Copper Cylinder Head Gaskets, 0.060 Thick, ACV-P01-92
- ___ Cylinder Head Assemblies, (See packing list for part number)
- ___ Push Rod Tubes, ACV-P06-50
- ___ Rocker Arm Nuts, (from Valve Cover package)
- ___ Gasket Set (partial), ACV-P02-15

Assembly Instructions:

Important: The cylinder heads will contain debris from machining. You must clean and inspect the cylinder heads for debris before installing them.

Note: The process of machining the spark lug holes for the secondary ignition often damages neighboring cooling fins. Missing fins is normal. You may wish to sand/file the rough edges to make them smooth.



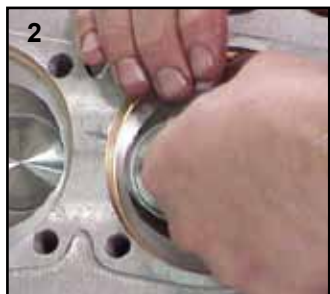
Note: "Grooves" in the seat of the secondary ignition spark plug hole are normal and do not impact the seal of the spark plug washer



- ___ 1. Install Push Rods Seals (from Gasket Set) on each end of the Push Rod Tubes. Expand the bellows end of each push rod tube slightly. This will improve the seal between the push rod tubes, engine case, and cylinder heads.



- ___ 2. Insert Cylinder Head Gaskets into Head Assemblies.

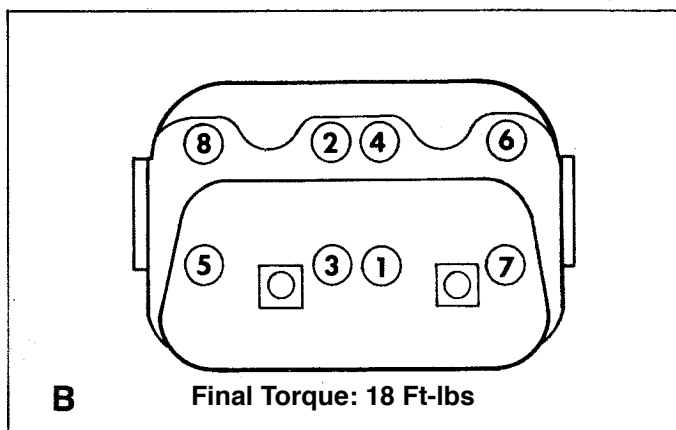
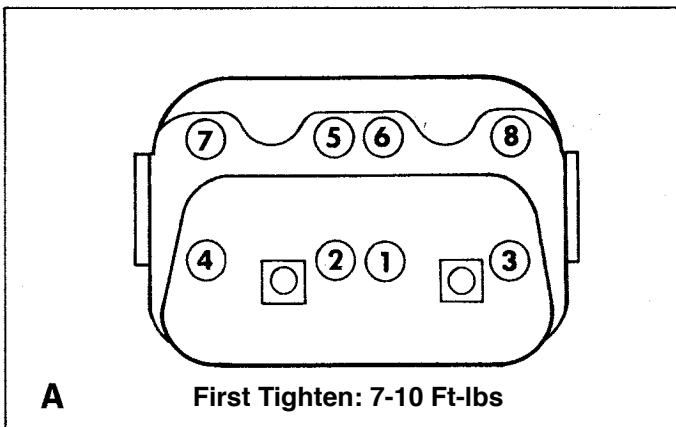


CYLINDER HEAD INSTALLATION

- ___ 3. Align the cylinder head with the engine studs and cylinders and then install the push rod tubes. Check alignment of Push Rod Tubes and barrels as you push the cylinder head into place.



- ___ 4. Place washers and retaining nuts (from the head stud kit) onto the head studs. Tighten in sequence shown in drawings A and B, below. Torque sequence must be used to prevent the head from warping.



- ___ 5. Perform this step only if the cylinder head has an O-ring recess at the base of the stud.

Install O-ring (from Gasket Set) onto the two head studs that hold the rocker assembly in place.



AeroVee 2.1 Turbo

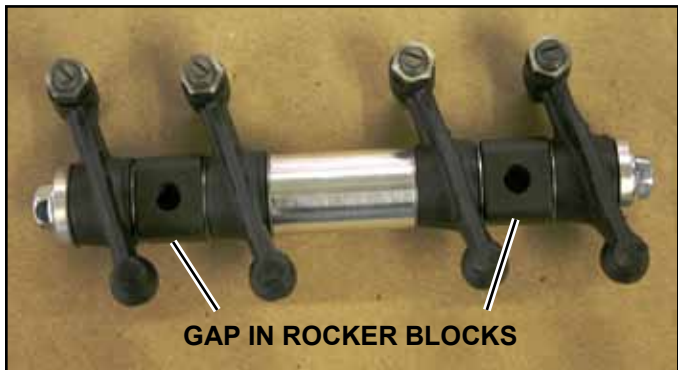
Parts Required:

- ___ Push Rods, ACV-P06-51
- ___ Pushrod Measuring Tool
- ___ Cylinder Head Nuts and Washers, from ACV-P01-86
- ___ Rocker Arm Nuts, from Valve Cover package
- ___ Rocker Shaft Assembly, ACV-P02-10

Assembly Instructions:

Note: Pre-assembled rocker assemblies often need to be disassembled for proper installation.

- ___ 1. Assemble the rocker shafts with the gap in the rocker blocks facing the cupped end of the rocker arms and the thin shims evenly distributed.



The rocker blocks are installed so their gaps are toward the cupped end of the rocker arms.

- ___ 2. Turn each adjuster fully counter-clockwise until the pad lightly contacts the rocker arm, and then turn it back clockwise 1.5 turns.

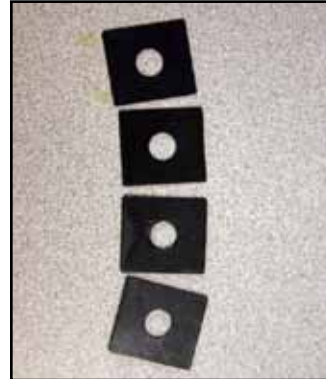


Two different swivel pads exist. The one on the left is a large, swiveling pad, the one on the right is a ball with a flat spot. The flat spot on the ball must contact the valve's stem.

ROCKER SHAFT INSTALLATION

Note: Steps 3 through 19 apply to one side of the engine at a time and will be repeated for each side.

- ___ 3. Place a square spacer from the rocker arm package over each of the rocker shaft mounting studs on a cylinder head.



- ___ 4. Place a rocker assembly over the mounting studs and inspect for interference between the rocker arm assembly and the head studs. If the rocker arm assembly contacts the head studs, trim the ends of the head studs to remove the interference.

The spacers placed under the rocker blocks influence the alignment of the rocker arm swivel pads to the valve tip. Proper alignment is achieved when the flat of the swivel pad is partially off-center from the valve stem. This is typically achieved with 1 or 2 shims under each rocker block.



Incorrect - Too few spacers. The swivel pad is centered on the valve stem.



Incorrect - Too many spacers. The flat of the swivel pad is off the edge of the valve stem.



Correct - The flat of the swivel pad is off center from the valve stem but sits fully on the valve stem. Typically 1 or 2 shims.

AeroVee 2.1 Turbo

- ___ 5. Observe the lateral alignment of each swivel pad to its corresponding valve stem. Arrange the spacers on the rocker shaft, between each rocker arm and mounting block, as needed to get each swivel pad properly aligned. It is acceptable to have no spacer between components if that will achieve the proper alignment between the valve stem and the swivel pad.

This slight offset rotates the valve a small amount each time it opens, improving the life of the valve train.



Correct - The flat of the swivel pad is off center from the valve stem but sits fully on the valve stem.



Incorrect - The flat of the swivel pad is centered on the valve stem.



Incorrect - The flat of the swivel pad is off the edge of the valve stem.



The spacers between the rocker arms and mounting blocks must be distributed as needed to get each swivel pad correctly aligned with each valve stem. It is acceptable to have no spacer between components if that will achieve the proper alignment between the valve stem and the swivel pad.

ROCKER SHAFT INSTALLATION

- ___ 6. Torque the hex head cap screws on the end of the rocker shaft assembly to 25 foot-pounds.
- ___ 7. Remove the rocker assembly from the cylinder head.
- ___ 8. Slide the push rod length tool into a push rod tube until it engages the lifter in the case.
- ___ 9. Rotate the crank until the push rod reaches the bottom of its travel.
- ___ 10. Re-install the rocker shaft assembly and secure it with the retaining nuts included with the valve covers. Torque the nuts to 14 foot-pounds.



The push rod length tool is inserted in a push rod tube after removing the rocker shaft.

- ___ 11. Adjust the length of the push rod tool until it is engaging the lifter, is seated in the cup of the rocker arm, and is holding the rocker arm swivel pad against the tip of valve stem.
- ___ 12. Remove the rocker arm assembly.
- ___ 13. Remove the push rod length tool without disturbing its setting. The tool is set for the over-all length of the four (4) pushrods for that side of the engine.

Note: It is not necessary to measure and trim each push rod individually, however, it may be beneficial to determine the push rod lengths for each side of the engine individually.

- ___ 14. Allow for the length of the push rod tip and trim the push rod bodies as needed.
- ___ 15. Make sure the inside of each push rod is clean.
- ___ 16. Press a tip onto each of the trimmed pushrods. The end of the push rod body may be heated if necessary, but do not apply excessive localized heat.
- ___ 17. Apply white lithium grease to the end of each push rod and slide them into the push rod tubes.
- ___ 18. Re-install the rocker assembly, carefully aligning the pushrods with the cups of the rocker arms.
- ___ 19. Install the rocker assembly retaining nuts and torque them to 14 ft-lbs.
- ___ 20. Repeat steps 3 through 19 for the other side of the engine.

Note: Make sure each rocker arm moves freely on the shaft. If binding exists but the rockers land correctly on each valve, lightly sand the surface of a spacer or mounting block by the binding rocker to relieve the binding.

Tools Required:

- ___ Feeler Gauges
- ___ Flat blade screw driver
- ___ Socket Wrench
- ___ 13 mm Socket

Parts Required:

- ___ Valve Covers, ACV-P01-15

Assembly Instructions:

- ___ 1. Rotate the prop hub until the # 1 cylinder is at top dead center and both the intake and the exhaust valves are closed (valve springs fully extended).
- ___ 2. Insert a .008" feeler gauge between the INTAKE valve's adjusting screw and the valve.
- ___ 3. Adjust the screw until the 0.008" feeler gauge moves smoothly between the valve and the swivel foot.
- ___ 4. Lock the adjustment screw in place by torquing the locking nut to 14 foot pounds.
- ___ 5. Recheck the valve setting with the .008 feeler gauge.
- ___ 6. Insert a .014" feeler gauge between the EXHAUST valve's adjusting screw and the valve.
- ___ 7. Adjust the screw until the 0.014" feeler gauge moves smoothly between the valve and the swivel foot.



Here an exhaust valve is being adjusted to .014".

- ___ 8. Lock the adjustment screw in place by torquing the locking nut to 14 foot pounds.
- ___ 9. Recheck the valve setting with the .014 feeler gauge.
- ___ 10. Rotate the crankshaft 180 degrees and adjust the valves of cylinder #4, following steps 2 through 9.
- ___ 11. Rotate the crankshaft 180 degrees and adjust the valves of cylinder #3, following steps 2 through 9.
- ___ 12. Rotate the crankshaft 180 degrees and adjust the valves of cylinder #2, following steps 2 through 9.
- ___ 13. Install the valve covers using the valve cover gaskets, hex head cap screws, O-rings, and washers included with the valve covers. The cap screws are tightened by feel to secure the covers and prevent leaks.

Tools Required:

- ___ 11/16" Spark Plug Socket Wrench
- ___ 0.018" & 0.032 Feeler Gauges
- ___ Anti-Seize Compound

Parts Required:

- ___ Autolite 4163 Spark Plugs (Qty 8), ACV-P01-21

Plug Installation:

- ___ 1. Gap four (4) TOP spark plugs to 0.018".
- ___ 2. Gap four (4) BOTTOM spark plugs to 0.032".



- ___ 3. Apply an anti-seize compound to the threads of each spark plug and install them in the cylinders.
- ___ 4. Torque each spark plug to 12 foot-pounds.

AeroVee 2.1 Turbo

Supplies Required:

___ Red High Temp RTV

Parts Required:

- ___ Intake Elbow Spacers (Qty 2) ACV-M01-17
- ___ Intake Elbow-Right Hand, ACV-M01-11
- ___ Intake Elbow-Left Hand, ACV-M01-12
- ___ Intake Hose, ACV-M01-20 (Qty 2)
- ___ Hose Clamp, ACV-Z01-10, Qty. 4.
- ___ ACV-Z01-49, Socket Head Cap Screw (Qty. 4)
- ___ ACV-Z01-26, Washer (Qty. 4)

Assembly Instructions

Note: If your cylinder heads are equipped with mounting studs at the intake ports, the mounting studs must be removed.

- ___1. Temporarily place each of the intake elbow spacers and intake elbows on the cylinder heads and inspect for interference between the elbows and the two upper, center head studs. If necessary, trim the ends of the studs to eliminate interference.



- ___2. Apply Red High Temp RTV to one side of each intake elbow spacer and position each spacer on each cylinder head, Permatex side against the cylinder head.



- ___3. Apply Red High Temp RTV to each intake elbow and secure the elbows to the cylinder heads with ACV-Z01-26 Washers (Qty 4), and ACV-Z01-49 Cap Screws (Qty. 4) torqued to 10 foot pounds.

INTAKE ELBOW INSTALLATION

- ___4. Slide an Intake Hose onto each intake elbow and secure it with a Hose Clamp.



- ___5. Position a second hose clamp on each intake hose. They will be used to secure the intake manifold in an upcoming assembly.

Tools Required:

- ___ High Temperature RTV Silicone Gasket Maker
- ___ VW Oil Seal Installation Tool (optional, recommended)
- ___ Rubber Mallet

Parts Required:

- ___ End Shims, ACV-P02-19
- ___ Oil Seal, ACV-P01-68

Assembly Instructions

Note: The correct number and thickness of end shims was determined in the Crank Case Assembly section.

- ___ 1. Clean the oil seal bore of excessive sealant, particularly around near the case parting lines.
- ___ 2. Install the end shims over the flywheel end of the crank.
- ___ 3. Apply a light coat of High Temperature RTV Silicone Gasket Maker to the outside diameter of the oil seal and install the seal. A VW seal installation tool may be used for best results, however the seal can also be lightly tapped in place if care is used.
- ___ 4. Wipe off any excess sealant.



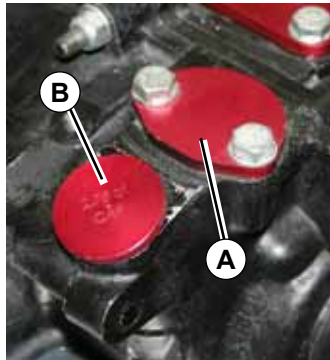
AeroVee 2.1 Turbo

Parts Required

- ___ Gasket Set (partial), ACV-P02-15
- ___ ACV-Z01-18 Bolts, Qty 6
- ___ Machined Breather Plate, ACV-P01-85
- ___ Oil Temperature Plate, ACV-P01-12
- ___ Fuel Pump Block-Off Plate, ACV-P01-14
- ___ Oil Fill Plug, ACV-P01-17
- ___ Dip Stick, ACV-P01-24

Assembly Instructions

- ___ 1. Install fuel pump block-off plate using ACV-Z01-18 Bolts (Qty. 2) and the corresponding gasket (from Gasket Set).
- ___ 2. Spread a light coat of clean engine oil on the O-rings of the oil fill plug and insert it in the case.



Fuel pump block-off plate (A) and oil fill plug (B).

- ___ 3. Remove the pre-installed studs from the engine case and install Oil Breather Plate using ACV-Z01-18 Bolts (Qty. 4) and the corresponding paper gasket from Gasket Set. **Do not install the metal louvered gasket as it will restrict the breather.**



BLOCK-OFF PLATES and PLUGS

- ___ 4. Drill and tap a hole in the center of the Oil Temperature Plate to accept the oil temperature sender. If you are using the optional temperature sender offered by Sonex you will drill a 1/2" diameter hole and tap it with a M14x1.5 tap.



This oil temperature plate has been drilled for, and fitted with, an oil temperature probe. It is located on the front of the engine, below cylinder #2.

- ___ 5. Install the temperature plate below cylinder #2. It is installed with two (2) ACV-Z01-23 nuts and the corresponding gasket (from Gasket Set).
- ___ 6. Install the oil temperature probe in the plate.
- ___ 7. Slide the dipstick into the dipstick tube in front of cylinder #2.



Note: The dipstick will be calibrated and marked in a later procedure.

AeroVee 2.1 Turbo

Tools Required:

- ___ Socket Wrench
- ___ 36mm Socket
- ___ Torque Wrench
- ___ Permatex High Temp Red RTV Silicone Gasket

Parts Required:

- ___ Flywheel Assembly, ACV-F01-02

Hardware Required

- ___ ACV-Z01-13 Cap Screws
- ___ ACV-Z01-20 Bolts
- ___ ACV-Z01-21 Bolt
- ___ ACV-Z01-24 Nut
- ___ ACV-Z01-27 Washers

Assembly Instructions:

- ___ 1. Using a high-temperature silicone sealant, lightly coat the dowel pin area of the flywheel and place a small bead (1/8" diameter) in the groove near the dowel pin area of the flywheel.

Note: The engine assembly DVD may show an O-ring being used instead. The O-ring has been discontinued.



- ___ 2. Install the flywheel on the back of the engine.

Important: The 8 dowel pins will only align one way.

Note: The flywheel may require some effort to get it started and seated on the drive pins. This is normal.



FLYWHEEL INSTALLATION

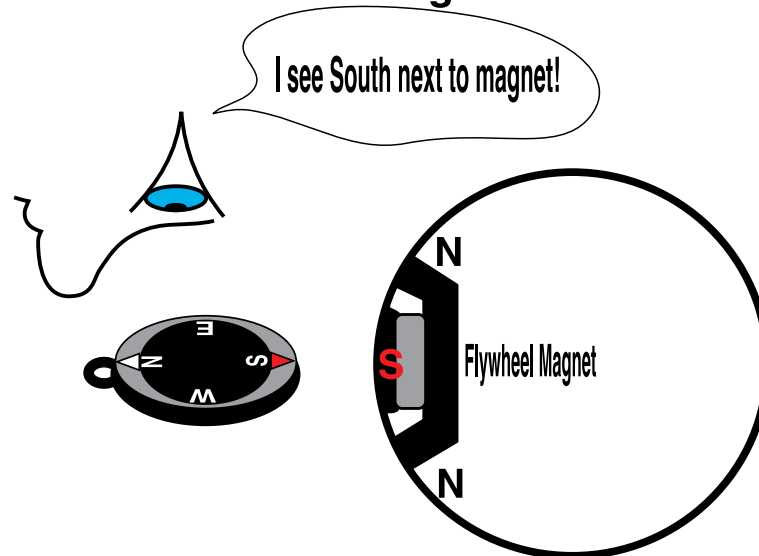
- ___ 3. Install wavy washer and gland nut with Locktite 272. Torque to 227 ft-lbs.

