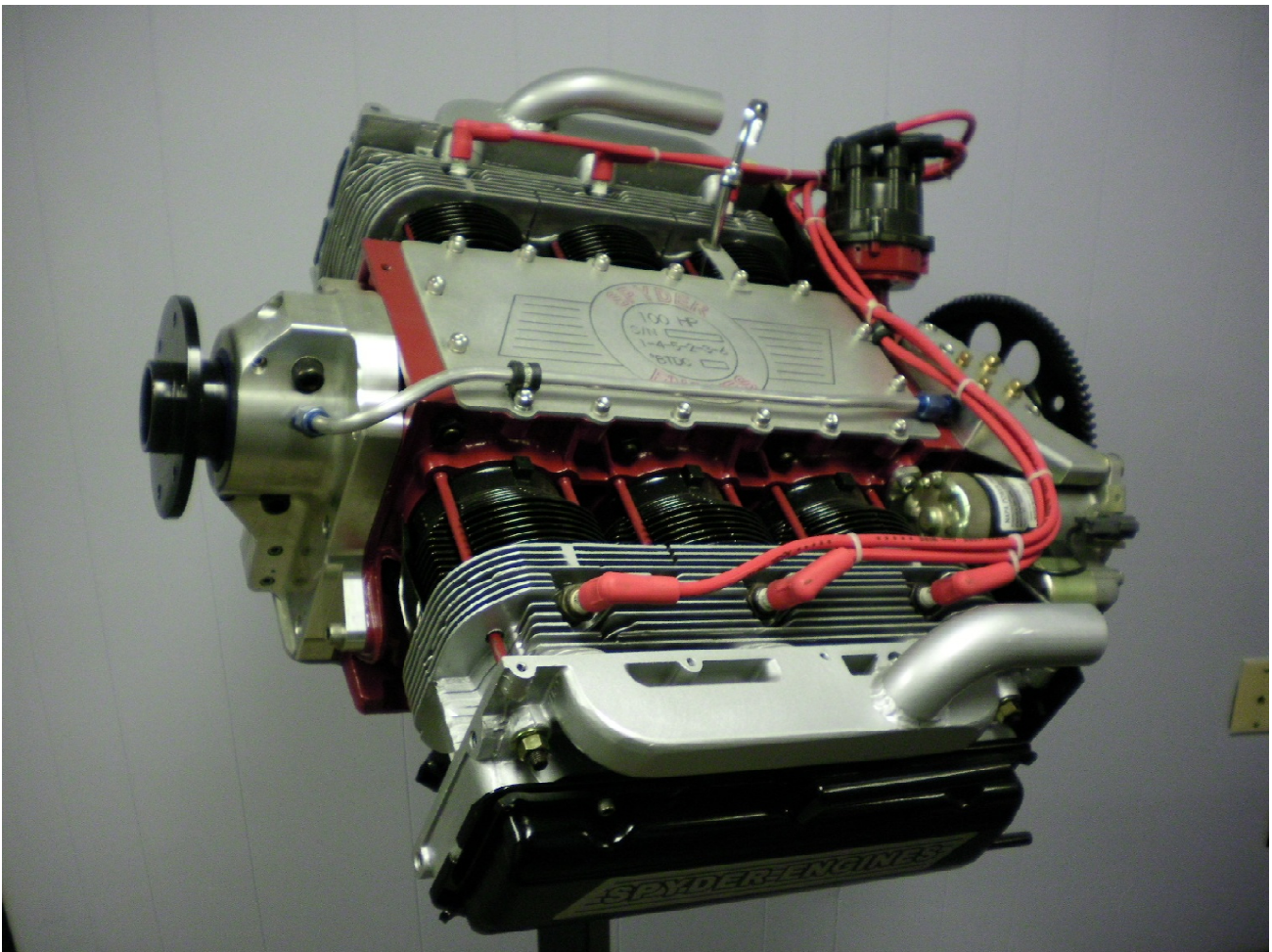




AZALEA AVIATION, LLC



100/120 HP SPYDER ENGINE ASSEMBLY MANUAL

AzaleaAviation.com

SPYDER 100/120 HP

Engine Assembly Manual

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Introduction

This Assembly Manual is a guide to the final assembly or rebuilding of the SPYDER 100/120 HP series engine. Basic power plant or mechanical skills are not required but helpful. As the builder you are ultimately responsible for the proper assembly of your engine. Azalea Aviation assumes no responsibility for improper assembly or lack of pertinent information in this manual. If you have any questions you can contact us or use several additional sources of information available. The Chevrolet "Green" Shop Manual for 1965 Corvair and the SPYDER Service and Operations Manual can be helpful. You can also contact the SPYDER Technical Service department at Azalea Aviation for further assistance.

This section of the manual assumes that the engine teardown, rebuild, and preparation of all components has been completed and are in airworthy condition. For information about these procedures you can purchase the SPYDER Engine Teardown and Preparation Manual through Azalea Aviation or join one of our engine clinics that are held periodically.

Accessory Housing Assembly

The accessory housing needs to be ready to assemble at this point with all cleaning, painting and preparation finished.

Tools Required:

- 3/16" Allen wrench
- Straight edge
- Feeler gauge .004
- 13/16" wrench
- Distributor shaft or Long screwdriver

Sealants Required:

- Grey RTV
- Loctite
- Lithium Grease
- Copper Spray adhesive
- Oil

Parts Required:

- Accessory Housing
- Oil Pump Kit
- (6) Stainless Drilled 10-32 Allen Screws
- Oil Pressure Valve Nut – spring - piston
- Oil Pump Cover
- Rear Seal



Oil Pump Installation

Lubricate the oil pump shafts lightly and install into the Accessory housing. With a straightedge on the gears, check the clearance to the housing with the .004 feeler gauge. If clearance is more than .004 then use the thicker gasket from the kit. If less, then use the thin gasket. (Fig 1) Spray copper adhesive to both sides of the gasket and let tack up. Spread a little bit of oil on the tops of the gears. Make sure to leave the housing surface dry where the gasket will lay. (Fig 2) Apply a dab of loctite to the six Allen bolts and install the oil pump cover and torque to specifications. (60-80 inch/lbs) Insert either a long screwdriver or a distributor shaft into the housing to rotate the oil pump gears. If it is tight then disassemble the oil pump to check for binding and clearances. If the gears are tight then a thicker gasket may have to be used. Once all is inspected then safety the bolts with standard .030 safety wire if they have drilled heads. (Fig 3)

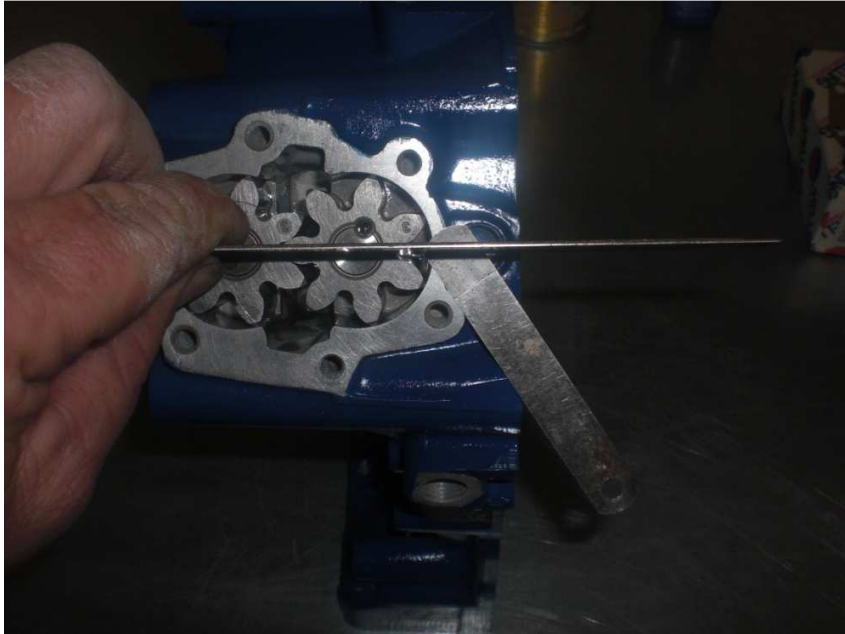


Fig 1. – Checking clearance



Fig 2. – Installing Cover plate



Fig 3. – Oil cover safetied and pressure relief valve installed

Oil Pressure Relief Valve Installation

Make sure the Oil Pressure Relieve valve piston is very clean and well lubricated with oil. Using a screwdriver or small tube insert the piston into the port and make sure it has freedom of movement in the port. If it sticks, then clean the port and try again. The piston has to move freely to function properly. Insert the spring and nut (loctite applied) in the order shown. (Fig 4) Tighten the nut to proper torque. (10 ft/lbs) If drilled, safety the nut to the housing.