Note: A piece of wood temporarily bolted to the prop hub provides good leverage to keep the crank from turning while the gland nut is being torqued.

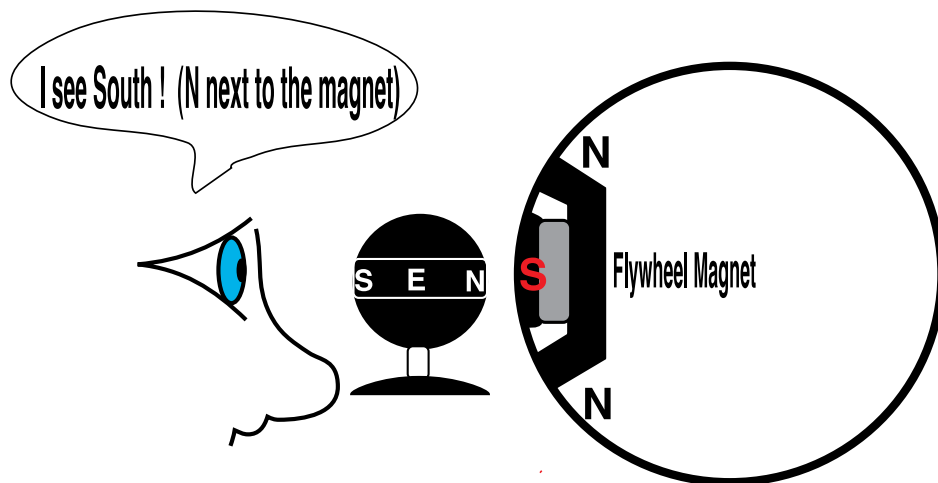


Confirming **AeroVee** Ignition Magnet Orientation.

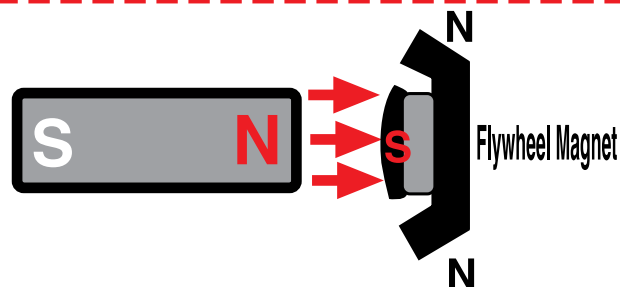
The **Center Pole** of the Magnet must be **South**!



1) Checking Magnet using a "Hiking" or "Boy Scout" Compass



2) Checking Magnet using an Auto or Aircraft Compass



3) Checking Magnet using a "BAR" Magnet N will attract...**S will repel**!

AeroConversions, Inc 10/02

Tools Required:

- ___ Socket Wrench
- ___ 17mm Socket
- ___ 9/64" Allen Wrench
- ___ 7/32" Ignition Wrench
- ___ Torque Wrench, 25 ft/lbs.

Parts Required:

- ___ Accessory Plate, ACV-A01-10
- ___ Ignition Modules (Magnatron), ACV-A01-19
- ___ ACV-Z01-13 Cap Screws
- ___ ACV-Z01-20 Bolts
- ___ ACV-Z01-21 Bolt
- ___ ACV-Z01-24 Nut
- ___ ACV-Z01-27 Washers
- ___ MS21042-08 Hex Nuts
- ___ Shim Stock .010", ACV-P01-75

- ___ 1. Bend P-Lead tabs on ignition modules 90° to clear the accessory plate.



- ___ 2. Attach ignition modules to the accessory plate using ACV-Z01-13 Cap Screws and MS21042-08 hex nuts. Install bolt at the bottom of the slot. **The note 'THIS SIDE OUT' stamped in each Magnatron must face towards the front of the engine.**



- ___ 3. Match the accessory plate to the raised groove on the back of the engine case.
- ___ 4. Attach accessory plate using the ACV-Z01-20 Bolts (Qty 3), ACV-Z01-21 Bolt (Qty. 1), ACV-Z01-24 Nut, ACV-Z01-27 Washers (Qty 4). Torque to 25 ft-lbs.
- ___ 5. Rotate the flywheel until the magnet shoe on the flywheel is under the Magnatron.

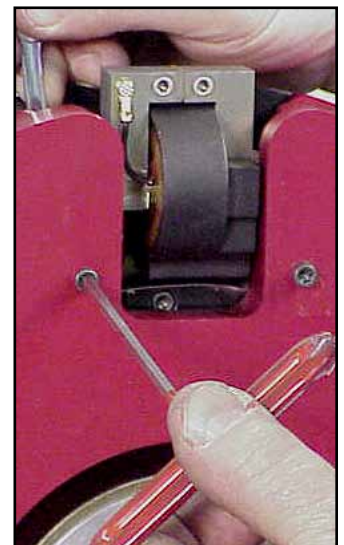


- ___ 6. Slide the 0.010 shim between the ignition module and magnet shoe.



- ___ 7. Push module down against the shim and tighten the module mount bolts.
- ___ 8. Remove 0.010 Shim.
- ___ 9. Repeat steps 5 through 9 for the remaining ignition module.

Note: The Ignition Timing is fixed. There is no need to time the primary ignition system.



AeroVee 2.1 Turbo

Tools Required

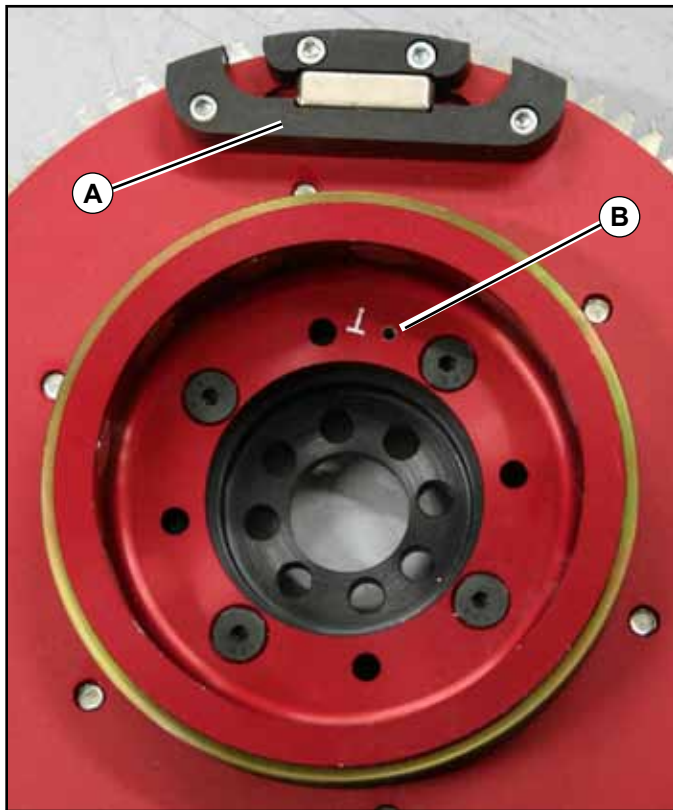
- ___ 9/64" Hex Drive
- ___ Locktite 242

Parts Required

- ___ Trigger Shaft Assembly, ACV-F01-24
- ___ ACV-Z01-81 Flat Head Socket Cap Screw, Special, Qty. 4

Trigger Shaft Installation

- ___ 1. Rotate the crank until the magnet shoe (A) on the flywheel is at the top of the engine. This will also put the witness hole in the flywheel assembly (B) near the 12 o'clock position, as shown in the photo below.

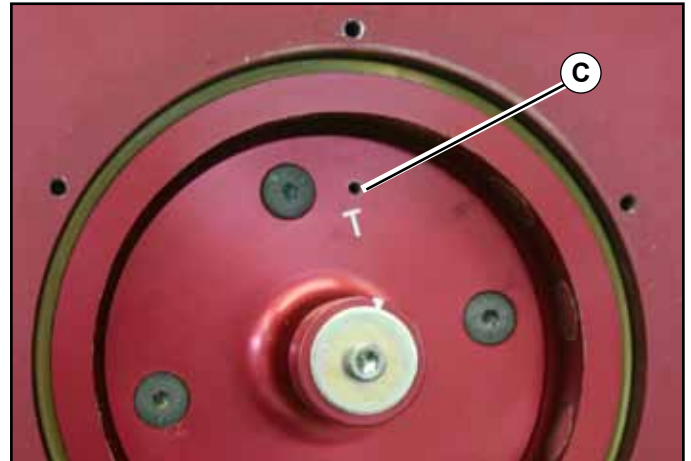


Rotate the engine until the magnet shoe (A) is in the 12 o'clock position. This will also put the flywheel's witness hole (B) near the 12 o'clock position. For clarity the flywheel is shown removed from the engine.

TRIGGER SHAFT INSTALLATION

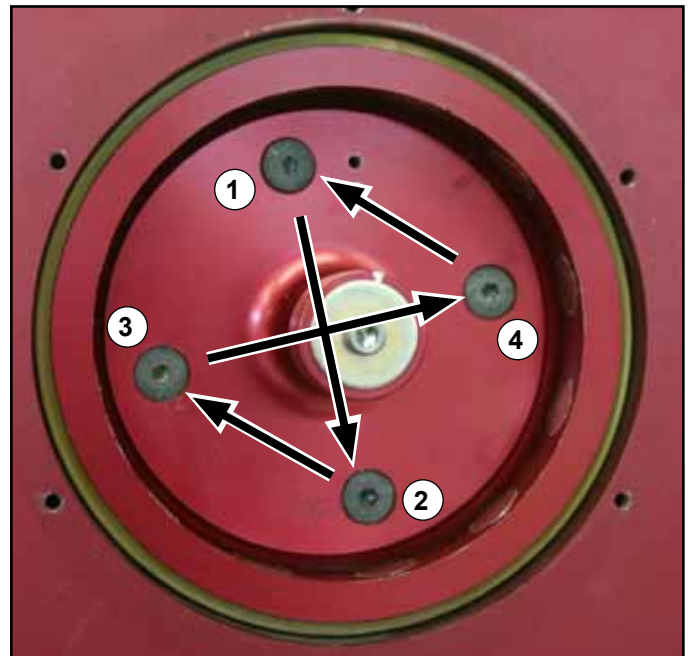
- ___ 2. Line up the witness hole in the trigger shaft (C) with the witness hole in the flywheel. Apply Locktite 242 to each of the four (4) ACV-Z01-81 flat head cap screws and install them loosely. They will be tightened in step 3.

Note: If your trigger shaft does not have a witness hole, the trigger shaft may be attached in any orientation.



The "C" identifies the witness hole on the trigger shaft. Align this hole with the witness hole in the flywheel.

- ___ 3. Sequentially tighten the screws in the crossing pattern shown below. This will center the shaft on the flywheel.



The screws are sequentially tightened in the crossing pattern shown here. This helps center the trigger shaft on the flywheel.

AeroVee 2.1 Turbo

Tools Required

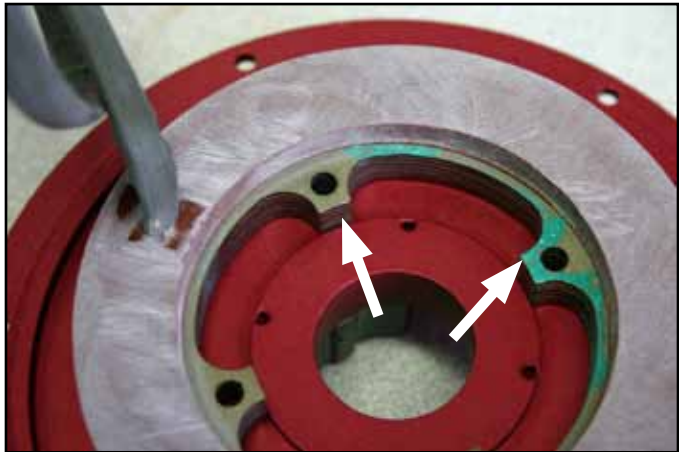
- ___ 9/64" Hex Drive
- ___ Locktite 242
- ___ Locktite 7471 Primer

Parts Required

- ___ Alternator Mount Plate w/ Ignition Modules, ACV-A01-03
- ___ Alternator Stator, 20 Amp, ACV-A01-15
- ___ ACV-Z01-12 Cap Screw, Qty. 6
- ___ ACV-Z01-76 Cap Screw, Patched, Qty. 4

Stator Assembly

- ___ 1. Test fit the stator to the stator plate. If interference is noted between the mounting lugs of the stator and the boss on the plate, sand or file the lugs to remove the interference.



Make sure the lugs of the stator do not interfere with the raised boss of the stator plate.

- ___ 2. Pass the wires of the stator through the hole in the stator plate.
- ___ 3. Prime four ACV-Z01-76 screws with Locktite 7471 Primer.



- ___ 4. Attach the stator to the alternator mount plate using the four (4) primed ACV-Z01-76 screws and Locktite 242 on each screw prior.



ALTERNATOR INSTALLATION

Installing the Stator Assembly

- ___ 1. "Paint" the surface of each magnet in the magnet ring and the outside of the stator with a permanent marker.

Important: The magnets of the magnet ring are very strong and will try to pull the stator assembly out of your hands as you install it. Maintain a firm grip to avoid pinched fingers.



- ___ 2. Carefully place the stator assembly over the magnet ring with the "top" pick-up near the 1 O'clock position and the "bottom" pick-up near the 7 O'clock position. The magnet ring may force the stator assembly into an unwanted position. Rotate the flywheel until the stator plate can be properly positioned.

- ___ 3. Temporarily install 6 (six) ACV-Z01-12 cap screws to secure the stator assembly in place.



- ___ 4. Rotate the crank shaft 3 or 4 full revolutions. This is easily done by removing a spark plug and turning the crank with a socket wrench on the prop hub bolt.

- ___ 5. Remove the stator plate and inspect the magnet ring and stator for signs that the two are in contact with each other. If the marker is intact on both parts, your clearance is acceptable. Continue with Step 6.

If there is evidence of contact between the parts, use a belt sander or equivalent to remove some material from the stator where the marker has been rubbed away and then repeat steps 1 through 5.

- ___ 6. Re-install the stator assembly as described in Step 2.
- ___ 7. Prime six ACV-Z01-12 screws with Locktite 7471 Primer.
- ___ 8. Secure the stator assembly to the accessory plate using six primed ACV-Z01-12 screws and Locktite 242.

Tools Required:

- ___ 5/16-18" x 2" Hex Head Cap Screw (not supplied in kit)
- ___ 5/16-18 Nut (not supplied in kit)
- ___ 5/16 Washer (not supplied in kit)
- ___ 5/8" Socket

Parts Required:

- ___ Prop Drive Bushings, ACV-H01-11

Assembly Instructions

- ___1. Insert a prop drive bushing into the prop hub.
- ___2. Insert the bolt through a drive bushing using a socket as a spacer.
- ___3. Use the bolt, washer, nut and socket to pull the drive bushing into the hub.
- ___4. Repeat for other 5 drive Bushings.



Parts Required

- ___ Voltage Regulator, ACV-A01-20
- ___ Ignition Coils (Red), Qty. 2, ACV-A01-25
- ___ AN-grade hardware as required (not supplied)

Before the engine is installed on the engine mount, the firewall should be prepared. This includes mounting the AeroVee's secondary ignition coils and voltage regulator.

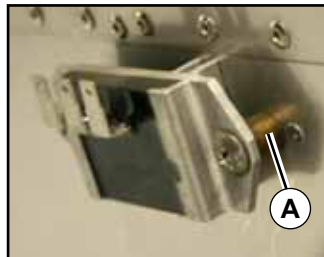
Though not part of the AeroVee kit, careful consideration must be given to the placement of the gascolator, battery box, master solenoid, and other firewall-mounted components to avoid interference with the engine installation and assure ease of maintenance.

Note: Due to the customized nature of Experimental aircraft it is beyond our ability to provide detailed firewall preparation instructions. Each builder must determine for themselves where the specific items of their unique installation will be mounted, keeping in mind the Turbo will occupy the space on the right side of the firewall.

Voltage Regulator Installation

Note: The voltage regulator must be grounded. In a typical installation the regulator will be grounded through the hardware which secures it to the firewall. If your installation uses non-conductive materials for the firewall, or for the mounting of the regulator, dedicated ground wires will be necessary between the regulator and a suitable ground point.

- ___ 1. Mount the voltage regulator to the firewall in a location which allows easy connection of the wires from the alternator. The use of 3/8" long stand-offs (aluminum or bronze tubing) is recommended to space the regulator away from the firewall.



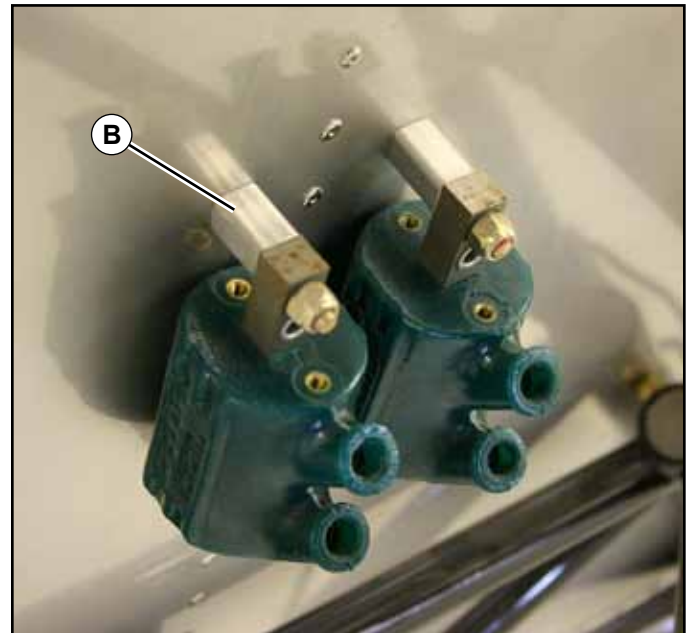
Stand-offs (A) are used to space the regulator off the firewall.

Wiring the alternator to the voltage regulator is described later in this manual.

Secondary Ignition Coil Installation

Note: The ignition coils must be grounded. In a typical installation the coils will be grounded through the hardware which secures them to the firewall. If your installation uses non-conductive materials for the firewall, or for mounting the coils, dedicated ground wires will be necessary between the coils and a suitable ground point.

- ___ 1. Mount the ignition coils (ACV-A01-25) to the firewall in a location which allows easy connection of the lower spark plug wires. The use of 3/4" long stand-offs (aluminum or bronze tubing) is recommended to space the coils away from the firewall.



Stand-offs (B) are used to space the coils off the firewall.

Parts Required

- ___ Motor Mount Shock Bushings (Qty. 8), ACV-P01-19
- ___ 3/8" ID x 1.25" OD Fender Washer (Qty. 16), ACV-Z01-40
- ___ AN4-36A Bolt (Qty. 4, not supplied)
- ___ AN363-428 Nut (Qty. 4, not supplied)
- ___ AN960-416 Washer (as needed, not supplied)

Sonex Airframes

Bolting the engine to the engine mount is shown in detail in the "Engine Installation, AeroVee" drawing of your airframe plans and on the next page of this manual, however, these few notes may save you some time.