Fig 4. – Oil Pressure Relieve valve parts

Rear Seal Installation

Apply Grey RTV (or equivalent) to out edge of seal and to inner edge of housing. Using an appropriate tool (such as a large washer and socket) press the Seal down into the housing until metal ring is flush with the housing lip. A new seal may have to be carefully trimmed around the outside edge to fit inside the stator ring. (Fig 5) Apply Lithium Grease to the inside of seal. This will be where the alternator puck rides.



Fig. 5. - Rear Housing rear seal installed

The Accessory Housing now is ready for installation onto the Case.

Notes: If you choose to install the High Volume Oil pump kit be sure to follow the instructions included in the kit. The use of a High Volume Oil pump is not detrimental to the engine if installed correctly.

Accessory Housing Installation

Tools Required:

- Rubber hammer
- ½" socket and Ratchet
- 9/16" Socket
- Large socket for gear installation

Sealants Required:

- Copper spray
- Loctite (red and green)
- Lithium Grease

Parts Required:

- Case assembly
- Drive gears (4 parts)
- Accessory bolts (7)
- Accessory housing
- 3/8" washers and nuts
- Alternator Kit (seen below)



Drive Gear Installation:

The distributor drive gear and slinger need to be installed before the accessory housing. This assembly is made up of four pieces and need to be in the right order and orientation. The photos below show the order and the assembled unit. (Fig 1) Use a large socket or pipe to lightly drive these pieces over the crankshaft end. The order is...eccentric, spacer, gear, and slinger (facing out). Some engines may be equipped with the wider spacer that eliminates the concentric and small spacer. (Fig 1b) Be sure the woodruff keys are installed properly onto the crankshaft prior to installation.

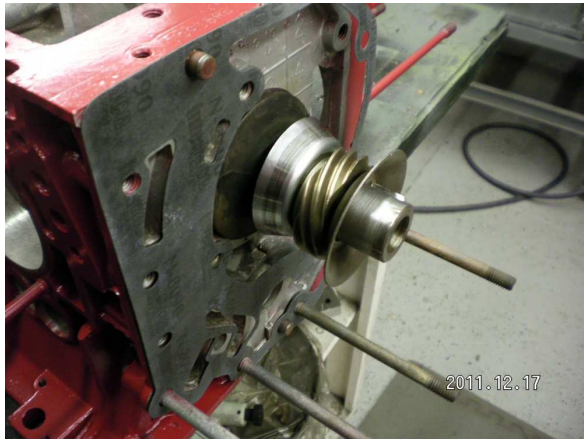


Fig 1. Rear gear parts installed on the crankshaft

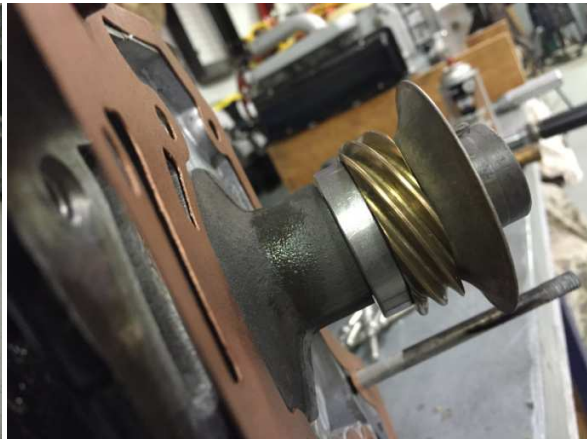


Fig 1b.

Housing Installation

Apply an even coat of copper spray on both sides of the rear gasket. Once it is tacky install onto the case. Slide the Accessory housing on and tap into place with the rubber hammer. Check to see that it has seated all the way around before installing the hardware. Apply a dab of Loctite onto the threads of the 4 long and 2 short bolts prior to installing them. (Do not install the bolt at the 4 o'clock position yet. Install three of the four washers and 3/8 nuts onto the studs. Leave the left one open. (Fig 2) Torque the hardware to the proper specifications. (13 ft/lbs)



Fig 2. Rear housing installed onto case

Take the alternator stator and install it onto the stator ring using provided Allen screws. Dab a bit of red Loctite onto end of threads. Place the output wire at the 4 o'clock position. Use the Adel clamp and the short housing Allen head bolt to secure it. Make sure the stator is flush against the stator mounting ring. (Figure 3)

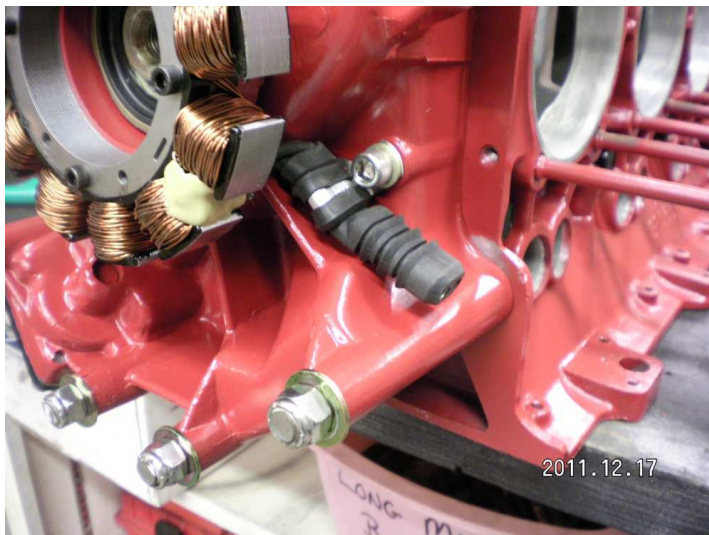


Fig 3. – Stator attached and clamp detail

Apply green sleeve Loctite to the rear Puck (inside) and a light coat of Lithium grease to the outside where the seal will ride. Place onto the end of the crankshaft and using a dead blow hammer tap into place. Install the large washer and bolt using red Loctite and torque to 50 -60

foot lbs. (Figure 4) Use a wooden block against the #1 crankshaft rod journal to hold the crankshaft in place while torquing.



Fig 4 – Rear Puck installed and Torqued

The Rear drum can be put onto the puck loosely until the ring gear and starter are installed. Be sure the drum is clean on the inside. Because it is made up of magnets it can attract small filings. Notice that there may be a positioning pin on the puck and a hole in the drum. This is to ensure that the TDC mark on the drum is in the proper location. Otherwise turn the crankshaft until the #1 rod journal is at the TDC position and make sure the mark on the alternator drum is near the timing marks on the housing.



Starter Installation

Tools Required:

- 3/16" Hex socket
- Torque wrench
- 17 mm wrench
- 9/16" socket

Sealants Required:

- Copper spray
- Pipe Sealant
- Red Loctite

Parts Required:

- Case with Rear Alternator attached
- Oil Cover Plate and hardware
- Starter
- Ring Gear
- Lower Starter bracket and hardware
- Oil Cooler block off and hardware



Installing Oil Cover Plate

Spray copper spray onto both sides of the oil cover gasket. Once it is tacky, place onto the case and bolt the cover plate into position. Torque the bolts to 150 " lbs or 13 foot lbs. Spray copper spray onto the block off plate gasket and bolt the block off into place with same torque. (Figure 1, Figure 2)



Fig 1. Oil Cover in Place

Install the ring gear and loosely snug up the six bolts. Install the starter and check for fit. Check the clearance on the ring gear to bendix gear on the starter. Have at least a 1/8" space. Adjustments can be made by placing a washer under the top starter bolt. The top of the gear should be in line with the "flat" spot on the starter nose. (Figure 3) Tighten the main starter bolt with it in this position. If you are installing a new starter kit the Lower Bracket may need to be drilled and fitted to hold the starter in place. Remove the ring gear and bolt the Starter and lower bracket into position using Loctite on the bolts/nuts. (Figure 4) Reattach the Ring gear using red Loctite on the bolts and torquing to 30 'lbs.



Fig. 2 – Block Off Plate Installed



Fig. 3 – Ring gear to Bendix clearance



Fig. 4 – Lower Bracket bolted in place.



Fig. 5 – Starter and Ring Gear Finally Bolted

Be sure to rotate the crankshaft and check for clearance and interference. Pulses felt during the rotation that is caused by the magnets in the alternator. Onto the next step!

Piston/Cylinder and Rod Assembly

Piston and Connecting Rod

Tools Required:

- Wrist pin tool
- Propane torch or equivalent
- Vise

Sealants:

- Oil

Parts Required:

- Rebuilt or new Connecting rods (6)
- Set of New Forged Pistons (6)



Fig 1 – Tools and Parts

Inspect condition and quality of parts (Fig 1)

Clamp the #1 Connecting rod in the vise with the numbers “up”. Use wooden blocks or aluminum angles in the vise to protect the connecting rod. (Fig 2) If the connecting rod nuts are tightened, loosen them at this time. Remove the wrist pin from the piston, lubricate it lightly with oil and reinsert it to check for freedom of

movement in the piston. Slide the wrist pin partially out of the piston allowing room for the rod. Insure the orientation at which the piston will be installed onto the connecting rod. Practice installing the pin properly while the rod is cool because once you heat it up and install it you have one chance to get it right without having to use a press.