All Airframes

Mount Bushings

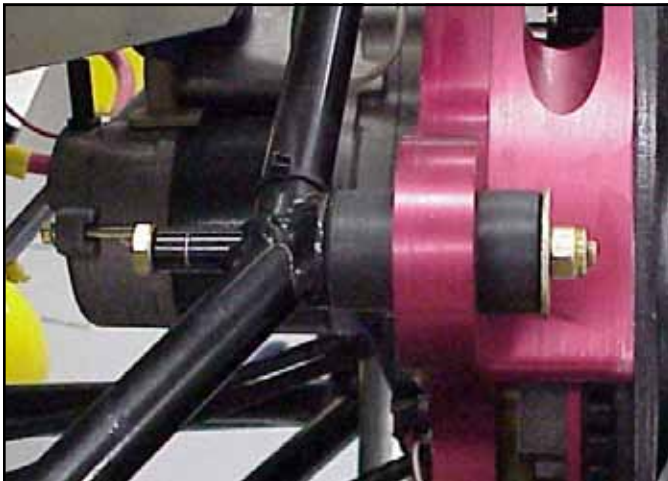
The engine mount bushings will go on the engine mount much easier if they lightly lubricated with soapy water.

Lifting the Engine

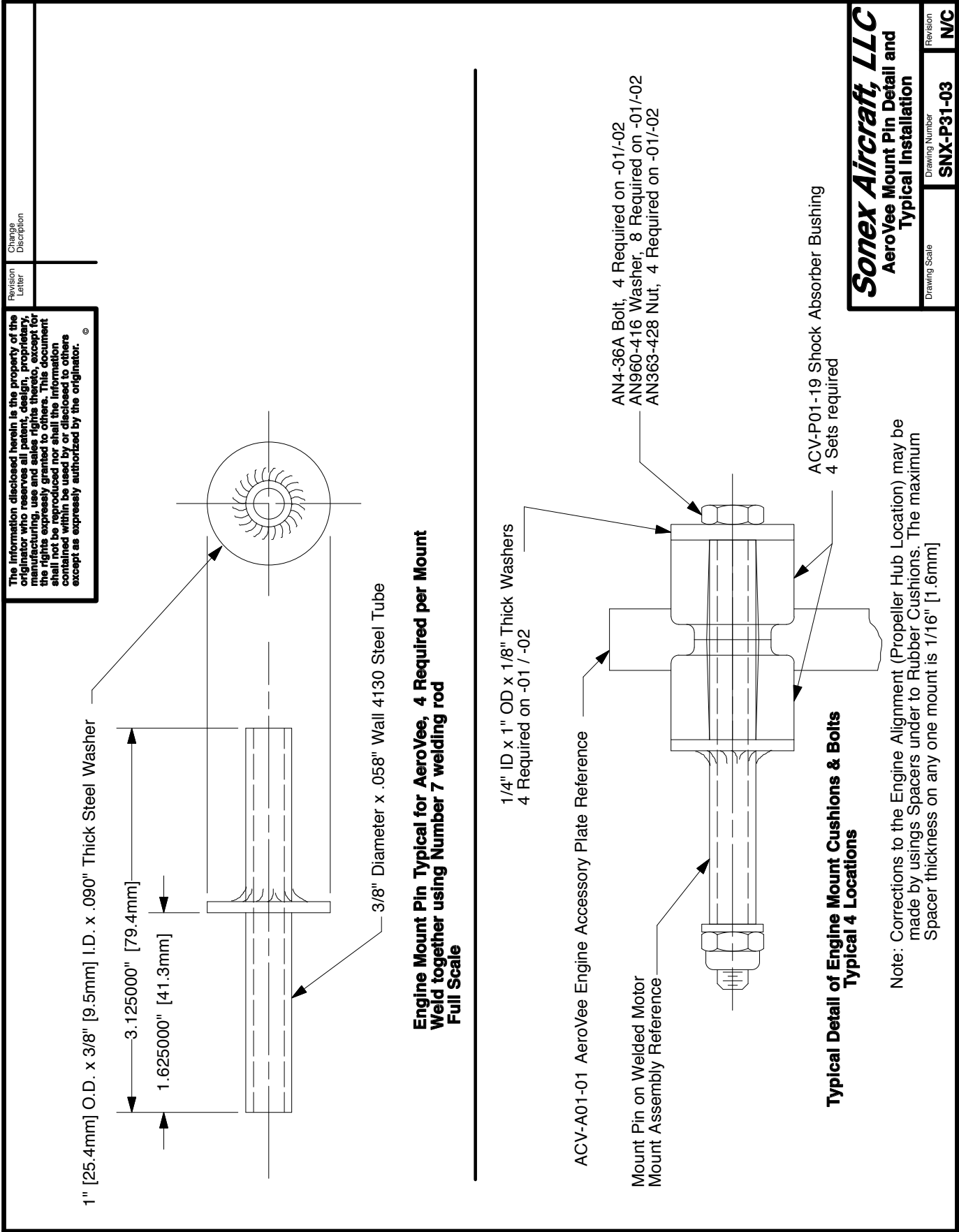
When lifting the engine into place care must be taken to make sure the pushrod tubes are not damaged.

Installing the Mount Bolts

The head of the mounting bolts may be inserted in either direction.



A typical engine mount and shock-rubber installation. A minimum of two ACV-Z01-40 washers (1/8" thick total, minimum) must be placed against the front bushing. Additional washers may be used as needed, and washers may be used behind the rear bushings as spacers to shim the thrust line as needed.



AeroVee 2.1 Turbo

Parts Required:

- ___ ACV-P06-75, Mini Sump with Filter
- ___ ACV-Z01-22, 6mm Elastic Stop Nut (Qty. 6)
- ___ ACV-Z01-83, 1/4 NPT Brass Pipe Plug (Qty. 1)

Service Parts to Keep on Hand:

- ___ ACV-P01-54, Oil Change Gaskets

Assembly Instructions:

Note: Refer to the exploded photo and the instructions included with the Mini Sump (and reproduced on this page) while installing the mini sump. The following additional notes will assist you with the installation.

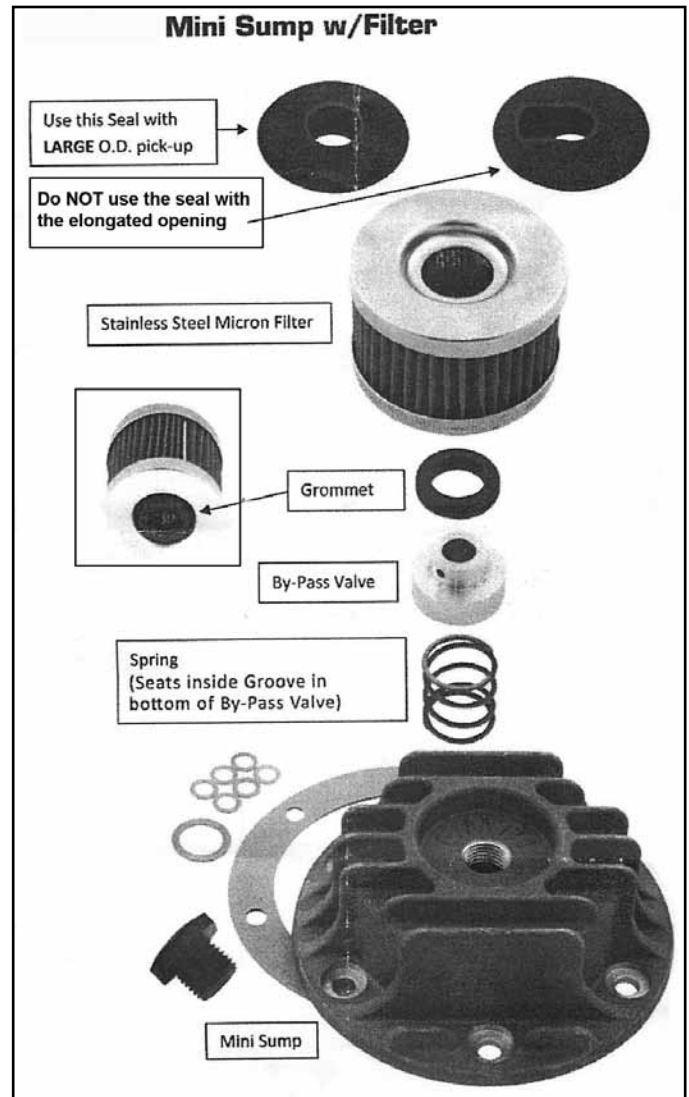
- ___ 1. Use the pick-up tube seal from the mini-sump kit that has the large hole. The curved surface goes toward the pick-up tube.
- ___ 2. Position the spring, filter and bypass valve in the sump housing and install them in the engine as a single unit.
- ___ 3. Install the sump housing with the oil return hole oriented on the *left* side of the engine. See photo below.



This installation has a return line from an oil separator. If this port is unused it must be plugged with a 1/4 NPT pipe plug.

- ___ 4. Secure the mini sump with the (six) copper washers and ACV-Z01-22 elastic stop nuts torqued to 60 in-lbs.
- ___ 5. Install the drain plug and metal/copper plug washer. DO NOT install an oil temperature sender in the oil drain hole of the mini-sump.

MINI SUMP INSTALLATION



- ___ 6. If you will NOT be using a return oil line from an oil separator, install the 1/4 NPT pipe plug in the side port of the mini sump.

Servicing Instructions:

The reusable filter of the mini sump must be cleaned with each oil change and new gasket fitted.

Oil Change Gasket kits, which include the large paper gasket and all necessary copper gaskets, are available from Sonex (part number ACV-P01-54).

AeroVee 2.1 Turbo

Parts Required (Supplied)

Supplied by Sonex:

- ___ Oil Cooler Mount Plate
- ___ Rubber gaskets from ACV-P02-15 Gasket Kit
- ___ AN4-14A bolt, Qty. 2
- ___ MS20365-428 Stop Nut, Qty. 3
- ___ ACV-Z01-80, M8-1.25 x 20mm Button Head Screw, Qty. 1
- ___ AN4-24A bolt, Qty. 1
- ___ AN4-27A bolt, Qty. 2
- ___ AN960-416 Washers, Qty. 6

Parts Required (Not Supplied)

- ___ Oil Cooler for 1971 or later T1 or T2 VW engine (such as CB Performance part number 1727)



The top-mounted oil cooler positions the oil cooler on top of the case, near the accessory plate.

Installing the Oil Cooler

1. Insert the two orange-colored cylindrical seals from the gasket kit (provided with your AeroVee engine) in the oil cooler ports on the top, right-hand side of the engine.



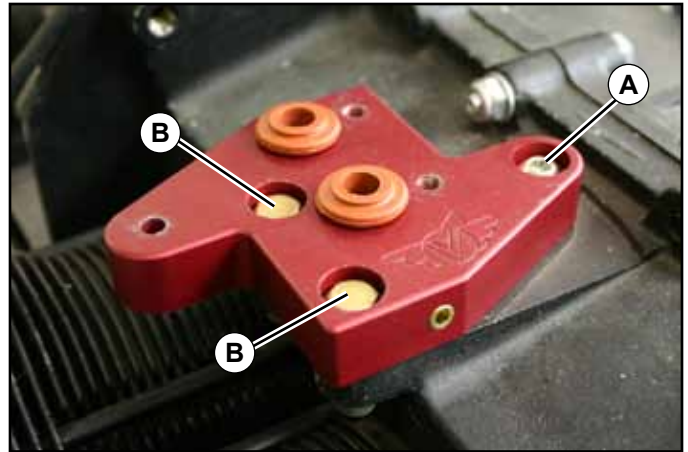
The arrow in this photo shows one of the seals before it is installed in its port.



This photo shows both seals installed in the ports.

OIL COOLER, TOP MOUNT

2. Carefully position the Oil Cooler Mount Plate over the seals and bolt the plate to the engine case using the hardware identified in the photo below.

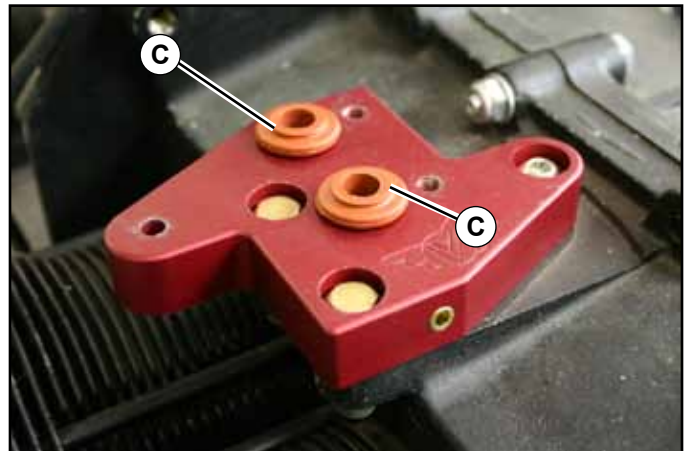


The Oil Cooler Mount Plate is attached with the following hardware:

*A = ACV-Z01-80, M8-1.25 x 20mm button head screw
B = AN4-14A bolt, AN960-416 washer (under nut) and MS20365-428 stop nut.*

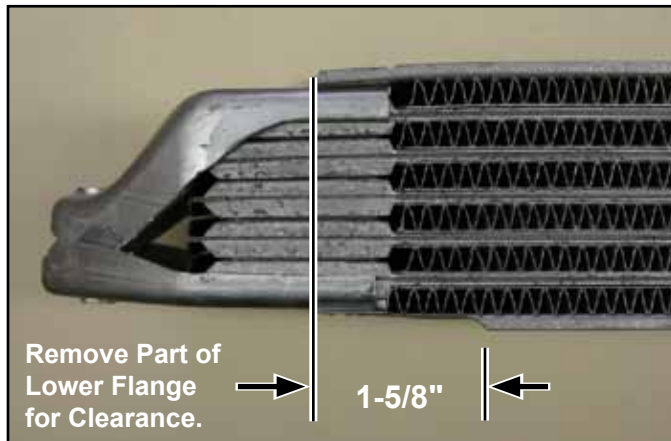
3. Insert the two short, orange-colored flanged seals from the gasket kit (provided with your AeroVee engine) in the oil ports of the Top Plate. See photo below.

Important: The gasket kit contains both tall (thick) and short (thin) flanged oil seals. Be sure to use the short (thin) seals for this installation.

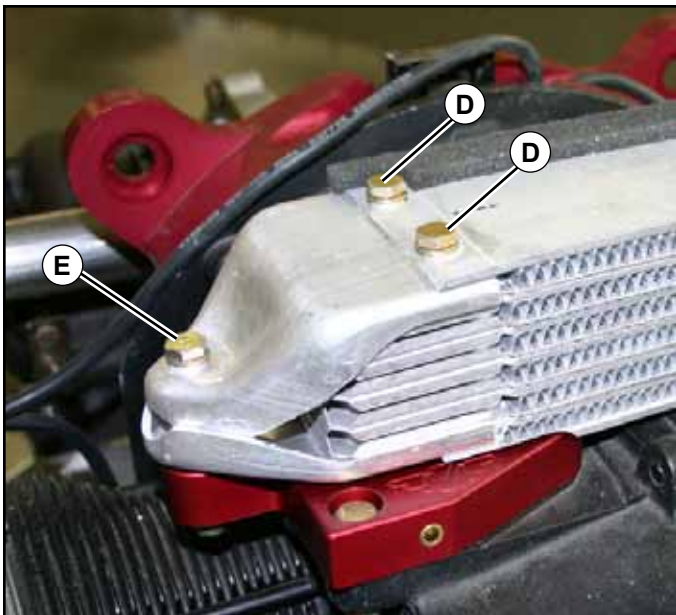


The short (thin) flanged oil seals installed in the Top Plate's oil ports (C).

4. Remove a 1-5/8" long portion of the front, lower flange of the oil cooler. This is necessary to eliminate interference between the oil cooler's flange and the adapter plate. See photo below for details.



5. Carefully position the oil cooler over the seals in the mount plate and bolt the oil cooler to the plate using the hardware identified in the photo below.



The Oil Cooler is attached with the following hardware:

D = AN4-27A Bolt with AN960-416 washer.

E = AN4-24A Bolt with two AN960-416 washers (one top, one bottom) and MS20365-428 stop nut.

AeroVee 2.1 Turbo

STARTER INSTALLATION / WIRING

Tools Required:

- ___ 3/8" Hex Wrench
- ___ Locktite 262

Parts Required

- ___ Starter, ACV-A01-16
- ___ ACV-Z01-14 Cap Screws
- ___ Electrical Terminals (not supplied)
- ___ Electrical Wire (not supplied)

Starter Installation

Note: Though the starter is grounded through the bolts which secure it to the accessory plate, anodizing in the threads of the accessory plate and the recommended use of Locktite can degrade this ground path. You may wish to install an 8 to 10 gauge supplemental ground wire under one of the starter attachment bolts and attach the other end to an appropriate ground on the airframe or battery.

Do not use an engine mount bolt for a grounding point as they are insulated from the engine by the rubber engine mounts and do not provide a good ground path.

- ___ 1. Attach the starter to the accessory plate using two (2) ACV-Z01-14 cap screws and Locktite 262.

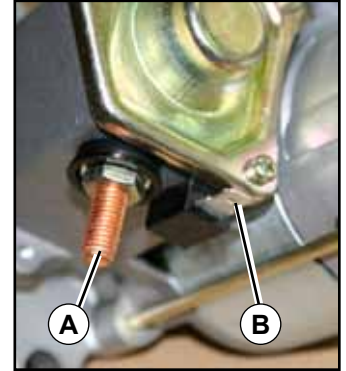


When installing the starter, consider attaching an 8 gauge ground wire under one of the starter mounting bolts and connecting the other end to the negative terminal of the battery.

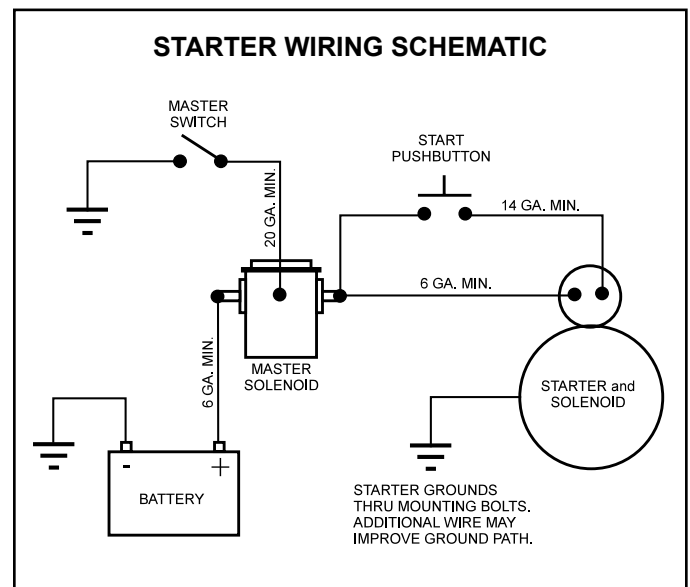
Starter Wiring

The drawing below illustrates a typical starter wiring schematic. This can be modified to suit your needs. Note that a separate starter solenoid is not needed as the AeroVee starter has a built-in solenoid.