The piston has an arrow marking on the top which should always point to the propeller or flange end on the engine. In the case above with rod #1 the arrow will point to the right. On rod #2 it will point to the left, and so on. Using the torch slowly heat up the small end of the rod until it starts to turn a light brownish color. (Fig 3) Quickly insert the piston (in correct orientation) and slide the wrist pin it until it hits the guide. Hold this position for a few seconds as the rod cools down and locks the wrist pin in place. (Fig 4) Check for freedom of movement of the piston. The wrist pin should be centered on the rod. If the pin locks in off center then a press may be needed to move the pin. Be very careful using a press to not damage the piston.

Remove the Piston/Rod from the vise once cool and proceed to the next set. Do not slap the rod against the piston skirt at any time. Always check the arrow direction on the pistons that they correspond correctly to the numbered rod and installation.



Fig. 2 – Rod Clamped into vise



Fig. 3 – Heating up Rod small end (brownish color)

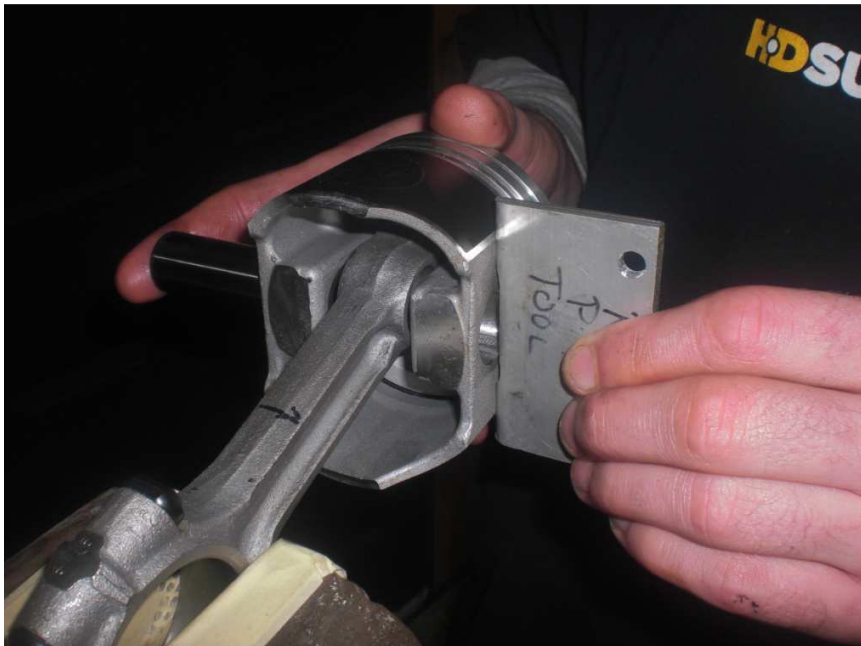


Fig. 4 – Inserting Rod pin using tool – quickly and smoothly

Piston Ring and Cylinder Assembly

Tools Required:

- Piston ring installation tool
- Dead blow hammer
- Cylinder/piston assembly tool
- Piston Ring Compressor

Sealants:

- Oil (in container)

Parts Required:

- Piston/connecting rod assembly (6)
- Piston Ring set (Hastings Chrome)
- Rebuilt cylinders or new (6)



Inspect the condition and quality of all the parts for this step. Be sure that the cylinders are matching the bore of the pistons and rings. Look at the hone work inside the cylinders for a consistent 45 degree crosshatch. The cylinder should be cleaned and painted on the fins. The rods should be balanced, stock forged stroker rods with ARP bolts or new forged rods (available through Azalea Aviation).

Using the instructions provided in the package of rings, install the rings onto the piston. Begin with the oil control ring, then the center ring and finally the top ring. (Fig 1) Use caution during this installation as to not break a ring or scratch the piston. The rings should rotate freely in the piston. Ring Gaps should be positioned at thirds around the piston. (Fig 2) Place the piston in a container with oil so as to soak the piston, ring and wrist pin in oil. Remove the piston and drain excess oil. Lubricate a cylinder lightly on the inside walls with oil. Place the cylinder into position on the assembly tool. (Fig 3) The tool is marked as to direction of piston installation. Place the piston assembly from the top, resting the rod on the wooden block, and align the piston so the arrow points in the correct direction for to appropriate numbered cylinder. (toward the prop flange) Place the ring compressor over the piston and tighten. (Fig 4) Remove the wooden block from under the rod. With a firm tap drive the piston into the cylinder. Make sure the piston moves in the cylinder without excessive binding which could be caused by a broken or damaged ring. Remove the cylinder/piston assembly from the assembly tool and proceed to the next cylinder and piston. (Fig 5)



Fig. 1 – Rings ready for Installation



Fig. 2 – Rings installed



Fig. 3 – Cylinder in alignment Fixture - (make your own or call Azalea Aviation for rental/plans to build)



Fig. 4 - Install piston in correct orientation and compress rings



Fig. 5 – Remove the wooden block and firmly tap the piston into cylinder



Finished and ready for next step!

Piston/Cylinder Final Assembly – 100HP

Tools Required:

- Torque Wrench
- 3/8" 12 point socket
- Wrench for turning crankshaft

Sealants:

- Copper spray
- Oil
- ARP grease

Parts Required:

- Case assembly
- Piston/Cylinder assemblies (6)
- Connecting rod bearing kit
- Cylinder base gaskets (6)
- Cylinder baffles and clips



Inspect condition and quality of parts (Fig 1)

Before installing any parts it is a good idea to write the cylinder number on the top edge of the case to ease installation and other assembly work. (Fig 2) The cylinders are numbered odd on one side, even on the other, numbers 5 and 6 toward the prop flange. Start with cylinder number 1 at the rear (nearest the distributor) and work forward. One method is to install the pistons and cylinder on one side and then use a head to hold the cylinders in position while installing the opposite side.

Begin by applying an even coat of oil to all rod journals on the crankshaft. Spray an even coat of copper spray on both sides of the copper base gasket and install onto the cylinder. (Fig 3) Remove the rod cap from cylinder #1 and install the rod bearing shells onto the cap and rod. Apply an even coat of oil on the bearings. (Fig 4)

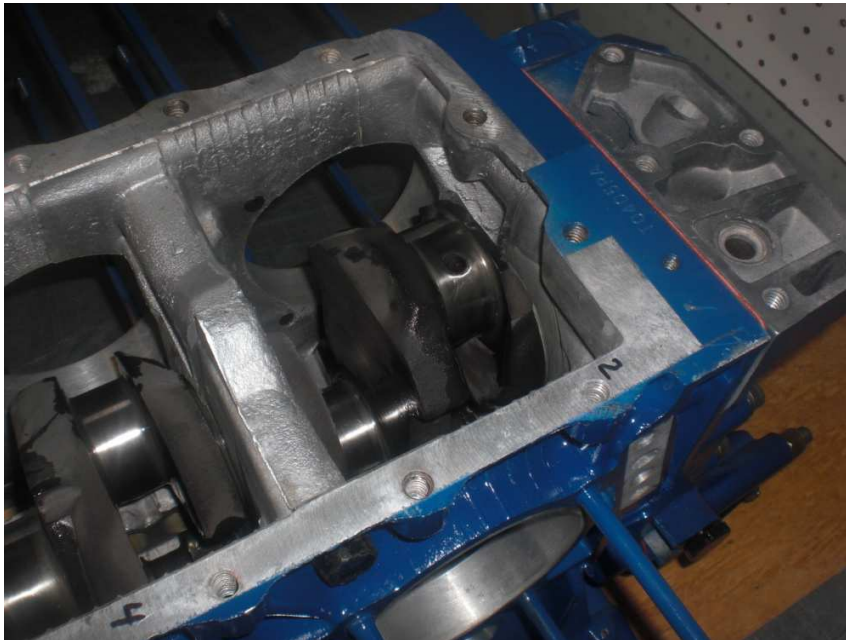


Fig 2. – Number the cylinder locations for ease



Fig 3. - Install rod bearing shell and copper base gasket on cylinder



Fig 4. – Oiling bearing shell

Install the #1 Piston/ Cylinder assembly into the case. The numbers on the connecting rod will be up and the arrow on the piston will point forward. A ¾”socket and breaker bar can be used to turn the crankshaft until the #1 rod journal is away from the hole. Insert the cylinder and rod assembly into the case hole and using the breaker bar rotate the crankshaft back until the journal is flush into the rod bearing. (Fig 5) Take care to not let the rod bolts scratch the crankshaft journal. Insert the rod cap into position on the rod and lightly tap into place. Place a dab of ARP grease onto the threads of the rod and install the ARP nuts. Tighten the nuts a little at a time until the cap is even and snugged up against the rod. Use the torque wrench and tighten the rod nuts in two stages up to 28 ‘lbs. (Fig 6)

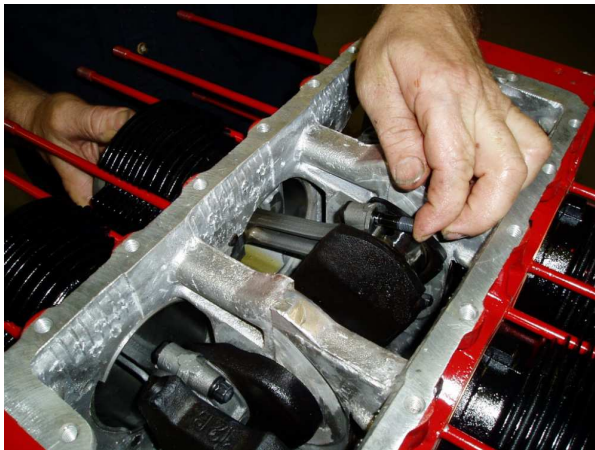


Fig. 5 – Installing a Piston/Cyl/Rod assembly in a 100 HP engine

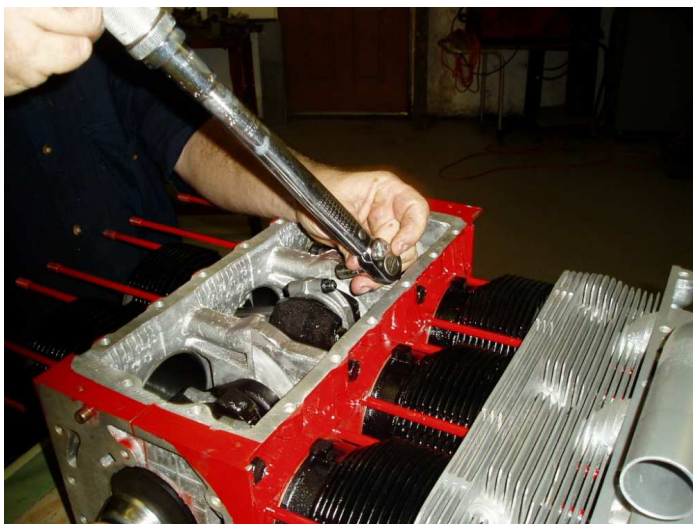


Fig. 6 – Cap in place and ready to torque

Rotate the crankshaft to check for binding and proceed to the next cylinder assembly. Hold the cylinder so it won't slide out of the case bore. (Fig 7) Once three on one side are installed into the case snap the cylinder baffle into position. Insure that the clips are well secured around the studs. (Fig 8) Use a cylinder head to hold the cylinders in position temporarily while the other side is assembled. (Fig 6) Once all the cylinders are in position and held securely (loosely install other head) rotate the engine over a couple times to check for binding. (Fig 9)

Clean up the table and prepare for the next step!



Fig.7 – Cylinders 1,3,5 installed



Fig. 8 – Installation of Baffle and clips (Notice the 3/4” assembly board under the case to provide clearance for the camshaft gear)



Fig. 9 - Installing head loosely to check for smooth rotation of parts. (note: no IFB in this installation picture)

ROD, PISTON AND CYLINDER ASSEMBLY - 120 HP

Rod Installation:

The connecting rods on the 120 are of a different design. (Fig 1) They are new forged rods and due to the close clearances are installed into the case through the cylinder openings and torque before installing piston/cylinder units. (Fig 2)



Fig 1.

Use the same procedures concerning checking bearing sizes and lubrication when installing as in the 100 HP section.



Fig 2.

Installation of Pistons and Cylinders:

Install the rings onto the pistons as per included directions. Mark each piston to be sure the offset is properly positioned when assembling into the cylinders. Wet the inside of the cylinder with a light coating of oil and gently install the pistons into the cylinders from the bottom. Use a blunt screwdriver or wooden stick (like tongue depressor) to push the rings into the grooves while installing. Push the cylinder into the piston up to the wrist pin opening. Because these are free floating wrist pins, the snap ring will have to be installed on one side of the piston before installing onto the rods. Spray the copper base gaskets with a light coating of sealant and install onto the cylinders. Position the cylinder and piston assembly onto the rod and slide the lubricated wrist pin into position until it bottoms against the snap ring. Install the other snap ring to lock the wrist pin in place. Push the cylinder into the case. Once you have three cylinders installed on one side, install the baffle and loosely install a head to hold into position.



Cylinder Head Installation

Tools Required:

9/16", 13/16" socket
Torque wrench

Sealants Required:

Lithium Grease
Antiseize
Oil
Cam grease

Parts Required:

Rebuilt cylinder heads
New Head gaskets (as required for proper compression ratio)
Pushrod tubes (12)
New Pushrod tube seals (24)
New Lifter Assemblies (12)
Rocker base plates (6)
Rocker Shaft bolts (12)
New Rocker shaft seals (12)
New Head nuts (12)
New Head washers (12)

Inspect all your parts for condition, fit, and wear. Have a clean work station and tools before proceeding.

This chapter assumes that the heads have been prepared for installation beforehand. Proper valve work, cc'ing of the combustion chamber, selection of appropriate head and base gaskets should be done with thought and care. More information is available through Azalea Aviation and internet sources concerning these procedures.



Apply cam grease to the cam “flat” surface of the lifters. (Fig 2) Oil the surface of lifters and inside of the lifter bores. You can put oil on your index finger and wipe the inside of the lifter bores. Slide the lifters into lifter bores and seat against the camshaft. (Fig 3) (do not “prime” the lifter) The lifters are inserted with the “flat” against the camshaft. Apply lithium grease to the pushrod tube sealing surface of the lifter bores. Apply antiseize to the threads of the cylinder head studs. (Fig 4)



Fig. 2 – Cam lube on lifters – ready to oil



Fig. 3 – Lifters oiled and installed into bores

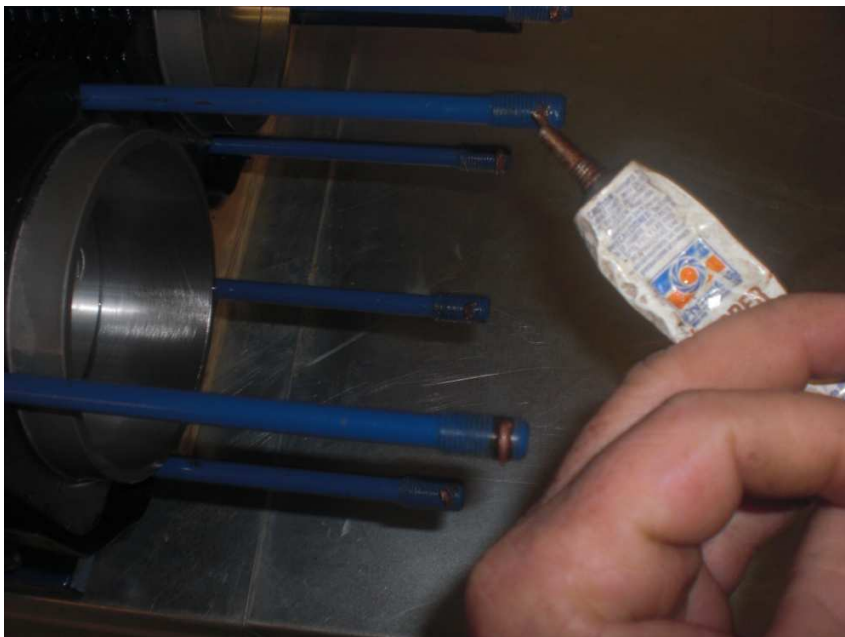


Fig. 4 – Apply anti-seize to head stud threads

Insure that the gasket surfaces of the heads and cylinders are clean. Insert the copper head gaskets into the cylinder bores (Fig 5) and gently slide the head over the studs and seat against the cylinders. Install the upper cylinder nuts and washer finger tight. (Fig 5)



Fig. 5 – Cylinder Head with gaskets installed

Apply lithium grease to the pushrod tube bores on the head. Prepare the rocker shaft plates by applying anti-seize to the bottom side of the nut where it touches the plate. Apply lithium grease to the o-rings and slide them onto the bolts. (Fig 6) The “U” on the plates should face outward.