The starter has two points for electrical connections: A large threaded lug (A) for the 6 gauge starter wire, and a small male spade terminal (B) for the 14 gauge solenoid wire.



Electrical connectors on the starter solenoid.



Parts Required

- ___ Turbo Exhaust Manifold (ACV-T05-20)
- ___ Exhaust Gaskets (included in ACV-P02-15 Gasket Kit). Available separately as p/n ACV-P01-73.
- ___ ACV-Z01-39 Exhaust Mount Bolts (Qty. 8)

Installing the Exhaust Manifold

Note: If your cylinder heads have exhaust studs installed they must be removed to fit the exhaust manifold.



Note: The space between the exhaust flanges can be increased or decreased by hand if it is too tight or too loose on the cylinder head. Tightening the exhaust attach bolts during final installation will pull the header together for a proper fit on the cylinder head.

- ___ 1. Using the supplied Exhaust Attach Bolts (ACV-Z01-39), attach the exhaust manifold with an exhaust gasket at each exhaust port.

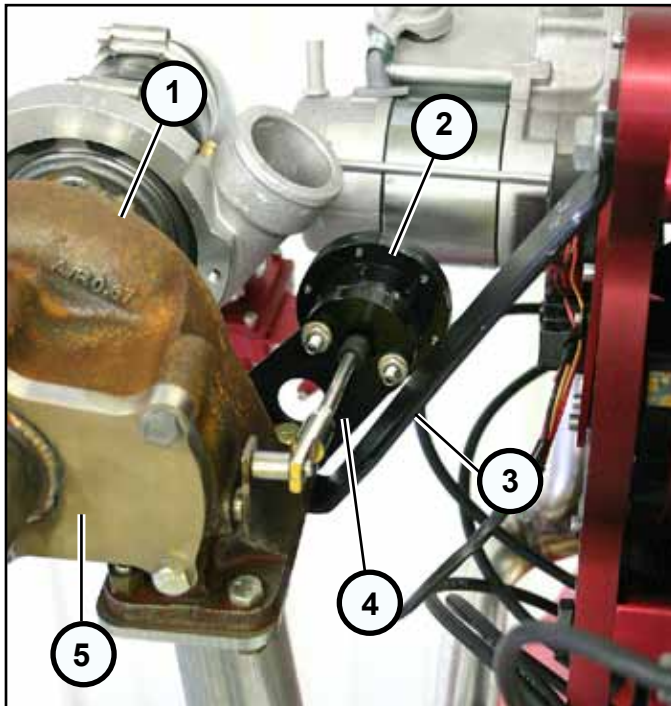


AeroVee 2.1 Turbo

INSTALLING the TURBO

Parts Required

- ___ Turbo Support Bracket (ACV-T05-39)
- ___ Waste Gate Actuator Mount (ACV-T05-36)
- ___ Turbo 4-Hole Gasket (ACV-T05-38)
- ___ Waste Gate Actuator (ACV-T05-41)
- ___ Turbo Body (ACV-T05-40)
- ___ Turbo Top Exhaust (As provided in your kit)
- ___ 5-Hole Gasket (ACV-T05-37)
- ___ ACV-T05-42, Turbo Shroud
- ___ ACV-T05-43, Shroud Clip
- ___ ACV-Z01-89, Spring
- ___ 6000-4, Actuator Balance Line (1/4" I.D.)
- ___ 6504, Hose Clamp, Small, (Qty. 2)
- ___ ACV-T05-60, 3/8-16 x 1-1/4" Bolt, (Qty. 3)
- ___ ACV-T05-61, 3/8-16 x 1-1/2" Bolt, (Qty. 1)
- ___ ACV-T05-62, 3/8-16 Nut with Star Washer (Qty. 4)
- ___ ACV-T05-50, Waste Gate Mounting Nuts (M6 x 1), (Qty. 2)
- ___ ACV-T05-51, External Tooth Lock Washers (M6), (Qty. 2)
- ___ ACV-T05-40-01, External Retaining Ring, (Qty. 1)
- ___ ACV-Z01-39, Exhaust Attach Screws, (Qty. 5)



The major components installed in this section include:

1. Turbo Body
 2. Waste Gate Actuator
 3. Turbo Support Bracket
 4. Waste Gate Actuator Mount Bracket
 5. Top Exhaust
- (Not Shown) Turbo Shroud

Clocking the Turbo

The turbo must be "clocked" so the oil drain port and the compressed air discharge are properly positioned. **The oil drain port must be parallel to the ground when the aircraft is resting on its tires.**

Exhaust Side

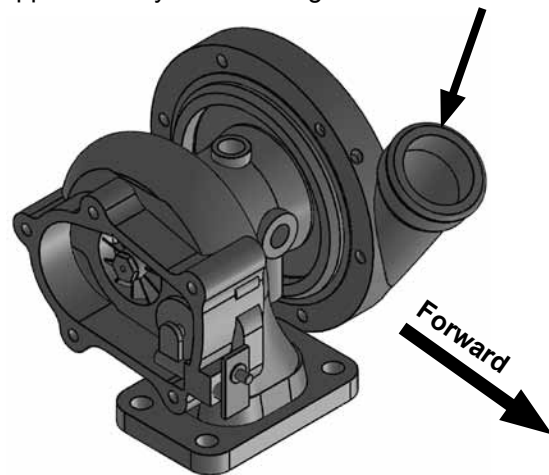
Loosen (do not remove) the four (4) bolts that hold the compressor housing to the bearing block. Retighten the bolts after completing the adjustments.

Intake Side:

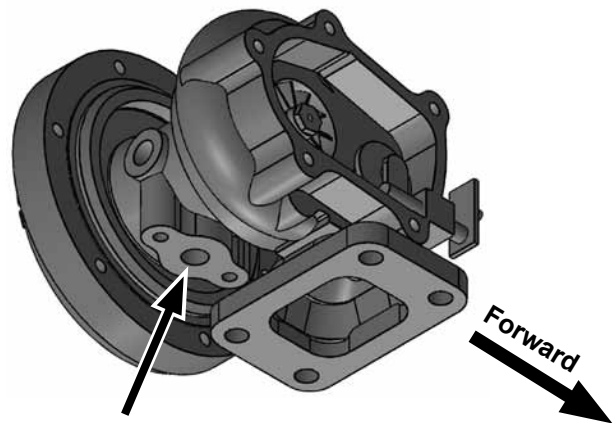
A large snap ring holds the compressor housing to the bearing block. The compressor housing may rotate by hand (it will be tight). If not, use a large snap ring pliers to take some tension off the snap ring. **Do not remove the snap ring.**

Top View Looking Aft

The **Compressed Air Discharge** must face "forward" approximately 40 to 45 degrees from vertical.



Bottom View Looking Forward



The **oil drain port must** be parallel to the ground when the aircraft is resting on its tires.

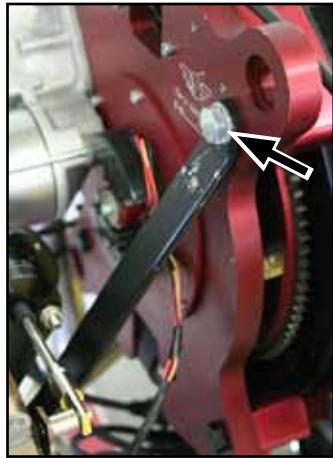
AeroVee 2.1 Turbo

INSTALLING the TURBO

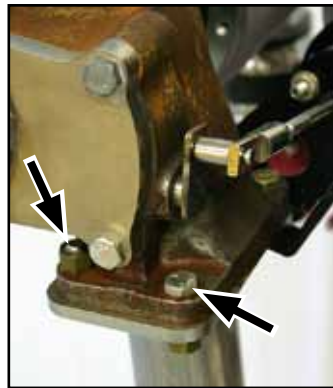
Assembly Instructions

Note: The turbo charger body is cast iron and will oxidize.

- ___ 1. Attach the Turbo Support Bracket to the back of the Accessory Plate with the existing Accessory Plate attach bolt. You may wish to leave this bolt slightly loose until the other components are in place.
- ___ 2. Place the Turbo 4-Hole Gasket on the exhaust manifold.



- ___ 3. Position the Turbo Body on the exhaust manifold and secure it with an ACV-T05-60 Bolt and ACV-T05-62 Nut through ONLY the two outboard mounting holes. Leave these bolts slightly loose until the other components are in place.



- ___ 4. Position the Waste Gate Actuator Mount *under* the exhaust manifold and secure it with an ACV-T05-60 Bolt and ACV-T05-62 Nut through ONLY the aft, inboard mounting hole. Leave this bolt slightly loose until the other components are in place.



- ___ 5. Position the lower end of the Turbo Support Bracket *under* the Waste Gate Actuator Mount and secure it with the ACV-T05-61 Bolt and an ACV-T05-62 Nut.



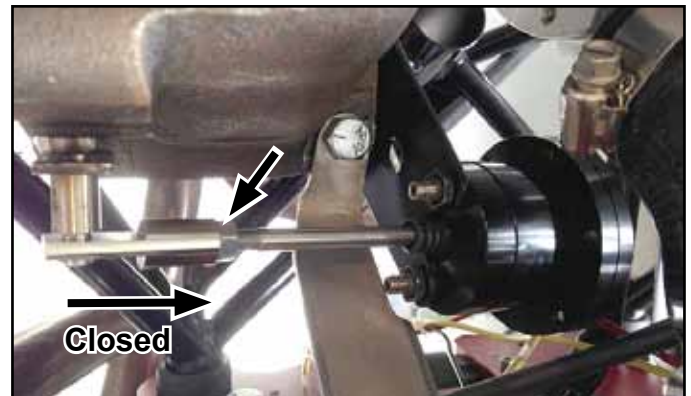
- ___ 6. Tighten all of the hardware.

- ___ 7. Attach the Waste Gate Actuator to the bracket with two ACV-T05-51 Lock washers and ACV-T05-50 Nuts.

Note: The actuator's hose nipple must point down.



- ___ 8. Adjust the actuator's pushrod (see photo, below) so it holds the waste gate in the closed position, but also has no end play. Do not allow any "preload" on the actuator.



The locknut on the actuator arm (arrow) locks the pushrod's length. Once the length is set a retaining ring is installed to hold the pushrod on the waste gate lever (See next page).

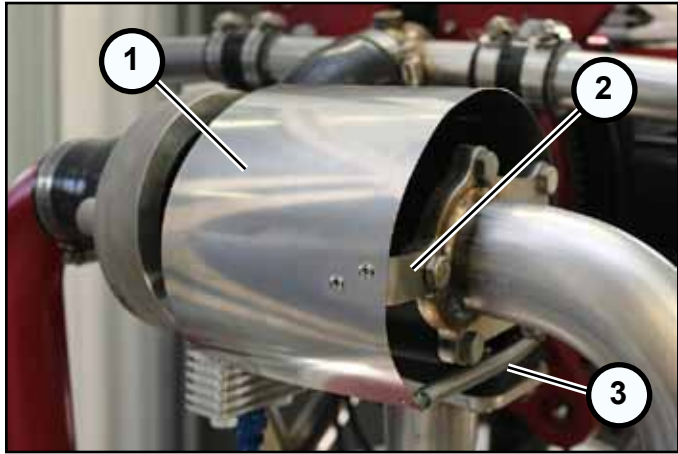
- ___ 9. Bolt the Turbo Top Exhaust to the turbo body using ACV-Z01-39 Bolts. Make sure you install the 5-Hole Gasket, ACV-T05-37, between the turbo body and the exhaust plate.

Note: The aft bolt (identified by the arrow in the photo, right) should be left out until the Turbo Shroud is installed in step 12.



AeroVee 2.1 Turbo

- __10. Form the turbo shroud into an open cylinder. This is easily accomplished by hand using the edge of a worktable.



A completed Turbo Shield installation is shown here.

1. Hand-formed shield (ACV-T05-42)
2. Mounting tab (ACV-T05-43) riveted in place
3. Mounting spring (one on each end) (ACV-Z01-89)

- __11. Bend the turbo shroud mounting tab 90-degrees and rivet it to the shroud.
- __12. Secure the turbo shroud to the turbo exhaust with the remaining ACV-Z01-39 bolt.
- __13. Install the two springs. one on each end of the shroud. Holes are provided in the shroud for attaching the springs.
- __14. Secure the actuator's arm to the waste gate lever with the ACV-T05-40-01 Retaining Ring.



Turbo Shield mounting tab and spring(s).



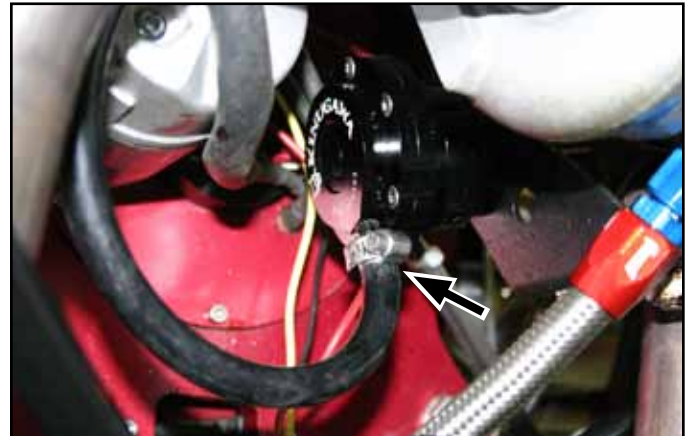
Secure the actuator arm with the snap ring provided.

INSTALLING the TURBO

- __15. Secure the Actuator Air Balance Line (p/n 6000-4) to the nipple in the bottom of the Actuator and to the nipple on the turbo using small hose clamps (p/n 6504).



One end of the Actuator Air Balance line is secured to the nipple on the compressor portion of the turbo.



The other end of the Actuator Air Balance line is secured to the nipple on the bottom of the Actuator.

Parts Required

- ___ Turbo Exhaust Tube - bottom (as provided in your kit)
- ___ Exhaust Springs, Qty. 2, (ACV-E01-23)
- ___ Exhaust Wrap (ACV-T05-59)

Supplies Required (not supplied by Sonex)

- ___ Stainless Steel Tie-wraps or hose clamps

EGT Probe Installation

If you are installing EGT probes (recommended, not provided by Sonex), it is recommended that the holes for each probe be drilled in the exhaust manifold prior to wrapping the manifold. Sonex suggests these guidelines for locating the probes:

- a. The probe should enter the pipe at a location that is 4" from the exhaust flange along an imaginary line through the center of the pipe.
- b. All probes should be the same distance from the exhaust flange.
- c. The hole for the probe should be drilled in a location that prevents the installed probe from contacting other items under the cowl, or being contacted by the cowl-ing.

Assembly Instructions

- ___ 1. Install the lower exhaust tube by securing it to the exhaust manifold with two ACV-E01-23 springs.
- ___ 2. Wrap the exhaust. Use stainless steel tie-wraps and/or stainless steel hose clamps to secure the exhaust wrap.



Stainless steel tie-wraps and/or hose clamps are used as needed to hold the exhaust wrap in place. The wrap can be pierced for the installation of an EGT probe. The probe's hose clamp will also help secure the exhaust wrap.

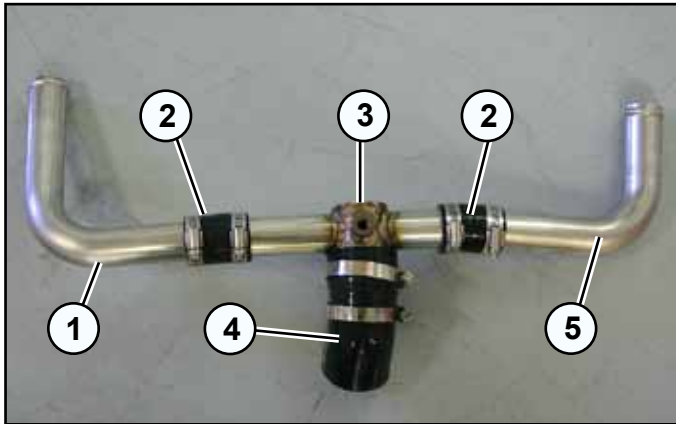
The AeroVee requires the use of baffles to direct air over and through the piston barrels and cylinder heads. The system must be designed and installed to keep the cylinder head within their operating limits during normal operation.

Sonex LLC has developed a fence baffle system specifically for use on Sonex Airframes installations. These system may also be adapted to other airframe installations.

Each fence baffle comes with its own instructions for fitting.

Parts Required

- ___ Turbo Intake Manifold Collector (ACV-T05-10)
- ___ Turbo Right Hand Intake Manifold Tube (ACV-T05-11)
- ___ Turbo Left Hand Intake Manifold Tube (ACV-T05-12)
- ___ Straight Silicone Coupler, Qty. 2 (ACV-M01-21)
- ___ 45-Degree Silicone Elbow, Qty. 1 (ACV-M01-22)
- ___ Hose Clamps, Qty. 6 (ACV-Z01-10)



The components of the intake manifold assembly (as viewed from above):

1. Turbo Left Hand Intake Manifold Tube
2. Straight Coupler
3. Turbo Intake Manifold Collector
4. 45-degree Elbow
5. Turbo Right Hand Intake Manifold Tube

Assembly Instructions:

- ___ 1. Trim 1.125" (28mm) of *each* end of the 45-degree silicone elbow.
- ___ 2. Remove any debris that may be in the intake tubes and couplers.
- ___ 3. Assemble the manifold as shown in the photo above. The tubes will generally butt in the center of each coupler.
 - a. Keep the hose clamps somewhat loose until the manifold is fitted to the engine.
 - b. Position the tightening screws of each clamp for easy access after installation.
 - c. Trim the tail of each hose clamp if desired.

Installation Instructions:

- ___ 1. Slide the LEFT intake tube into the silicone reducer already installed on the left intake elbow.
- ___ 2. Slide the Right intake tube into the silicone reducer already installed on the right intake elbow.
- ___ 3. Slide the silicone elbow onto the turbo unit.
- ___ 4. Adjust the tubes and couplers as needed.
- ___ 5. Position and tighten the hose clamps.



These images show the intake manifold installed.



Parts Required

- ___ Elbow, 1/8 NPT to 1/4 Hose Barb, AN842-4D, (Qty. 1)
- ___ Clear Pulse Line, 05-01063
- ___ Small Hose Clamp, 6504, (Qty. 2)



The manifold pressure line is a simple connection at the top of the Turbo Intake Manifold. The opposite end of the tube (not shown) connects to your manifold pressure gauge.

Installation Instructions

Important. Do not use teflon tape on this installation as it may impede air flow. Use teflon paste.

- ___ 1. Install the 1/8 NPT Elbow in the port in the turbo intake manifold.
- ___ 2. Attach the hose to the elbow and secure it with a hose clamp.
- ___ 3. Route the hose as needed for attachment to your manifold pressure gauge.

AeroVee 2.1 Turbo

Parts Required

- ___ Turbo Intake Tube (ACV-T05-16 or ACV-T05-17)
- ___ Silicone Reducer, Qty. 1, (ACV-M01-23)
- ___ Silicone Reducer, Qty. 1, (ACV-M01-24)
- ___ Hose Clamp, ACV-Z01-10-68 (Qty. 4)
- ___ AeroInjector, C07S

Installation Instructions:

Note: Depending on your particular installation and engine mount design, it may be necessary to remove or postpone some or all of this procedure until the engine is installed on the aircraft.

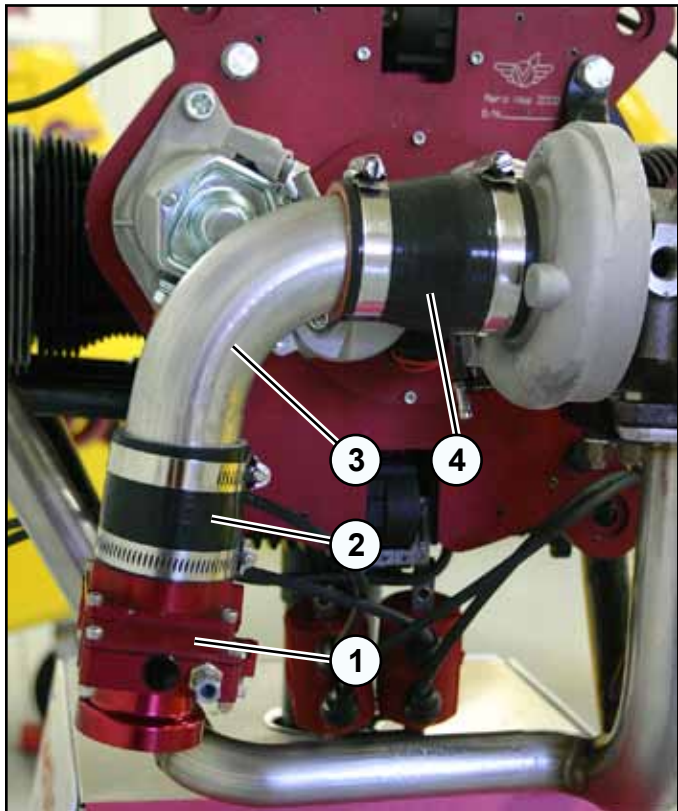
Note: Rotate the tube and AeroInjector as necessary to eliminate interference with other engine, motormount, and firewall-mounted components.

INSTALLING the AEROINJECTOR

Note: Rotate each hose clamp for easy access to the tightening screw.

- ___ 1. Secure the ACV-M01-23 Reducer to the intake port of the turbo body with a hose clamp.
- ___ 2. Secure the Intake Tube to the Reducer with a hose clamp.
- ___ 3. Secure the ACV-M01-24 Reducer to the Intake Tube a hose clamp.
- ___ 4. Secure the AeroInjector's the Reducer with a hose clamp.

Refer to the AeroInjector's Owner's Manual, provided with the AeroInjector, for additional AeroInjector-specific installation instructions.



The components of the AeroInjector intake manifold:

1. AeroInjector
2. Silicone Reducer (ACV-M01-24)
3. Down Tube
4. Silicone Reducer (ACV-M01-23)

AeroVee 2.1 Turbo

Parts Required

- ___ Coupling Nut, AN818-6D, (Qty. 2)
- ___ Coupling Sleeve, AN819-6D (Qty. 2)
- ___ Elbow, 90-degree, 1/4 NPT to 37-degree Flare, AN822-6D, Qty. 1
- ___ Aluminum Tubing, 3/8 OD x .035 3003-O, approx. 24"
- ___ ACV-T05-44, -6 AN Flare to 16mm x 1.5 Fitting Adapter, Qty. 1
- ___ ACV-T05-45, Crush Washer, Qty. 1

Installation Instructions:

Important. Never use teflon tape on any oil system connection as it may block oil flow. Use teflon paste on all NPT pipe threads. No paste should be used on the threads of a flared tubing connector.

- ___ 1. **IMPORTANT: If you are performing this step on an assembled engine care must be taken to prevent debris from entering the crankcase.**

Drill and tap a 1/4 NPT hole centered approximately 1.5" below the oil filler port. The 90-elbow will be installed in this hole in step 2. See photo below.



Oil line from the right port of the secondary oil pump to a hole tapped in the engine case approximately 1.5" below the oil fill cap.

OIL LINE: PUMP to CASE

- ___ 2. Install the 90-degree elbow / flare fitting in the engine case.
- ___ 3. Install the ACV-T05-44 -6 AN to 16mm Fitting Adapter with an ACV-T05-45 Crush Washer in the right hand port of the Secondary Oil Pump.



- ___ 4. Place a Coupling Nut and Coupling Sleeve one end of the aluminum tube and flare that end of the tube with a 37-degree flaring tool. This end be attached to the oil pump.
- ___ 5. Form the tubing so it is routed near the case and as directly as possible to the 90-degree elbow. When the cooling baffles are installed this tube will need to pass through a hole in the baffle and be protected by a grommet.
- ___ 6. Place a Coupling Nut and Coupling Sleeve on the free end of the aluminum tube.
- ___ 7. Confirm the tube is correctly formed and trimmed and flare the end of the tube with a 37-degree flaring tool.
- ___ 8. Secure the tube assembly to the 90-degree elbow on the engine.

AeroVee 2.1 Turbo

Parts Required

- ___ Fitting, Hose End, -06 Straight, SUM-220690 (Qty. 1)
- ___ Fitting, Hose End, -06 Elbow, SUM-220687 (Qty. 1)
- ___ ACV-T05-44, -6 AN Flare to 16mm x 1.5 Fitting Adapter, (Qty. 1)
- ___ ACV-T05-45, Crush Washer, Qty. 1
- ___ Elbow, 45-Degree, 1/4 NPT to 37-Degree Flare, AN823-6D (Qty. 1)
- ___ Braided Hose, -06, SUM-230606 (Approx 26" needed)
- ___ Turbo Oil Drain Sump, (ACV-T05-48)
- ___ ACV-Z01-42 Bolts, 8-1.25 x 70mm, (Qty. 2)
- ___ ACV-Z01-26 Washers, M8, (Qty. 2)

Installation Instructions:

Important. Never use teflon tape on any oil system connection as it may block oil flow. Use teflon paste on all NPT pipe threads. No paste should be used on the threads of a flared tubing connector.

- ___ 1. Apply Red High-Temp RTV to the mating surface of the Oil Drain Sump and bolt it to the underside of the turbo body with ACV-Z01-42 bolts and ACV-Z01-26 washers.
- ___ 2. Install a straight or a 45-Degree 1/4 NPT to Flare Elbow in the port in the Oil Drain Sump.



The oil drain sump is bolted (1) to the bottom of the turbo body. A 1/4 NPT to -06 hose fitting (2) is installed in the drain. The fitting may be straight or a 45-degree elbow.

- ___ 3. Install the ACV-T05-44, -6 AN to 16mm Fitting Adapter, with a crush washer in the left hand port of the Secondary Oil Pump.



OIL LINE: TURBO DRAIN to PUMP

- ___ 4. Attach the straight hose end fitting to a 30" (approx.) length of -06 hose.
- ___ 5. Loosely attach the hose to the fitting in the oil drain sump.
- ___ 6. Determine the best hose routing to the secondary oil pump. The accompanying photo (below) shows the line routed along the lower, left side of the oil sump and secured to the engine case.
- ___ 7. Trim the hose as needed.
- ___ 8. Attach the 90-Degree Hose End Fitting to the -06 hose.



The oil line secured under the engine case. The oil line runs from the bottom of the Turbo Oil Drain Sump to the left port of the secondary oil pump (right photo).

- ___ 9. Install the hose assembly on the engine.
- ___ 10. Secure the hose as needed to prevent movement and chafing.

AeroVee 2.1 Turbo

Parts Required (Supplied)

- ___ 1/8 NPT Brass Street Fitting, 16775NOS, (Qty. 1)
- ___ Nipple, 1/8 NPT to -4 Flare, AN816-4D (Qty. 1)
- ___ Coupling Nut ("B" Nut), AN818-4D (Qty. 2)
- ___ Coupling Sleeve, AN819-4D (Qty. 2)
- ___ Bulkhead Fitting, -4 Flare, AN832-4D, (Qty. 1)
- ___ Nut for Bulkhead Fitting, AN924-4D, (Qty. 1)
- ___ Nipple, 592047ERL, (Qty. 1)
- ___ 3003-O Aluminum Tubing, 1/4" OD x .032 Wall, (1 Foot)
- ___ 45-degree -4 AN Hose to Female -4 AN (610080) (Qty. 1)
- ___ Straight Adapter, -4 AN Male to 1/4 NPT Male (SUM-220447) (Qty. 2)
- ___ Straight Hose End Fitting, -4 AN Hose to Female -4 AN (SUM-220490) (Qty. 3)
- ___ -4 Braided Hose, (SUM-230436) (Qty. 6 feet)

Parts Required (Not Supplied)

- ___ Remote Oil Filter Mount Bracket, Derales 25044, available from Summit Racing, JEGS, etc.
- ___ Oil Filter, FRAM PH8172 or equivalent.
- ___ Hardware to mount oil filter bracket (determined on installation)

Installation Overview

Important. The installation of the oil line must be done after the cooling fence baffle has been installed.



This overview photo shows the items installed in steps 1 through 11 of this section. These items are all forward of the flange on the back of the engine case.

OIL LINE: SUPPLY LINE to TURBO

Installation Instructions

Important. Never use teflon tape on any oil system connection as it may block oil flow. Use teflon paste on all NPT pipe threads. No paste should be used on the threads of a flared tubing connector.

- ___ 1. Install the 1/8 NPT Brass Street Fitting in the oil port on the upper, right-hand side of the engine block. **Do not over-tighten this fitting as the tapered thread can crack the engine case.** The tapered thread does the sealing, not excessive tightening of the fitting.



- ___ 2. Install the 1/8 NPT to -4 Nipple in the street fitting.
- ___ 3. Drill a 1/2" diameter hole through the baffle and the rear flange of the engine case for the bulkhead fitting.



The bulkhead fitting installed through the engine case flange (fence baffle not shown in this photo).

- ___ 4. Install the bulkhead fitting.
- ___ 5. Place a Coupling Nut and Coupling Sleeve one end of the aluminum tube and flare that end of the tube with a 37-degree flaring tool.
- ___ 6. Temporarily install the tube on the bulkhead fitting (see photos).



Looking down on the bulkhead fitting installed through the engine case flange and rear fence baffle.

AeroVee 2.1 Turbo

- ___ 7. Route the tubing forward to nipple and trim it to length, allowing material for flaring. If you leave the tube slightly long the extra length can be taken up with gentle bends in the pipe.
- ___ 8. Place a Coupling Nut and Coupling Sleeve on the free end of the aluminum pipe.
- ___ 9. Confirm the tube is correctly formed and trimmed and flare the end of the tube with a 37-degree flaring tool.
- ___ 10. Install the tube assembly on the nipple.
- ___ 11. Install an oil pressure sender (ACV-P01-76) in the brass street fitting. Use teflon paste on the threads.

Note: To assure a reliable signal, attach a ground wire to the body of the sender.



Oil Filter Installation

Important. Never use teflon tape on any oil system connection as it may block oil flow. Use teflon paste on all NPT pipe threads. No paste should be used on the threads of a flared tubing connector.

- ___ 1. Mount the oil filter bracket to the firewall or motor-mount.
- ___ 2. Install straight adapters (SUM-220447) in the oil filter mounting bracket.



The bulkhead fitting installed through the engine case flange (fence baffle not shown in this photo).

OIL LINE: SUPPLY LINE to TURBO

- ___ 3. Install the oil filter.

Note: The oil filter can be safety-wired by attaching a hose clamp to the filter and installing safety wire between the hose clamp and a small hole drilled in the oil filter mounting bracket.

Oil Line Installation - Oil Filter to Turbo Body

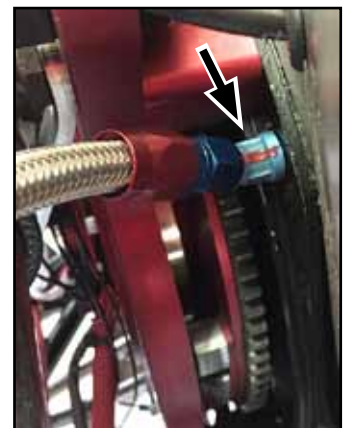
Important. Never use teflon tape on any oil system connection as it may block oil flow. Use teflon paste on all NPT pipe threads. No paste should be used on the threads of a flared tubing connector.

- ___ 1. Install the 45-degree -4 AN Hose to Female -4 AN fitting to the bulkhead fitting in the engine case flange.
- ___ 2. Install a straight adapter (592047ERL) in the oil port at the top of the turbo body. See photo below.



The oil supply port in the top of the turbo body and oil line fittings are shown here.

- ___ 3. Assemble a hose to connect the oil port in the top of the turbo (see photo above) to the "OUT" port of the oil filter mounting bracket.
- ___ 4. Attach the 45-degree -4 AN Hose to Female -4 AN elbow to the bulkhead fitting in the flange of the engine case.
- ___ 5. Assemble a hose to connect the 45-degree elbow installed in step 4, above (see photo, right) to the "IN" port of the oil filter mounting bracket.



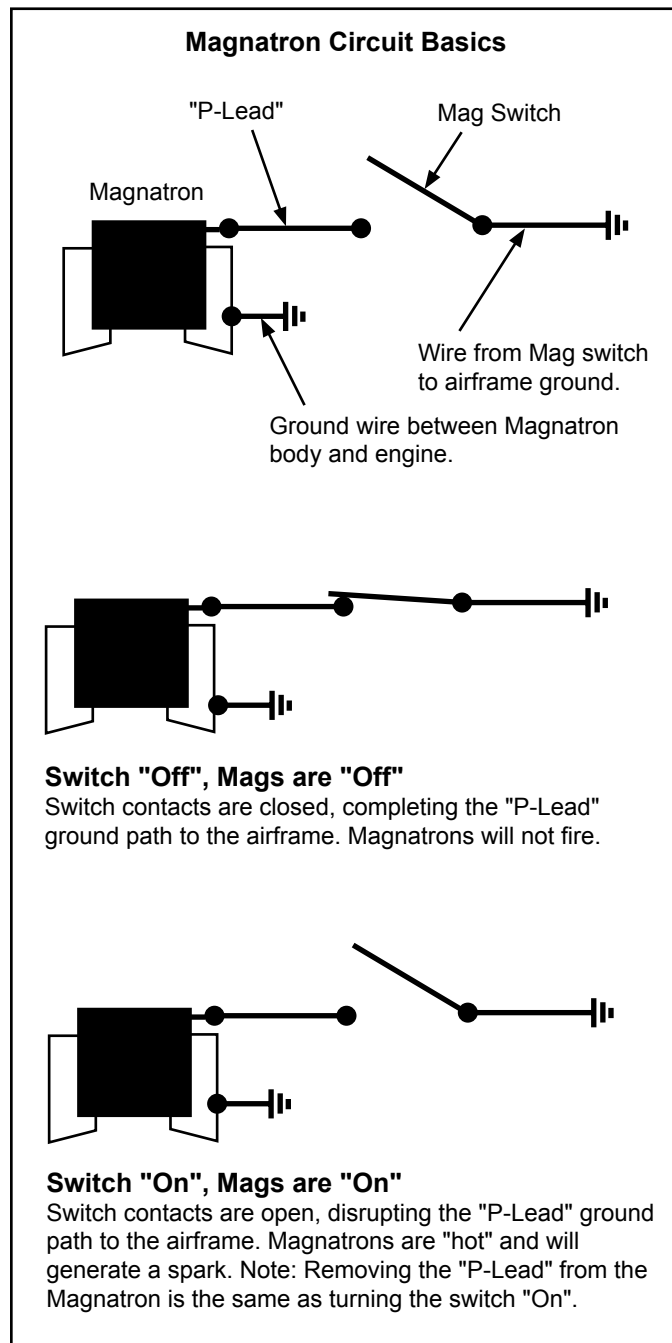
AeroVee 2.1 Turbo

Parts Required

- ___ Spark Plug Boots, Qty. 4, ACV-P01-23
- ___ Dual Pole, Single Throw Switch (not supplied)

Magnatron Circuit Basics

The magnatron is a very simple ignition system, however, understanding the circuit wiring is often confusing. Unlike most other electrical devices, when the switch is "Off" the Magnatron circuit is *closed* and the Magnatrons are *disabled*. When the switch is "On" the ground path is *open* and the Magnatrons become *operational*.



MAGNATRON IGNITION WIRING

Magnatron Wiring

The Magnatron ignition should be controlled by a single Dual Pole, Single Throw (DPST) toggle switch.

Important: Aircraft-style key switches (Off-Left-Right-Both-Start) may not work, depending on how they are internally wired. Sonex LLC is unable to assist on any installation with this type of switch.

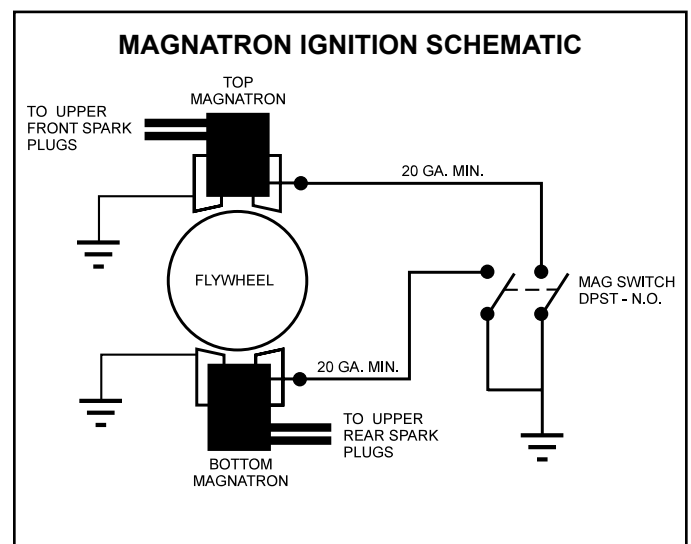
Important: The DPST switch must be installed in the panel in a manner that assures that when the switch is in the down ("Off") position, its contacts are closed, grounding the P-Leads to the airframe and disabling the Magnatron ignition.

To check for proper switch installation:

- ___ A. Place the switch in the down ("Off") position.
 - ___ B. Place an ohmmeter across a pair of the switches' terminals. If there is no resistance (0 ohms) between the terminals, the switch is properly oriented in the panel.
- If the resistance is infinite, the switch is "On" and needs to be rotated 180-degrees in the panel for proper installation.