Fig. 6 – Rocker shaft installed on plate with o-ring

Apply lithium grease to the o-ring grooves on the pushrod and onto on the surfaces of the bores where the tubes are inserted. Insert the tube into the hole on the head , and then install the other o-ring. (Fig 7) Insert the tube into the lifter bore. Use the 9/16” socket to push the pushrod tube into position. (Fig 8)



Fig. 7 – Installing pushrod tube



Fig. 8 – Pushing pushrods into position

With the tubes in place screw the rocker plate/bolt assemblies into place. Tighten them finger tight. Double check all work before proceeding to torquing the head. Use the 9/16" and 13/16" sockets to snug up the head. Once finished, turn the crankshaft over a couple times to insure smooth rotation and no binding. If binding is encountered remove the head and check for obstruction. Use the torque sequence and pattern to bring the head up to final torque. (Fig 9) Use the torque wrench in a steady and smooth motion. Once it "clicks", hold that position for a few seconds to let the stud and nut settle.

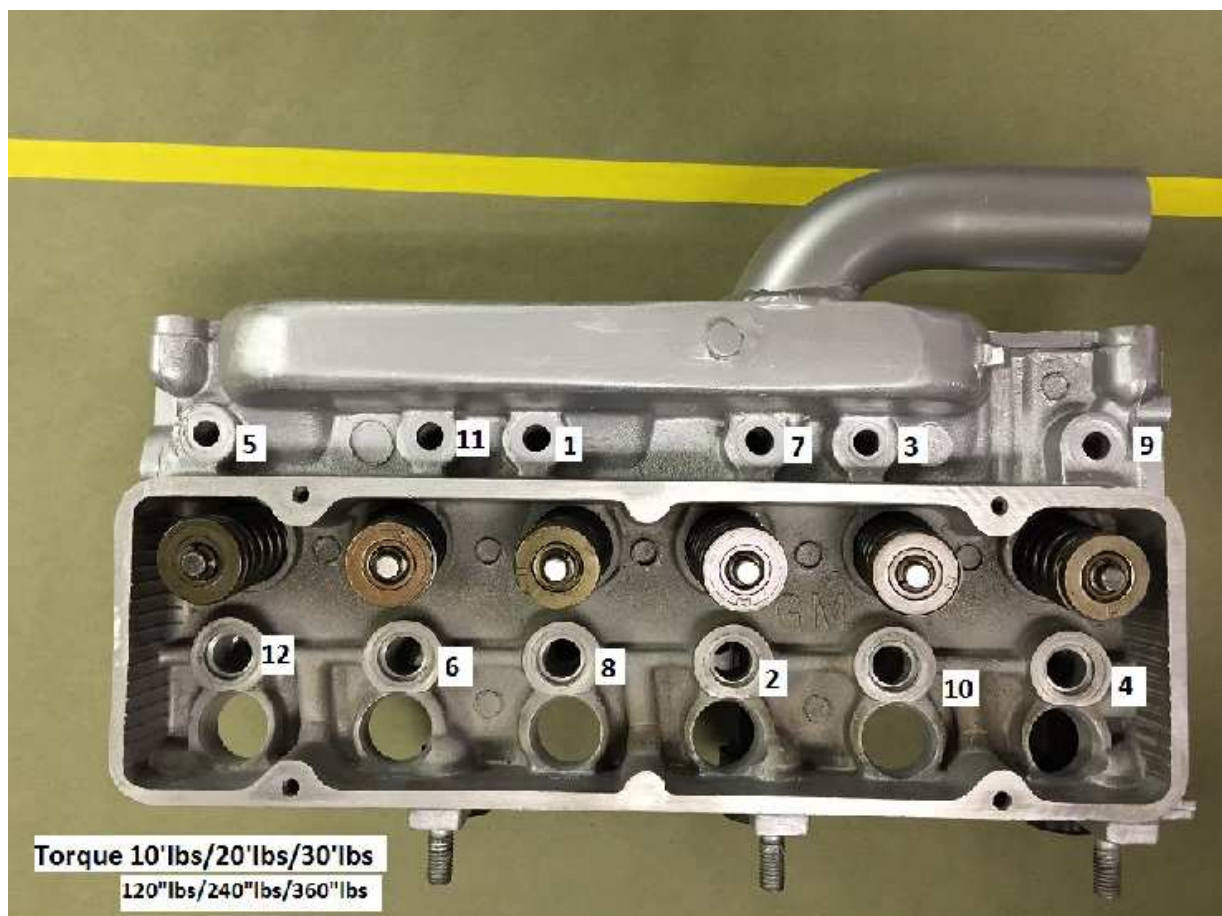
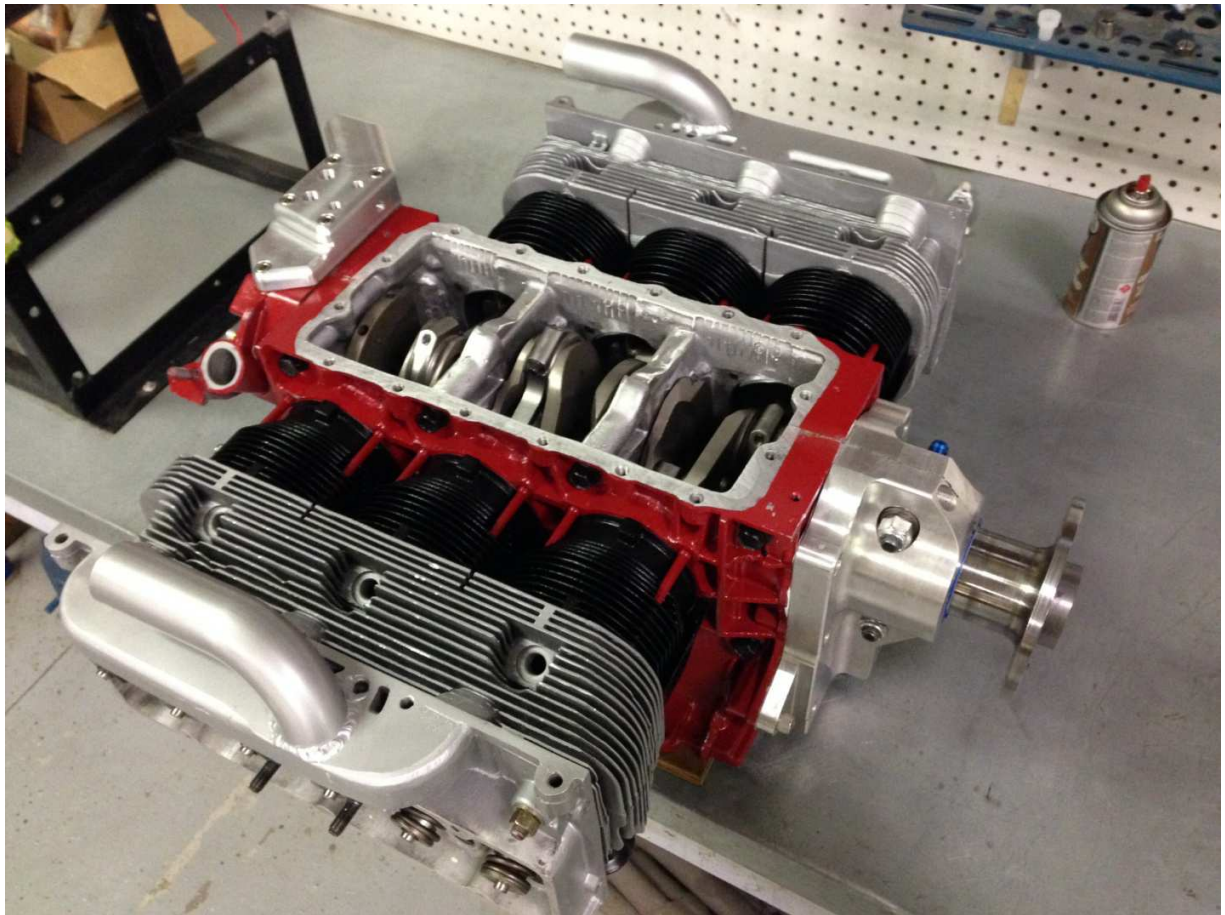


Fig 9. Head Torque Sequence

Once both head have been torque to the proper amount and in the correct sequence, use a clean cloth or paper towel and clean any excess grease or oil off of the pushrod tubes/case/head area. This will reduce the amount of "smoking" the engine will do at startup. Also, a clean engine is a "goodly" engine.



Heads are installed and torqued – On to the valve train....

Valve Train Installation and Adjustment

Tools required:

- 5/8" Deep Socket and ratchet
- 3/16" Allen wrench
- 3/4" Socket and handle

Sealants:

- Oil
- Grey RTV
- Loctite

Parts Required:

- Pushrods (12)
- Rockers (12)
- Grooved balls (12)
- Rocker shaft nuts (12)
- Valve covers (2)
- Valve cover gaskets (2)
- Valve cover clips (8)
- Valve cover bolts (8)



Pushrods and rockers



Valve cover set

Inspect all parts for condition and quality.