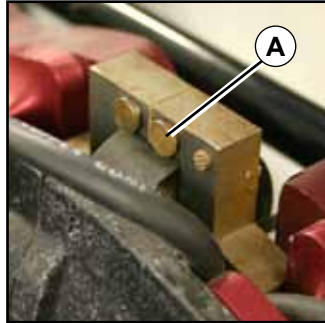


This DPST switch would have a P-lead from each Magnatron attached to the top terminals, and wires to ground attached to the lower terminals. Your switch may vary.



- ___ 1. Attach a 20 gauge (minimum) ground wire to the body of each magnatron. The ground wire may be attached to a magnatron mounting bolt, or to one of the "studs" (A) on the metal frame.

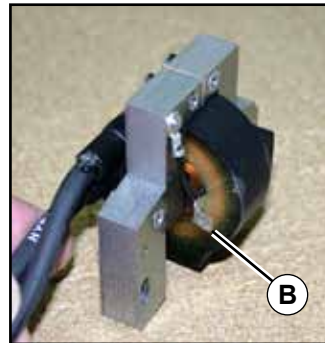
Attach the other end of the ground wire to a suitable ground on the engine block.



A large spade terminal will slip over a stud (A), providing a ground point for each Magnatron.

Do not attach the ground wire to the "P-Lead" terminal ("B", photo below). This terminal must only be used for the ignition switch wiring.

- ___ 2. Attach a 20 gauge (minimum) wire between a DPST ignition switch and the P-Lead terminal (B) of each magnatron.



Magnatron P-Lead terminal.

- ___ 3. Attach a 20-gauge (minimum) wire between the remaining terminals of the DPST switch and an appropriate airframe ground.
- ___ 4. Slide a spark plug boot over the end of each spark plug wire.

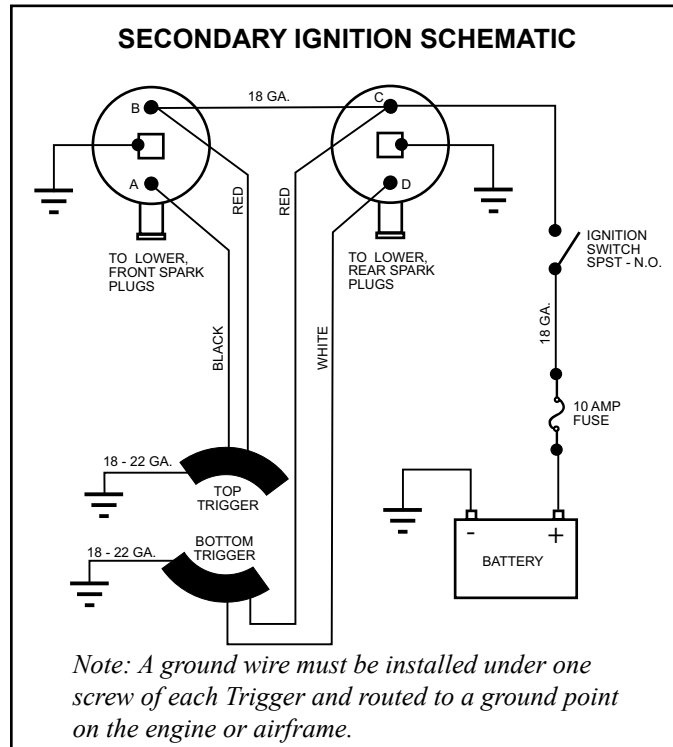


- ___ 5. Attach the top Magnatron's spark plug wires to the upper front spark plugs.
- ___ 6. Attach the bottom Magnatron's spark plug wires to the upper rear spark plugs.

AeroVee 2.1 Turbo

Parts Required

- ___ Electrical Terminals (not supplied)
- ___ Electrical Wire (not supplied)
- ___ 10-32 x 3/8" machine screws, Qty. 4 (not supplied)



Trimming the Wires

The trigger wires can be trimmed to the needed length. Use care when trimming the sheath to avoid damaging the wires.

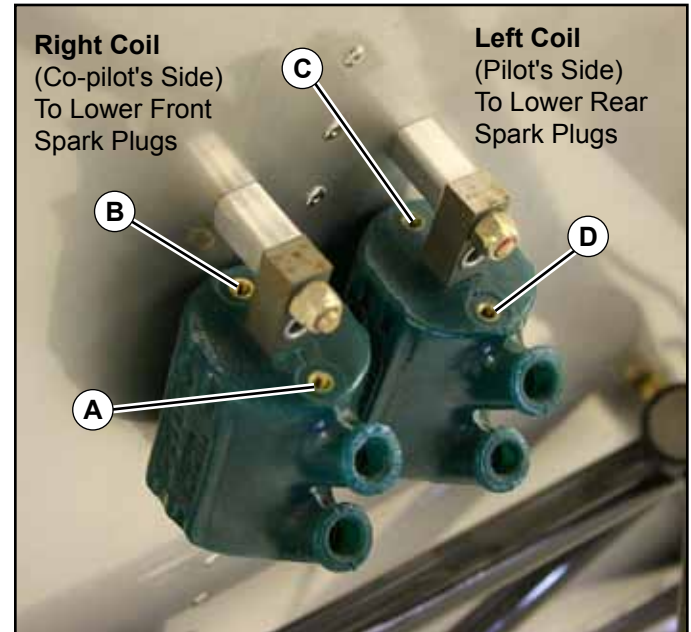


The pre-installed connectors need to be removed.

ELECTRONIC IGNITION WIRING

Trigger Power Wires (Red)

- ___ 1. The red wire of the top trigger attaches to terminal "B" of the right hand coil.
- ___ 2. The red wire of the bottom trigger attaches to terminal "C" of the left hand coil.



The coils are mounted on the firewall. Note that "Left" and "Right" are as viewed from the pilot's seat.

Trigger Signal Wires (Black, White)

- ___ 1. The black wire of the top trigger attaches to terminal "A" of the right hand coil. Use a 10-32 x 3/8" screw.
- ___ 2. The white wire of the bottom trigger attaches to terminal "D" of the left hand coil. Use a 10-32 x 3/8" screw.

Trigger Ground Wires (Not included)

- ___ 1. A ground wire must be attached under one mounting screw of EACH trigger. The other end must attach to a ground point on the engine or airframe. The wires can share a single ground point.

Coil Wiring

- ___ 1. Connect an 18 ga. wire between terminals "B" and "C". This is a jumper for the +12V power supply wire.
- ___ 2. From the ignition switch, run an 18 ga. wire through a 10 amp fuse and connect the wire to terminal "B" of the right coil.
- ___ 3. The coils ground through the hardware that secures them to the firewall. A non-conductive firewall or mounting method requires dedicated ground wires between the coil laminations and a suitable ground point.

AeroVee 2.1 Turbo

SPARK PLUG WIRES

Parts Required:

___ Spark Plug Wires, ACV-A01-24

Assembly Instructions:

Important: The factory crimped ends of each wire will be re-used. When cutting the wires to the correct length, do not cut the crimped ends off.

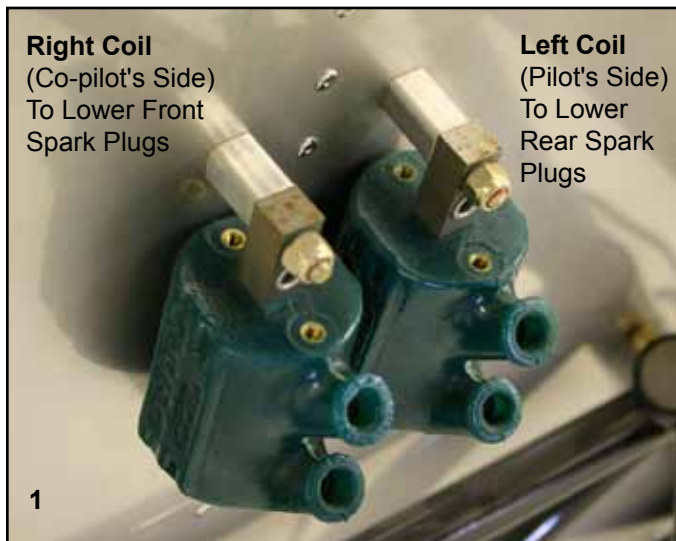
Note: Extra wires have been included with your kit. It is possible to wire your secondary ignition with a single package of spark plug wires, leaving the second set for spares.

___1. Determine the length for each spark plug wire.

The front, lower plug wires attach to the right coil.

The rear, lower plug wires attach to the left coil.

The pre-crimped ends are kept in place for the spark plugs. Cut the wires to the correct length.



Attach the spark plug wires to the proper coils. Note that "Left" and "Right" are as viewed from the pilot's seat.



The crimped end of each plug wire is re-used - do not cut them off.

___2. Slide a boot (included with ACV-A01-24) over the cut end of each spark plug wire.



The boot included with the spark plug wires is slipped over the cut end of each wire.

___3. Remove the black outer jacket and the white insulation core to expose a 3/8" length of the inner conductor.



___4. Fold the conductor over the jacket and crimp a metal connector in place. The end of the cable must come to the hole in the connector.



___5. Slide the boot over the connector. This is the end of the cable which attaches to the coil.



___6. Attach the spark plug wires to the coils and spark plugs.

Parts Required

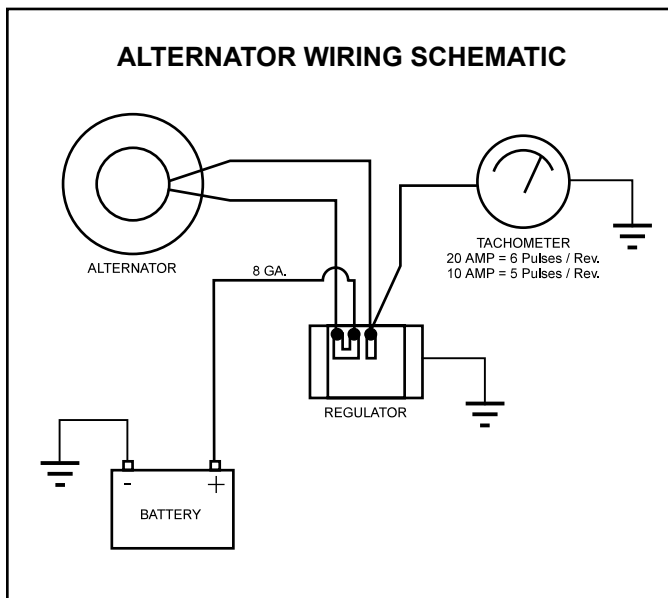
- ___ Electrical Terminals (not supplied)
- ___ Electrical Wire (not supplied)

Alternator - Regulator Wiring

- ___ 1. Attach the two wires from the alternator to the two outer terminals of the voltage regulator. It does not matter which wire attaches to which terminal.
- ___ 2. Attach an 8 or 10 gauge wire from the center terminal of the voltage regulator to the positive battery terminal.
- ___ 3. If you will be using a tachometer which senses pulses from the alternator, it must be spliced in to one of the wires from the alternator. Consult the instrument manufacturer's instructions for proper installation and set-up.

Note: The 20 amp alternator delivers 6 pulses per revolution.

- ___ 4. If the voltage regulator is attached to a non-conductive surface a ground wire needs to be attached between the body of the regulator and an appropriate airframe ground.



Materials Required

- ___ 5/8" O.D. x .035" Aluminum Tube (6061-T6 or 5052-0)
- ___ Permatex High Temp Red RTV Silicone Gasket

Breather Installation

- ___ 1. Form an engine breather tube from 5/8 diameter x .035" wall 6061-T6 or 5052-0 aluminum tube. The tube should curve up slightly after exiting the breather plate. This encourages oil to flow back into the case rather than get discharged.



Additionally, a 1/16" diameter hole drilled at the top of the curve permits crankcase breathing in the event the exit tube freezes shut.

Route the tube so it discharges out the bottom of the cowlings, or into the top of the optional AeroConversions Oil Separator.

- ___ 2. Secure the tube in the breather plate with high temperature silicone gasket.
- ___ 3. Secure the tube as needed to prevent vibration.

Parts Required

___ 4 quarts approved SAE engine oil. Approved oils are listed below.

Approved Oils

Break-in Period (First 25 hours)

The flat-tappet (non-roller rocker) design of the AeroVee requires an oil with zinc and phosphate levels of approximately .12% to .14% (1200 - 1400 ppm)

Do not use diesel engine oils (Rotella) and do not use oil additives.

Approved break-in oils are:

Brad Penn Penn-Grade 1 Racing 20w50

Post Break-in

The flat-tappet (non-roller rocker) design of the AeroVee requires an oil with zinc and phosphate levels of approximately .12% to .14% (1200 - 1400 ppm)

Do not use diesel engine oils (Rotella) and do not use oil additives.

Synthetic oils are incompatible with 100LL fuel and must not be used.

Approved post break-in oils are:

Brad Penn Penn-Grade 1 Racing 20w50

Priming the Engine and Setting Oil Level

The following method should be used to achieve the proper oil level for your engine:

- ___ 1. Add 2 quarts of oil to the crankcase and allow it to settle into the sump.
- ___ 2. With the aircraft in its normal ground attitude (on its tailwheel for tailwheel aircraft), remove the dipstick and file a mark on the dipstick at the oil line. This is the "Low" mark for the oil level.
- ___ 3. Add an additional .75 quart of oil to the crankcase and allow it to settle into the sump.
- ___ 4. With the aircraft in its normal ground attitude (on its tailwheel for tailwheel aircraft), remove the dipstick and file a mark on the dipstick at the oil line. This is the "Full" mark for the oil level.
- ___ 5. Remove one spark plug from each cylinder.
- ___ 6. With the fuel off and ignition switches off, operate the starter until oil pressure registers on the oil pressure gauge.

Note: If no oil pressure registers, the oil pump may need to be re-primed with white lithium grease. Also, check the electrical connection of the oil pressure sender.
- ___ 7. Re-install the spark plugs.
- ___ 8. Add oil as needed to bring the oil level back to "Full".

In operation you may find that your engine prefers a slightly lower oil level. This will be evidenced by excessive oil draining from the breather tube and, in some cases, the front seal. It is acceptable to operate your engine with less than 2.75 quarts, 2.5 quarts being fairly common.

If your oil level is allowed to drop too low you will experience increased oil temperatures and fluctuating and/or decreased oil pressure. **Do not operate your engine in this condition.**

Oil Changes During Break-in Period

During the first 25 hours of operation the oil level should be monitored closely and oil changes performed at 1 hour, 5 hours, 15 hours, and 25 hours. Thereafter, oil should be changed every 25 hours or 3 months.

Note: Engines which are not operated frequently collect damaging moisture. This moisture can only be removed by operating the engine until oil temperatures are above 190-degrees for an extended period of time, or by changing the oil. Short runs of the engine, which do not allow the engine to come to full operating temperature, are more damaging than not running the engine at all.

AeroVee 2.1 Turbo

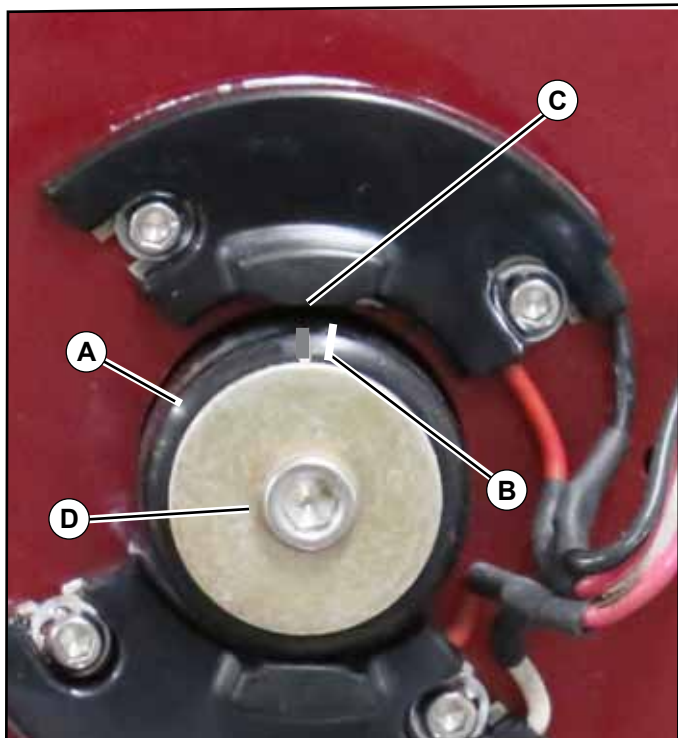
Tools Required

— 5/32" hex wrench

Timing Basics

The electronic (secondary) ignition on a turbo-equipped AeroVee is timed to 18 degrees BTDC, unlike the Magnatron (primary) ignition, which is fixed at 28 degrees BTDC. Accurate timing is accomplished when the two ignition systems are firing as one, which is indicated by little or no difference in engine RPM when switching between ignition systems.

The trigger cap (A) of the secondary ignition system rotates to make timing adjustments. It is locked in position by a socket head cap screw (D). When the magnet in the trigger cap passes by the sensor in the triggers (C), it fires the spark plugs. The location of the magnet in the trigger cap is marked with a line (B).



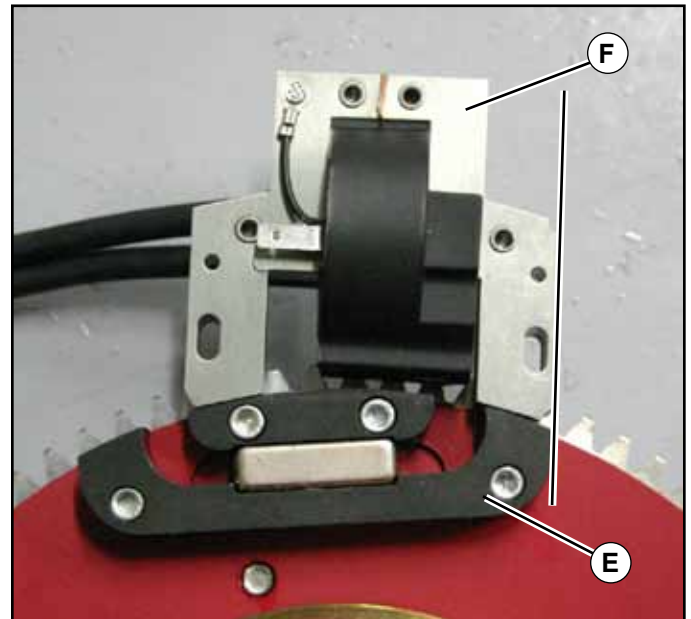
The trigger cap (A) is locked in position by a socket head cap screw (D). A mark (B) on the trigger cap corresponds with the location of the trigger magnet. When this magnet passes by a sensor (C) in the upper and lower triggers, the spark plugs fire.

ELECTRONIC IGNITION TIMING

Timing the Secondary Ignition

Important: The secondary ignition will spark when the ignition is on and the trigger magnet passes by the sensor. This can cause ignition. Avoid serious injury or death by turning off the fuel, ignition switch, and master switch and remaining clear of the propeller while timing the ignition.