Apply oil to the ends and sides of the pushrods and install into the guide plates until seated fully into the lifters. Apply oil to the guide plate where the pushrod makes contact. Make sure the end of the pushrod with the small hole on the side is toward the heads and away from the lifter. This hole squirts oil onto the rocker assembly. (Fig 1)

Apply oil to the grooved ball and to the rocker. Assemble the rocker, grooved ball and nut as shown and install. (Fig 2) Tighten only until the end of the nut is even with the rocker shaft. Proceed with all twelve assemblies.

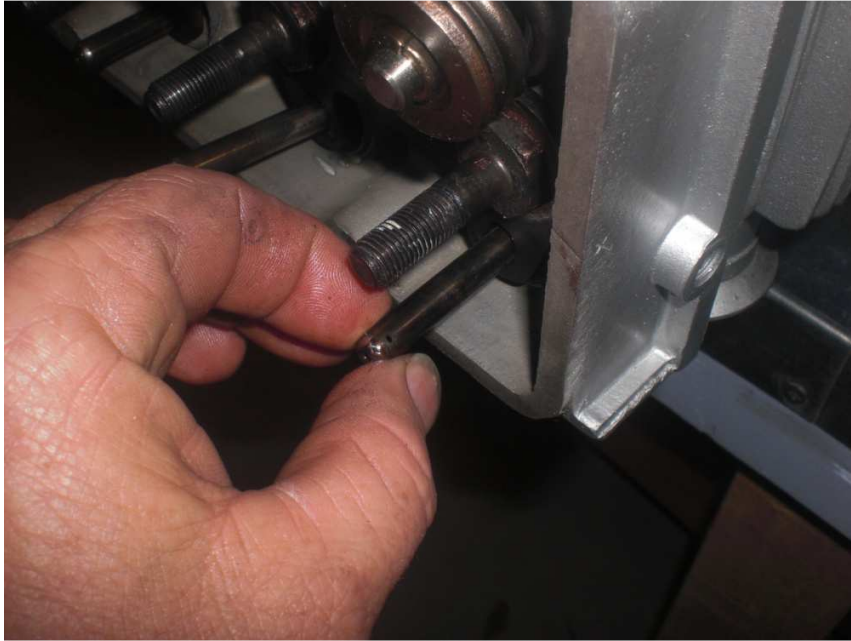


Fig. 1 – Inserting pushrod into guide plate



Fig. 2 – Rocker assembly



Fig. 3 – Rockers installed and ready for adjustment

Valve Adjustment:

Some consider this to be the most complicated part of the valve train installation.

Take time to read and understand the procedure before performing the tasks. It is actually quite simple, just don't forget any of the steps. Here we go...

#1. Find TDC (Top Dead Center) on cylinder # 1. Write the cylinder numbers on the case edge to assure proper adjustment. Using your $\frac{3}{4}$ " socket and wrench on the starter end, or prop hub tool and turn the engine (direction of prop rotation - clockwise) until # 1 piston is all the way up in the cylinder. Use a flashlight look at the cam lobes for cylinder #1. They should be pointing away from Cylinder 1. They will appear to be at an angle - this is normal. If they are pointing toward the cylinder rotate the crankshaft one full turn (360 degrees) and check again. This should be TDC Compression stroke. The flat of the crankshaft will be horizontal and connecting rod fully extended into the cylinder. (Fig 4) The timing mark on the alternator drum should be pointing to the "0" mark on the rear housing.



Fig.4 – Finding TDC #1

#2. Using your fingers, rotate one of the pushrods for cylinder #1 while slowly tightening the nut on the rocker with a 5/8" deep socket. The pushrod should rotate freely until the rocker bottoms against the valve. The pushrod will suddenly be harder to rotate. At this point **TIGHTEN** the nut $\frac{3}{4}$ of turn. Now repeat this step for the other rocker for cylinder #1. (Fig 5)



#3. Push against the rocker at the pushrod end with your finger. It should move in and out with some tension. This is the lifter spring causing the give. I usually tap this area of the rocker lightly with a rubber mallet to insure the pushrod is properly seated. If the rocker suddenly loosens up it is because the pushrod was not fully seated. If this occurs repeat step 2.

#4. Now that Cylinder #1 is completed Rotate the crankshaft 180 degrees (prop rotation) until the next cylinder is in TDC position. The firing order is 1-4-5-2-3-6. Once Cylinder #4 is at TDC perform step # 2 and 3. Continue this procedure through the firing sequence. Do Not forget to rotate the crankshaft in direction of rotation between adjustment of each cylinder.

Check to see that all the rocker shafts bolts show about the same number of threads past the nuts. If one is obviously different check for misalignment of the pushrod or a rocker ball installed up-side down. As a final check rotate the crankshaft through several revolutions and see that the valve train is operating smoothly and there is no binding. Apply little bit of oil to the valve stems and rocker assemblies to aid in the break-in procedure.

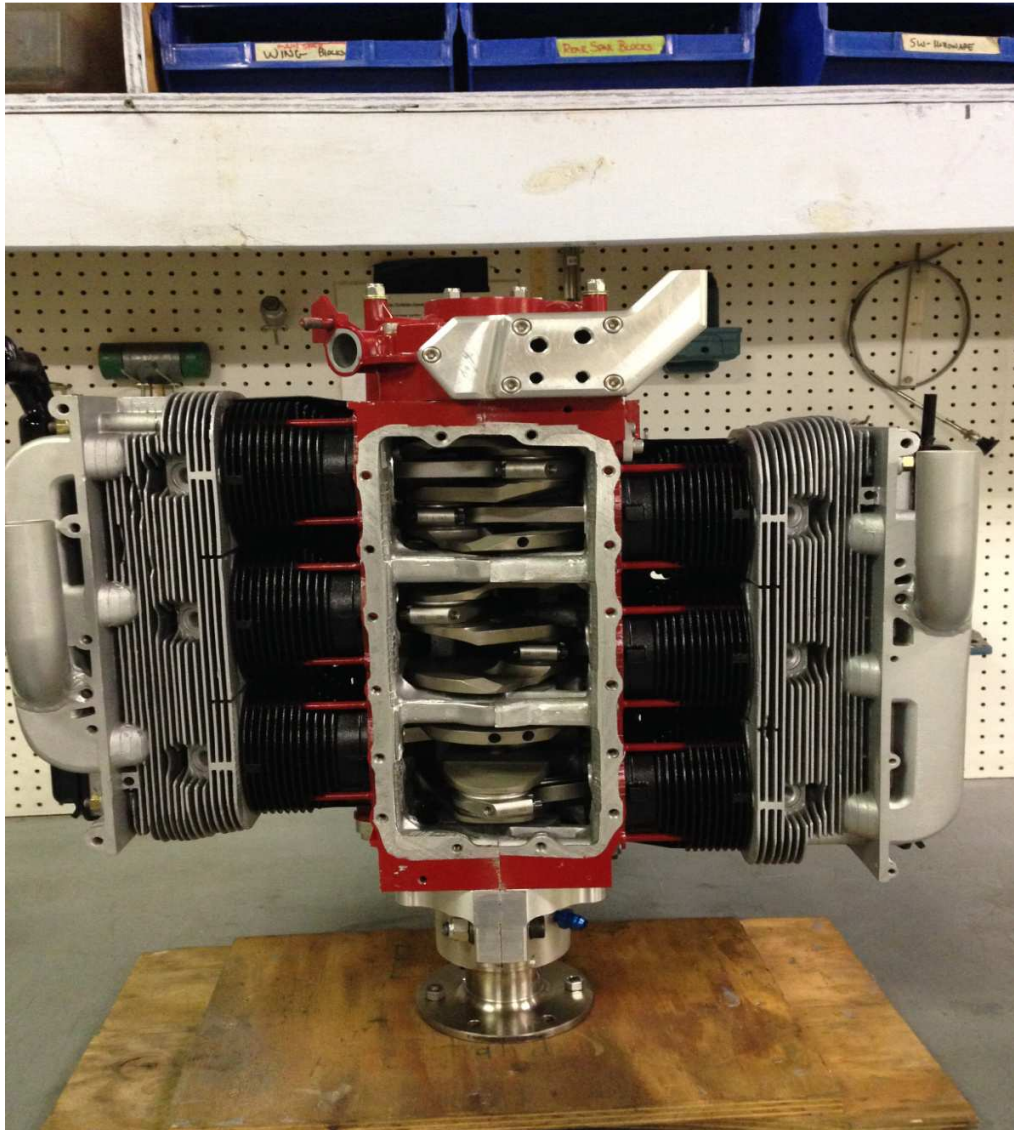
Valve Cover Installation:

The left and right valve covers are different. The oil filler is typically on the rear end of the right valve cover.