Initial timing is achieved by aligning the right edge of the magnet shoe on the flywheel (E, photo below) with the right edge of the top Magnatron (F) and then rotating the trigger cap (A) until the mark on the cap (B, previous column) is approximately 10 degrees to the right of the sensor (C) of the upper trigger. The following steps detail this process.

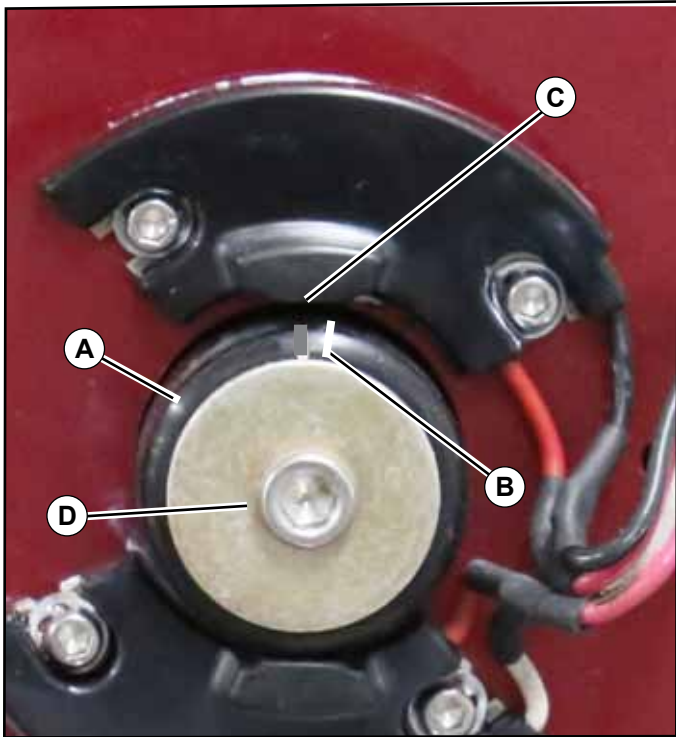


The black / white line on the right shows how the top Magnatron and magnet shoe on the flywheel align prior to setting the secondary ignition timing. For clarity these parts are shown removed from the engine.

- 1. Turn off the aircraft's Master switch, secondary ignition switch and fuel valve.
- 2. Pull the cockpit mixture control to "Idle Cut-off".
- 3. Rotate the crank until the right edge of the magnet shoe on the flywheel (E, above) is aligned with the right edge of the top Magnatron (F, above). Look down between the accessory plate and the rear flange of the engine case to check the alignment of the top Magnatron to magnet shoe on the flywheel.

AeroVee 2.1 Turbo

- ___ 4. Loosen the socket head cap screw (D) and rotate the magnet cap (A) until the mark on the magnet cap (B) is in the approximate position shown in the photo, below, relative to the sensor (C) of the upper trigger.



When the crankshaft is in the proper position (See steps 1 through 4) static timing is achieved by loosening the cap screw (D) and rotating the trigger cap (A) until the mark on the trigger cap (B) is in the approximate position shown.

- ___ 5. Tighten the socket head cap screw.

ELECTRONIC IGNITION TIMING

Timing Check

The nominal figure for proper timing of the secondary ignition is 18-degrees BTDC.

Ground Check. Running the engine and performing a mag check will indicate the accuracy of the timing of the secondary ignition. A mag check at 1600 - 2000 RPM should reveal a slight change in RPM when the Primary (magnatron) ignition is turned off. No change will be noted when the Secondary (electronic) ignition is turned off.

If a change of 50 RPM or greater is noted, the magnet cap should be rotated slightly one way or the other.

In Flight Check. Under normal cruise power (2900 to 3400 rpm):

- ___ 1. Turn off the secondary ignition and observe the cylinder head temperature.
- ___ 2. Turn on the secondary ignition and turn off the Primary ignition. Observe the cylinder head temperature.

If the cylinder head temperature rises when operating with only the secondary ignition, the secondary ignition needs adjustment. Advance or retard the secondary ignition, as needed, by turning the magnet cap slightly.

AeroVee 2.1 Turbo

The AeroConversions' AeroVee Turbo Radiator is a self-contained turbo cooling system intended to greatly reduce or eliminate “turbo coking” and turbo seizing caused by extreme temperature soaking of the bearing block after engine shutdown.

Installation Guidelines

Each installation will need to be adapted to the particular airframe it is being installed on. These guidelines, together with the following resources, will help you achieve a functional installation. These resources can be downloaded from:

www.aeroconversions.com/support/manuals.html

- ☐ ACV-T06 Bill of Materials / Shopping List
- ☐ Drawing ACV-T06, Turbo Cooling System (Schematic)
- ☐ Drawing ACV-T06-07, Radiator Plenum Drawing

An over-view photo of that installation on a Waix airframe is included on page 68.

Radiator

Cushioned clamps (AN 742) can be used to secure the radiator to the motormount.

B-Model Airframe

Mount the radiator/fan assembly horizontally on the left side of the firewall. See photo, page 68.

Legacy Airframe

Mount the radiator/fan assembly vertically on the left side of the motor mount.

Catch Can

Mount the catch can as high as possible. The filler neck must be above the radiator.

Coolant Hoses

Route the coolant hoses in a manner that prevents trapping air.

Vent Tube

A vent tube must be installed on the barbed fitting of the catch can's filler neck. The end of the vent tube must be routed out the bottom of the cowl. The vent tube allows the release of excessive pressure from the system. When the coolant is hot avoid the vent tubes's outlet to avoid serious burns.

Water Pump

Mount the pump lower on the firewall than the radiator. It should be positioned to facilitate hose installation and minimize hose length.

TURBO COOLANT SYSTEM

Cowl Vents

Top cowl vents are highly recommended.

Two 4” dia. vents cut in the top of the cowl provide outlets for ambient and forced cooling air after shutdown. 4” diameter louvered aluminum soffit vents work well.

Switch / System Wiring

Wire the system to the “hot” side of the Master switch to allow operation when the Master switch is turned off. This is particularly important for automatic operation with the thermostat.

A 3-position switch installed in the panel allows these pump/fan operation modes:

Off - Pump and fan will not run

Automatic - The thermostat controls the operation of the pump and fan. The system turns on/off at approximately the thermostat's rated temperature

On - Pump and fan will run until the switch is manually turned off.

An indicator light wired to the switch and placed next to the switch in the panel indicates when the system is running.

Bearing Block Temperature Sender

Install a temperature sender under the thermostat to monitor the turbo bearing temperature. Unused CHT or EGT inputs on most EFIS systems will work for this purpose. Our prototype installation uses a large diameter CHT probe held in place by the thermostat.

Coolant

High-temperature waterless coolants (Evans Coolant EC10064 or equivalent) are recommended due to their high boiling point which reduces pressure in the system.

The capacity of the system is approximately 1.5 pints (24 fl. oz., .75 liters)

Filling the Coolant System

1. Add coolant until the catch can no longer accepts more coolant.
2. Leave the filler cap off and run the pump to purge air from the system.
3. Add more coolant as described in step 1.
4. Repeat steps 2 and 3 until the catch can remains full.
5. Install the filler cap.
6. Operate the pump and inspect for leaks.

Ground Testing the Installation

Perform the initial post-installation tests with the cowl removed.

IMPORTANT: Keep the CHT within limits while ground running the engine.

1. Tie down the aircraft.
2. Have someone watch for coolant leaks.
3. Run the engine until the bearing block reaches approximately 230°F or its temperature stabilizes below 230°F.
Note: Oil flow through the bearing block may prevent the temperature from getting to 230°F.
4. Turn the pump/fan switch to "On."
5. Shut down the engine.
6. Listen for both the pump and fan running. Positive operation will also be indicated by air being forced through the radiator.
7. Observe the bearing block temperature for a marked decrease in the indicated temperature of the bearing block.
8. If there are coolant leaks or the fan or pump do not operate, allow the engine to cool before investigating and correcting the problem. Repeat the test.
9. Repeat the test with the switch turned to the "Automatic" position.
10. Listen for both the pump and fan running. Operation will also be indicated by air being forced through the radiator and a marked decrease in the indicated temperature of the bearing block.
11. Confirm the fan and pump shut off automatically when the bearing block temperature falls near, or below, 160°F.
12. If the fan or pump do not operate properly, allow the engine to cool before investigating and correcting the problem. Repeat the test.

Operational Notes

The bearing block temperature is typically under 230°F while the engine is running. The purpose of the cooler is to prevent oil coking by maintaining the temperature below 250°F after shut down.

Prior to Takeoff

There is no benefit to operating the pump prior to take-off or during flight.

Always check turbo operation with a proper engine run-up prior to takeoff. **DO NOT take off if a power loss is indicated.**

Post Landing / Pre-Shut-Down Pump Operation

The pump should be switched to "On" or "Automatic" after landing or immediately before shut down.

Automatic pump/fan shut down occurs near the thermostat's rated temperature when the switch is placed to "Automatic."

Manual shut-down is required when the switch is placed to "On."

Maintain Battery Health

When possible, connect a battery maintainer after shutdown. Normally, battery drain is not significant during the automatic cool-down cycle but poor battery condition due to battery age or other factors could prevent engine restart.



Bringing your engine to life is exciting and rewarding. These points and procedures will assure the greatest success.

SAFETY FIRST!

- ___ 1. Have the correct propeller installed, torqued and tracked. **DO NOT OPERATE THE ENGINE WITHOUT A PROPELLER.**
- ___ 2. Remove loose tools, rags, and debris from the engine and immediate area.
- ___ 3. One person **MUST** remain in the cockpit while the engine is running, and an observer **MUST** be on hand to keep an eye on the engine in case of oil leak, fire, and to observe and keep bystanders safely away.
- ___ 4. Have an approved fire extinguisher available.
- ___ 5. Know your aircraft's cockpit controls.
- ___ 6. Tie the aircraft down securely, set the brakes, and chock the wheels.
- ___ 7. Start the engine using a checklist. The AeroCarb manual includes some sample start-up and shut-down checklists which may be used or adapted to your aircraft.

Engine Checks

- ___ 1. Cowl removed.
- ___ 2. Oil in crankcase.
- ___ 3. All parts installed and secured.
- ___ 4. Propeller installed, torqued, and tracked.
- ___ 5. Heads torqued and valves properly adjusted.
- ___ 6. Electronic ignition system static-timed.

Starting the Engine

- ___ 1. Install the correct oil and prime the engine as described in "Engine Oil."
- ___ 2. Use your start-up checklist to start the engine.
- ___ 3. Immediately upon engine start look for oil pressure. If no oil pressure registers in 5 seconds, turn off the engine and investigate.
If the engine does start, exhibits oil pressure and runs well enough, let it idle for 3 minutes to assure the oil system is well primed.
- ___ 4. If the engine does not start, investigate the cause (see Troubleshooting section) and repeat steps 2 and 3, above.
- ___ 5. Adjust the timing of the electronic ignition as required. There should be little or no change in RPM when performing a mag check between 1600 and 2000 RPM. A change of more than 50 RPM indicates a timing correction is needed.

- ___ 6. Tune the AeroCarb for optimum engine performance. Tuning is detailed in the AeroCarb manual.
- ___ 7. Limit ground running to the minimum necessary to correct the timing, tune the AeroCarb, assure smooth throttle response, confirm proper oil pressure, and assure no oil leaks.

Important: Extended ground running will overheat the engine and cause serious damage.

Operation

It is important to follow these operational notes.

Pre Take Off

Abort the take-off if the engine does not develop 40" of manifold pressure during the take-off roll.

Pre Shut Down

Allow the engine to idle for 3 minutes prior to shutting the engine off. This idle period helps cool the turbo.

See also "Operating Limitations" on page 6.

Break-in, the First 25 Hours

Proper break-in will help you get the best performance and longest life from your AeroVee engine.

- ___ 1. Limit ground running to what is needed to properly tune the engine and assure no oil leaks.
- ___ 2. Do not "baby" the engine during the first few flights. As soon as possible, climb to a safe altitude over your airfield and operate the engine at 3000 rpm and above for at least an hour. This will seat the rings. Monitor the engine's temperatures and reduce throttle as needed to keep the engine temperatures "in the green". Step climb if needed. Higher than normal temperatures during the break-in period are to be expected, however, temperatures which exceed the redline or continue to climb must be investigated.
- ___ 3. Change the oil at 1 hour, 5 hours, 10 hours, and 25 hours.
- ___ 4. Adjust the valves at 5 hours, 10 hours, and 25 hours.
- ___ 5. Torque the heads and adjust the valves at 10 hours and 25 hours. Always torque the heads before adjusting the valves.

After 25 hours you should see the engine's temperatures decrease and stabilize and there should be little change in the head torque.

Turbo Charger-specific Maintenance

The turbo charger unit requires no specific maintenance beyond the oil change interval recommended below for the AeroVee engine.

Minimum Maintenance Interval

1 Hour Accumulated

___ Change the oil and clean the oil filter.

5 Hours Accumulated

___ Change the oil.

___ Adjust the valves (cold engine). See page 29.

10 Hours Accumulated

___ Change the oil.

___ Torque the heads to 18 foot pounds. Do NOT loosen the nuts prior to torquing them. See page 22 for proper torque sequence. The rocker shaft assemblies must be removed to torque the heads.

___ Adjust the valves (cold engine). See page 29. Valves must be adjusted after torquing the heads.

___ Check all fasteners for tightness and security.

25 Hours Accumulated

___ Change the oil and wash the oil screen.

___ Torque the heads to 18 foot pounds. Do NOT loosen the nuts prior to torquing them. See page 22 for proper torque sequence. The rocker shaft assemblies must be removed to torque the heads.

___ Adjust the valves (cold engine). See page 29. Valves must be adjusted after torquing the heads.

Every 25 Hours

___ Change the oil.

Every 50 Hours

___ Change the oil and wash the oil screen.

___ Adjust the valves (cold engine). See page 29.

___ Inspect and/or replace air filter.

On Annual Inspection

___ Change the oil and wash the oil screen.

___ Torque the heads to 18 foot pounds. Do NOT loosen the nuts prior to torquing them. See page 22 for proper torque sequence. The rocker shaft assemblies must be removed to torque the heads.

___ Adjust the valves (cold engine). See page 29. Valves must be adjusted after torquing the heads.

___ Inspect and/or replace air filter.

___ Inspect and/or replace spark plugs.

___ Check all fasteners for tightness and security.

___ Check all hoses for condition, tightness and security.

___ Check all wiring for condition and security.

___ Perform a leak-down test of each cylinder. 80 psi is normal, anything below 60, or a large deviation between individual cylinders, requires additional investigation.

When to Rebuild Your AeroVee

Experimental engines, such as the AeroVee, have no TBO. As the owner/operator of an AeroVee engine you decide when it will be rebuilt and to what extent.

Signs an engine needs some degree of rebuilding include low compression, loss of power, increased oil usage, and low oil pressure.

Torque Values

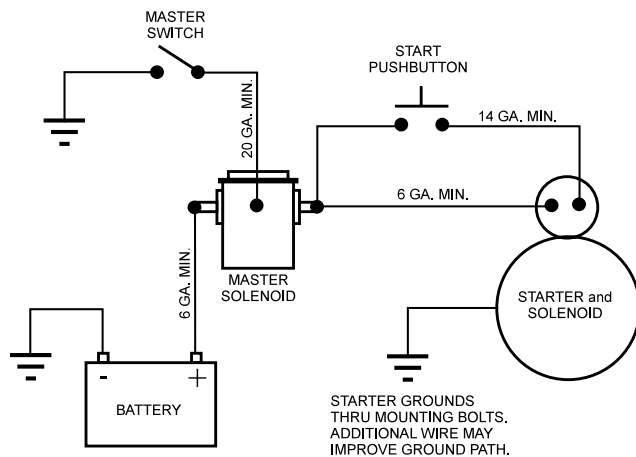
Item	Socket	Ft-lbs	In-lbs.
Large Case Nuts	19mm	25	300
Cam Case Nuts.....	13mm	10	120
Small Case Nuts.....	13mm	14	168
Cylinder Head Nuts.....	15mm	18	216
Rocker Arm Nuts	13mm	14	168
Prop Hub Nut	30mm	70-80.....	840-960
Flywheel Gland Nut.....	36mm	227	2724
Connecting Rod Nuts.....	14mm	30	360
Valve Cover Bolts	13mm	10	120
Oil Pump Cover	13mm	14	168
Oil Pan Cover Nuts	10mm	5	60
Rear Unit Mount Bolts.....	17mm	25	300
Prop Bolts/Nuts*	1/2"	11	132
Spark Plugs	11/16"	12	144

*Refer to the propeller manufacturer's torque specification. In the absence of a manufacturer specification, use these values.

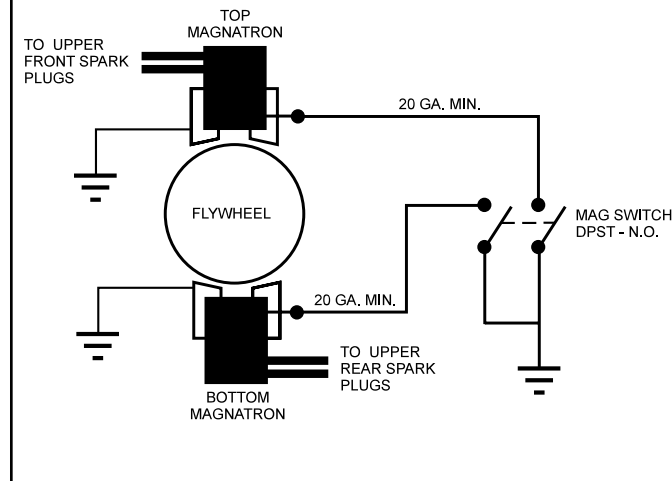
AeroVee 2.1 Turbo

This page is a quick reference of electrical schematics associated with the AeroVee installation. Detailed instructions for each sub-system are provided elsewhere in this manual.