Apply Grey RTV sealant to the gasket sides of the cylinder head, valve cover, and both sides of the gasket. (Fig 6) Insert the gasket into the valve cover and place on the cylinder head. Apply Loctite to the threads of the valve cover bolts and install with the valve cover clip. Tighten to 10 “ lbs. (that’s inch pounds!)...Once the sealant has begun to harden..a couple hours... torque the screws to 40 “ lbs.



Fig 6.



A 120 HP engine with valve train work finished and up on rotator stand....

Oil Pan and Dipstick Installation

Tools Required:

7/16", 1/2" Socket and Ratchet
Rubber mallet
Tubing cutter

Sealants:

Grey RTV
Aviation Permatex sealant
Loctite

Parts Required:

Oil Pan
Oil Pan Hardware
Oil Pan Gasket
Oil Pickup
5/16 bolt and lock washer for pickup
Dipstick and tube



Check all parts for condition and quality. There are a couple different oil pans on the market that are usable including a modified stock. We use a deep oil pan that adds a quart of oil. This pan necessitates a modified oil pickup.

For these procedures we place the engine upright on it's prop hub, bolted to a wooden fixture to stabilize it. There is a picture in Section 9 and at bottom of this section. This will allow for better access and installation.

Dipstick tube installation:

If you are using a stock dipstick tube be sure it is clean inside and out. If you are using a new tube, check the diameter of the tube where it enter the case to be sure it is the correct size. A small hole is drilled into the tube an inch or so from the sealing surface. (Fig 1) This hole is there to allow for accurate oil level checking and to be sure you don't blow oil out the dipstick.



Fig 1 – Stock and new dipsticks

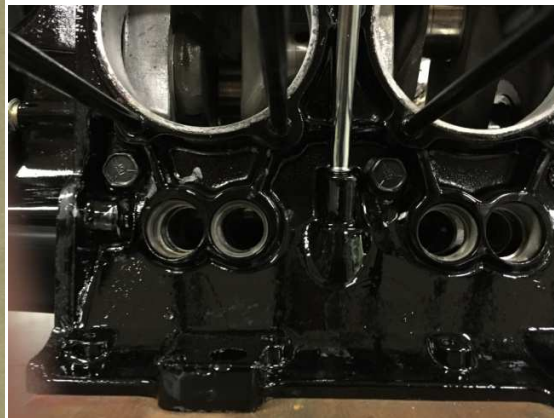


Fig 2 – Tube installed

Apply Aviation Permatex sealant to the lower end of the dipstick tube. Use the Rubber mallet and tap the tube into position in the case. (Fig2) Trim the length of the Tube if necessary for your installation. Trimming and marking the dipstick will be done later.

Oil Pickup Installation:

Apply Aviation Permatex sealant to the end of the oil pickup tube. Using the rubber mallet and screwdriver, tap the pickup tube into position until the flange is flush against the case. We use an adjustable wrench that is set to the width of the tube and placed against the rolled edge to drive the tube in flush with the case. Apply Loctite to the threads of the 5/16 bolt and install into the pickup clamp. Torque to 10 ft/lbs. (Fig 3) There are a couple different styles of pickup tubes that will match the oil pan. Installation is the same with all of them.



Fig. 3 – Typical oil pickup installation

Oil Pan Installation:

Clean the case flange area where the oil pan will seat. (Fig 4) If you keep the surfaces very clean and oil free when you apply the RTV you are very likely to have a well sealed oil pan. There are a couple different oil pans available for installation. Check that the holes on the pan line up with the holes on the case and adjust if necessary. Some hardware kits have studs and nuts. Insert the studs with Loctite before installing the pan. If the kit comes with bolts then apply Loctite to

the threads on final installation.



Fig 4 – cleaning surfaces

Apply Grey RTV along the entire flange area in an even coat. Apply a similar coat to the oil pan and both sides of the gasket. Insert the gasket and oil pan on the case and begin installing and tightening the bolts. Tighten the bolts around the oil pan slowly and evenly until 90 inch/lbs is met. Clean excess RTV from around the oil pan. You can also use a razor blade to clean excess gasket material away from the oil pan.

Make sure the oil drain plug has a hole drilled for safety wire purposes. Sometimes a tab needs to be installed under one of the oil pan bolts to provide a location for the safety wire to be secured. The oil drain plug typically comes with a copper washer as a gasket. Use torque chart for proper torque.



Final Pan Installation. This is showing our HD cast aluminum pan. It allows you to place the engine on the ground without fear of damaging the pan. Some pans are very lightweight and thin and will require that the engine be supported.

Top Cover Installation

Tools Required:

3/16" Allen Socket and Ratchet

Sealants:

Grey RTV

Pipe sealant

Parts Required:

Top Cover

Top Cover hardware

IFB Oil delivery tube and clamp

Loosely install the top cover onto the engine in its correct orientation to protect the inside of the case. If it will be some time before pre-oiling and test running, secure a couple of the allen screws.

Install the AN-8 pipe fitting onto the front of the Starter bracket. Use some pipe sealant on the threads. Also install the similar fitting onto the IFB housing if not already installed. (Fig1)

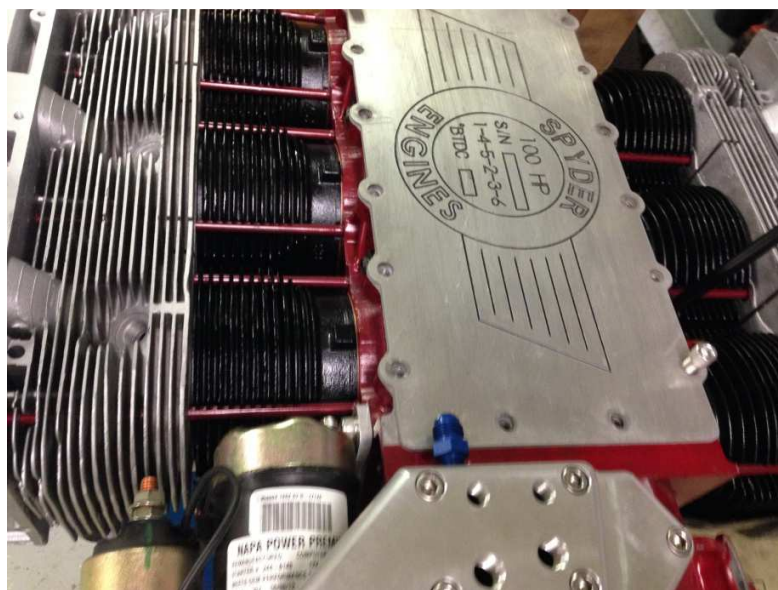


Fig 1 – Top cover and fitting

Connect the aluminum tube from the IFB housing to the Starter bracket fitting and tighten. Removal of the top cover should still be possible. Once pre-oiling is accomplished and everything looks good, proceed to final installation.

Final Top Cover Installation:

Our top covers come engraved and have a location for a serial number stamp. In the case of our production engines we stamp those in-house. If you are building your own you may stamp any ID you wish to keep track of the engine. We suggest that you match it to the case number (located by the starter bracket). Our production numbers are different. You may also wish to paint or decorate/polish the cover.

Once pre-oiling is done, clean the surface of the case and the top cover. Apply a light coating of Grey RTV to each surface. Apply a light coating to one side of the gasket and lay it onto the case – RTV side down. Apply another light coat to the upper side of the gasket. Place the top cover into position and install the screws around the perimeter. Lightly tighten them until the RTV just starts to ooze out. Wait an hour before final torque.

The IFB oil line will have a clamp that secures it to the top cover near the front. This screw will typically be longer for that reason, as well as any that are used for Plenum installation.



John finalizing his installation – a good view of the oil line and top cover.

Ignition Installation

Tools Required:

9/16" Wrench

Sealants:

Oil

Parts Required:

Distributor (aviation ready)

Distributor gasket

Distributor Hold Down Clamp

3/8-24 Self-locking nut

Check all parts for condition and quality.



Distributor Installation:

Set Piston #1 at TDC of the compression stroke. The timing marks on the Alternator Drum will line up with the "0" mark on the Accessory Housing. (Fig 1) Slide the gasket over the distributor shaft. Apply oil to the distributor shaft and gear. Insert the distributor into the housing with the Rotor button pointing in the 9 o'clock position. As the gears mesh the rotor will turn slightly to the 10 o'clock position. If the distributor does not seat all the way rotate the crankshaft slowly until the distributor shaft drops into the oil pump coupling. The distributor should be fully seated with the rotor at 10 o'clock - Pointing at the upper left screw - and timing at "0" TDC #1 Cylinder. (Fig 3) The slot on the distributor plate will be at the 3 o'clock position. Install the hold down clamp and nut. Final timing adjustments will be completed at a later time on the test stand or engine.