STARTER WIRING SCHEMATIC

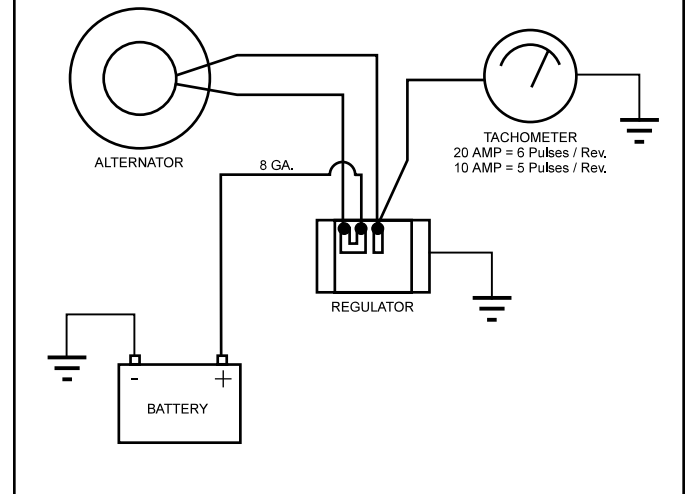


MAGNATRON IGNITION SCHEMATIC

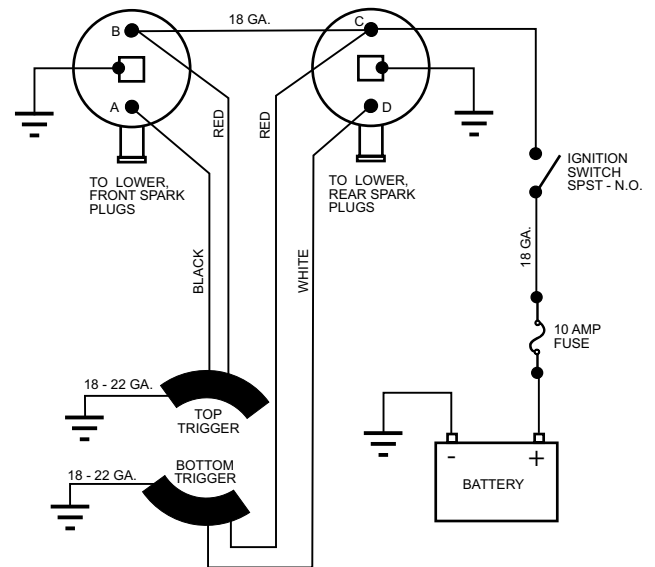


ELECTRICAL SCHEMATICS

ALTERNATOR WIRING SCHEMATIC



SECONDARY IGNITION SCHEMATIC



Note: A ground wire must be installed under one screw of each Trigger and routed to a ground point on the engine or airframe.

Engine does not start

Possible Cause

- 1) Ignition OFF
- 2) Spark plug gaps too large
- 3) Closed fuel valve or clogged filter
- 4) No fuel in tank
- 5) Wrongly connected spark plug leads
- 6) Starting speed too low, faulty or discharged battery
- 7) Coil to magnet gap too wide
- 8) High tension leads loose or damaged
- 9) Spark plugs damp due to condensation
- 10) Spark plugs wet by fuel due to flooding
- 11) Water in fuel system
- 12) Insufficient compression
- 13) Engine damage
- 14) No Spark from Secondary Ignition module

Remedy

Switch ON
Adjust gaps or replace plugs
Open valve, replace or clean filter, check for fuel system leaks
Refuel
Connect as shown in manual
Recharge or replace battery

Adjust to .010"
Check or renew connections
Thoroughly dry both inside and outside of plugs
Remove, dry and reinstall spark plugs
Drain water from sump and tank
Trace pressure loss & repair if necessary
Inspect oil screen for metallic particles
If present, an engine overhaul may be necessary.
Check for/add ground wires from ignition cap screws to engine case.

Engine idles unsteadily after warm-up period and/ or smokey exhaust emission

Possible Cause

- 1) Rich idle setting
- 2) Intake manifold leak

Remedy

Adjust AeroInjector (See AeroInjector manual)
Tighten all connections, replace hose

Engine runs erratically or misfires occasionally

Possible Cause

- 1) Spark plug failure
- 2) Faulty ignition leads or caps
- 3) Faulty ignition unit
- 4) Clogged fuel filter

Remedy

Check plugs, clean inside & outside, adjust electrode gap. If necessary, replace plugs
Dry damp leads, replace damaged leads
Replace ignition unit
Clean or replace fuel filter

Engine runs too hot - Oil temperature above 230°F (110° C) or high CHT (400°+)

Possible Cause

- 1) Too much oil in crankcase
- 2) Low oil level
- 3) Poor quality oil
- 4) Clogged oil screen
- 5) Excessive piston blow by
- 6) Faulty bearings
- 7) Faulty oil or CHT temperature gauge/ probes
- 8) Faulty cooling baffles
- 9) Oil cooler not installed
- 10) Secondary Ignition Advanced

Remedy

Check oil level & adjust if necessary
Check oil level & add oil if necessary
Change oil, use specified oil
Clean screen
Common reason: worn or sticking piston rings, "top" engine overhaul necessary
If metallic particles are present in oil, a complete engine overhaul is necessary
Replace the gauge or probes
Check for leaks, cowl inlets and exits and baffles are built to plans
Install recommended oil cooler and baffles
Retard Secondary Ignition Timing

Unsatisfactory power output

Possible Cause

- 1) Ignition failure
- 2) Too much oil in crankcase
- 3) Insufficient fuel supply
- 4) Fuel not according to specifications
- 5) Incorrect throttle adjustment
- 6) Leak in air intake

Remedy

Check ignition circuits; Check wiring and /or replace ignition units
Check oil level & adjust if necessary
Check fuel supply system
Refuel with specified fuel
Readjust throttle setting
Check and tighten all manifold and Carb connections

Low oil pressure

Possible Cause

- 1) Insufficient oil in sump
- 2) High oil temperature
- 3) Faulty pressure gauge, sender or wiring
- 4) Faulty crankshaft bearings
- 5) Oil Pump plate on Incorrectly

Remedy

Check oil level and top as necessary
Improve engine cooling
Check gauge, sender & wiring. Replace if necessary
Engine overhaul
Properly install oil pump cover

Engine Keeps Running with Ignition Off

Possible Cause

- 1) Faulty ignition switch
- 2) Overheated engine
- 3) Bad fuel or octane rating too low

Remedy

Check switch & cables.
Conduct cooling run at 900 RPM
Refuel with recommended fuel

Excessive oil consumption

Possible Cause

- 1) Worn, broken or poorly fitted piston rings
- 2) Poor oil quality
- 3) Worn valve guides
- 4) Oil leaks

Remedy

Repair or engine overhaul necessary
Oil change, use specified oil
Repair of cylinder head necessary
Seal leaks

Knocking under load

Possible Cause

- 1) Octane rating of fuel too low
- 2) Spark plug fitted without sealing washer
- 3) Heavy carbon deposits
tion chamber

Remedy

Use fuel with higher octane rating
Ensure one sealing washer on each plug
Remove cylinder heads & remove deposits in combustion chamber

Engine Hard to Start at Low Temperature

Possible Cause

- 1) Starting speed too low
- 2) Low battery charge
- 3) No spark
- 4) Lean or rich mixture

Remedy

Preheat engine
Charge or replace battery
Check ignition gaps and adjust
Adjust AeroCarb. See AeroCarb manual.

Keep Your Packing Lists

The packing list provided with each AeroVee kit lists the specific parts provided for that specific engine. Please reference your engine's packing list for correct part numbers when ordering maintenance and repair parts for your particular engine.

In addition to the packing list secured to the outside of the engine kit boxes, a duplicate packing list has been attached to the back of each physical manual supplied with that engine.

If you are holding a manual provided with an engine that was shipped after January 1st, 2014, there should be a copy of the original packing list attached after third page. If there is no packing list attached the manual you have may have printed from the website, provided as a replacement, or the packing list may have been removed.

Copies of (most) packing lists are archived by Sonex and you may request an electronic (PDF) copy. To get a copy, provide evidence you own the engine for which you are requesting the original packing list as well as the engine's serial number.

Part Number Changes - Interchangeable Parts

AeroConversions reserves the right to supply compatible, alternative replacement parts for any part of the core engine or conversion package. Such parts may appear different than the part originally provided in the kit or depicted in the manual, and may bear a different part number, but will be functionally identical or superior to the original kit-supplied component.

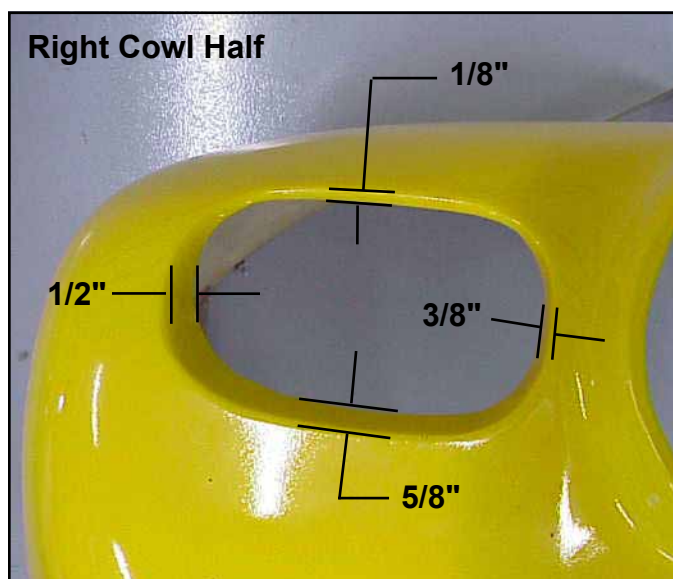
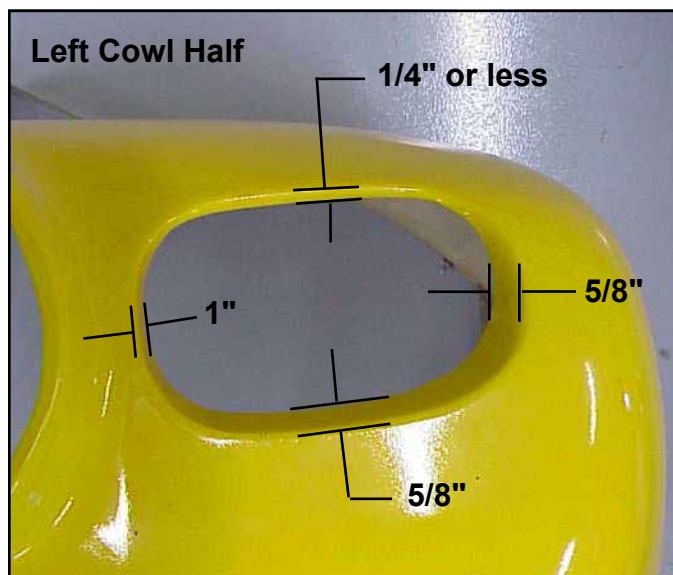
Proper cooling inlets and exhaust outlets are critical to proper engine cooling. Arbitrarily changing any of the defined openings can have a negative affect on cooling.

This Appendix details the cowling inlets and outlets of a Sonex cowl fitted to a Sonex, Waixex, or Xenos.

The cowling of a Onex airframe is supplied with all cut-outs pre-finished so no additional details are provided in this manual.

Cylinder Head Cooling Air Cut-outs

These photos identify the depth of the cowl lips for the cylinder head cooling air.



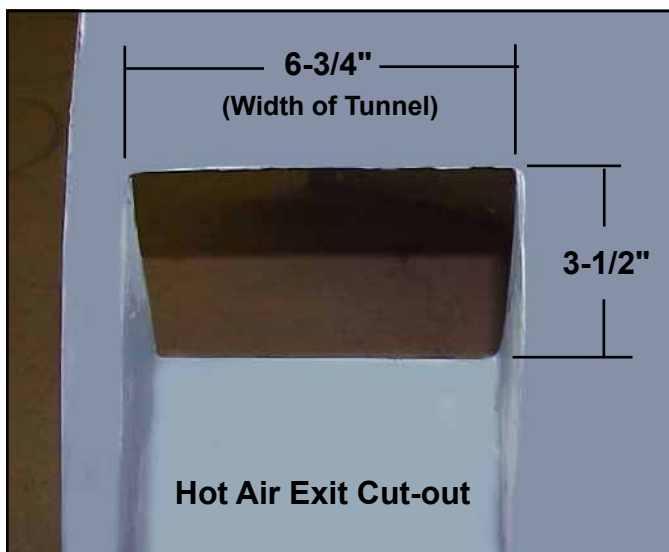
Hot Air Exit Cut-outs

The cowling provided with your kit is one of two types: a VW cowl with premolded exhaust tunnels (detailed below), or a Universal cowl, detailed on the next page.

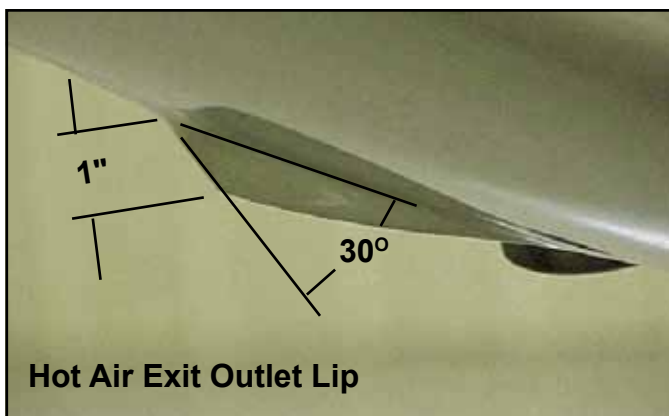
VW Cowl with Pre-molded Exhaust Tunnel

The VW cowl with pre-molded exhaust tunnels was phased out in favor of the Universal cowl in 2004. The change was made to eliminate the cheeks on the side of the cowl.

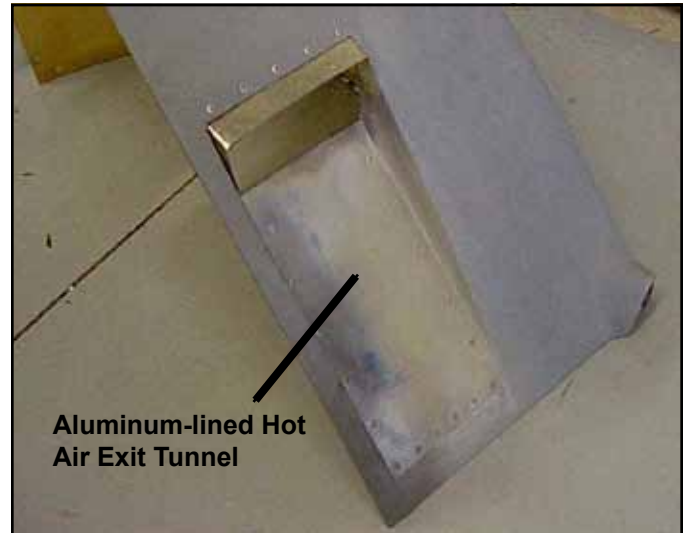
The VW cowl must have the exhaust outlets cut open to the proper size and have air deflector lips added, as shown in the accompanying photos. In addition, .025" aluminum sheet is riveted to the exhaust tunnel to protect the fiberglass from the hot exhaust gasses.



This is a view of the hot air outlet cut-out before the lips are added.



The hot air outlet lips can be molded from fiberglass, as shown here, or made from .025" aluminum and riveted in place.



This tunnel has been lined with .025" 6061-T6 aluminum to protect the fiberglass from the heat.



This view of a completed cowl clearly shows the air deflector lips which are added to the front of the hot air exit cut-out. These lips create a low pressure area which draws the cooling air through the cowl. These lips are particularly important when the airplane is in a climb attitude. This aircraft is fitted with a non-turbo exhaust. A turbo installation will require a hole be cut large enough to allow the turbo exhaust to exit the cowl without contacting the cowl (see photo next page).

Legacy Sonex Universal Cowl without Exhaust Tunnels

A 4" x 12.5" cut-out is made on the lower aft edge of the cowl-ing, where it attaches to the bottom of the firewall. This open-ing provides an outlet for the engine's cooling air. **No other cooling air outlets should be added to the cowl.**

Note: The loss of piano hinge in this area has no impact on the strength and security of the cowl installation.

An aluminum lip must be added to the front of the opening. The lip should be 1" high and rake back 60 degrees from front to back.



*This photo shows the hot air exit for a legacy Sonex cowl **without** pre-molded tunnels. The cut-out measures 4" x 12.5". No additional cowl outlets are needed for cooling air; however the turbo installtion requires a hole be cut large enough to allow the turbo exhaust to exit the cowl without contacting the cowl (photo below).*



This photo shows the cut-out to allow the turbo exhaust to exit the cowl without contacting the cowl. The opening can be en-circled by an aluminium or stainless steel heat sheild to protect the fiberglass cowl.

B-Model Cowl Side Vents

Note: The side vents introduced on the B-Model airframes are not intedned for use on legacy airframes.

The B-Model side vents should be positioned in accordance with the B-Model airframe plans.

Supplementing Cooling when using B-Model Side Vents

While a factory prototype has been flying succesfully with only the side vents for hot air exits, some customer aircraft have experienced insufficient cooling. There can be many reasons for individual, handbuilt aircraft to run hot and each aircraft must be diagnosed individually, however, some have benefit-ted from adding the standard cooling air outlet described in the previous column.



This B-Model Side vents should only be fitted to B-Model cowlings. They may need to be supplemented with an additio-anl exit air opening on the bottom of the cowl.

Rev. L 6/30/23

Removed references to third-party hardware kits.
Removed tech support email address.
Added B-Model Cowl Side Vent details to Appendix A

Rev. K 12/20/22

Added Turbo Coolant System instructions, which were previously a free-standing document.

Rev. J 03/24/22

Changed Sonex Aircraft LLC to Sonex LLC.
Updated Secondary Ignition Instructions and schematics for ACV-A01-23 triggers that require user-installed ground wire.

Rev. I 12/21/21

Rocker Shaft Assembly. Added note check for free rotation of rocker arms after installing the rocker shafts.

Rev. H 04/26/21

Page 9, Made up-drilling the oil supply hole in bearing #1 optional. Pre-assembled cranks are not up-drilled.
Page 45, Corrected Parts List Errors: (None of these changes altered the assembly or the contents of the kit):
-ACV-T05-43 Shroud Clip WAS Waste Gate Mount Nuts.
-ACV-T05-50 Waste Gate Mount Nuts WAS Actuator Mount Nuts.
-Deleted ACV-T05-72 Turbo Shroud Group Part number and replaced with individual part numbers: ACV-T05-42, Turbo Shroud; ACV-Z01-89, Spring; ACV-T05-43, Shroud Clip.
Page 47, Added Part Numbers to caption for Turbo Shroud installation.

Rev. G 04/06/21

Page 45, Added Turbo Clocking instructions.

Rev. F 03/20/18

Corrected prop drive lug diameter from 9/16" nominal to .590 +/- .001".

Rev. E 06/30/17

Part number call-out corrected.
Page 56, "Oil Line Installation - Oil Filter to Turbo Body," step 2, part number SUM-220447 changed to 592047ERL.

Rev. D 03/10/17

Updated connecting rod installation procedure. Removed "Starred Bolt" connecting rod option, redefined installation orientation.

Rev. C 12/21/16

Revised manual to include changes to reduce coking of the turbo. Specific changes include:
3 minute turbo cool-down at idle RPM added.
Added note that turbo drain must be parallel to the ground when the aircraft is resting on its tires.
Turbo blanket replaced with turbo shroud.
Added Turbo Drain Sump.
Added remote oil filter.
Added Turbo Operation notes to page 66.
Removed Valvoline VR-1, 20W50 non-synthetic as a recommended oil.

Other changes:

Timing specification for secondary ignition changed to 18 BTDC (was 10).
Removed synthetic oils as oil options.
Moved oil return line from valve cover to engine case by oil filler.

Rev. B 08/05/15

Added cowl opening guidance for Sonex aircraft.
Bolts used to attach oil cooler were lengthened +1. Shorter bolts previously used are still acceptable.

Rev. A 01/06/15

Changed the step sequence for installing the actuator's retaining ring and turbo blanket.

Rev. NC 11/24/14

Original Publication of AeroVee 2.1 Turbo Assembly Manual