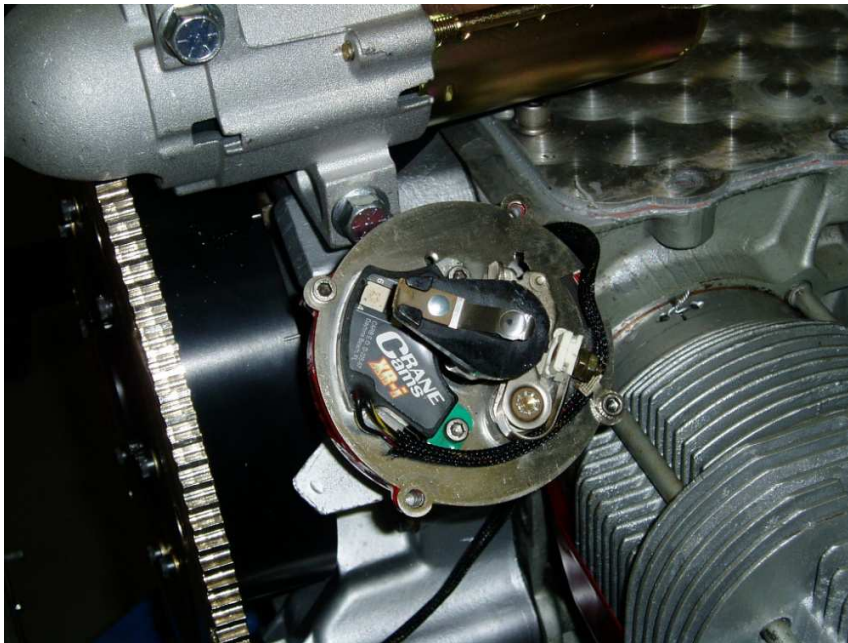
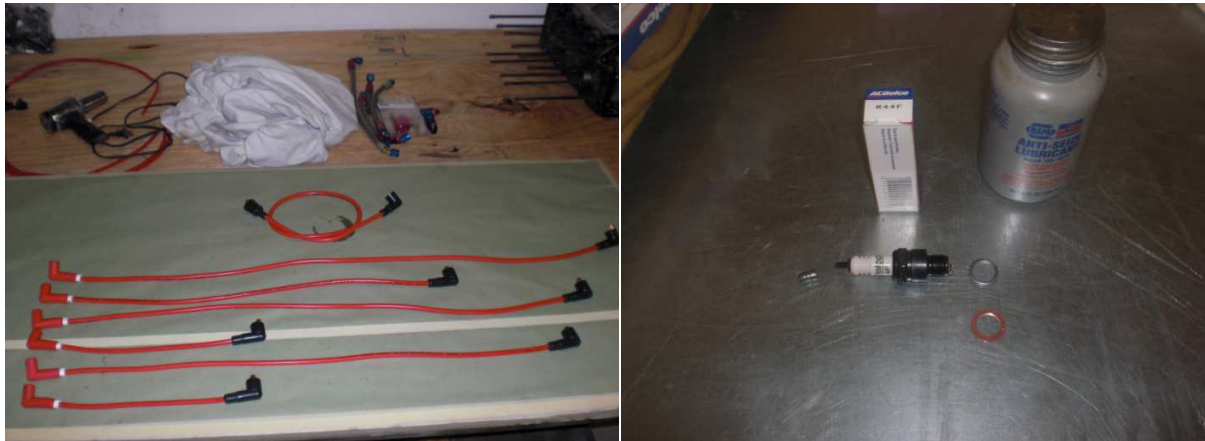


Fig. 1 – Distributor installed – TDC and rotor at 10 o'clock

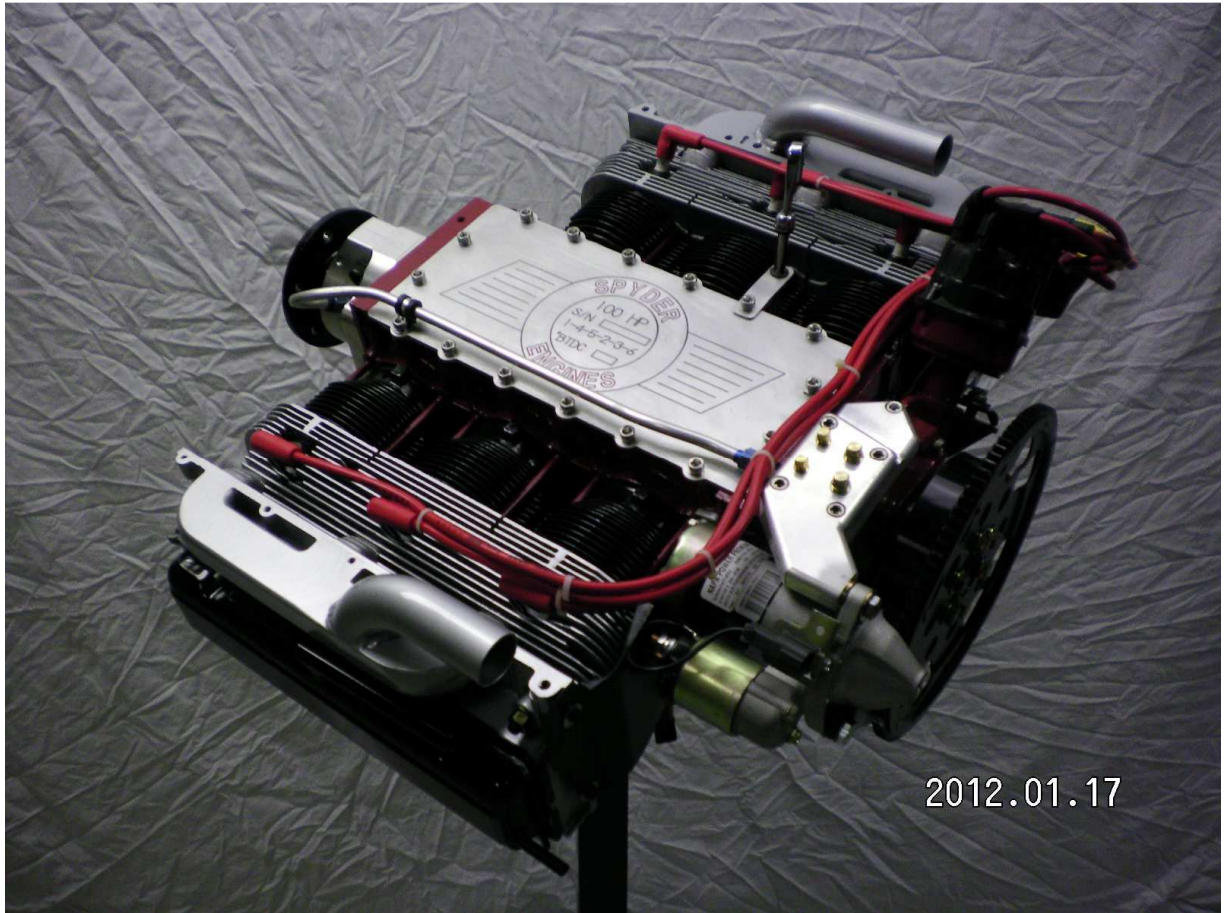
Spark plugs and Wires:



Check the condition of the spark plugs and wires that you are installing. We recommend that you start with a new set of AC Delco 44F series spark plugs. In all our engines we remove the silver gasket ring and use a machine copper gasket under the spark plug. Check the spark plug gap on each. The threads of the heads should be clean prior to installation and small amount of anti-seize put on the plug threads. The spark plugs should screw into the heads most of the way by hand. Never use a wrench to start spark plugs as the danger of cross-threading is real high. Torque the plugs to the rated torque.

The firing order of the Engine is marked on our top covers. It is 1-4-5-2-3-6. The rotor turns clockwise and the Number 1 plug wire should go to the 10 o'clock position on the cap. It is a good idea to write the firing order on the cap plug towers to avoid confusion.

Our Spark plug wires are cut to length and labeled to allow for ease of installation. It is best to route one head at a time and use tie wraps to secure them. Take your time to insure proper routing around your cooling and other wires. A little bit of dielectric grease on the plugs aids in protecting the wires from moisture and corrosion.



A finish up engine on display – wires are cleanly routed and tied

Final Details

There are a couple final details to be dealt with that will help finalize the engine assembly prior to test running.

Cooling Tins:

The rear of the engine will require cooling baffles that will tie into either the plenums or standard baffle kit. These are available through Azalea Aviation or could be fabricated by the engine owner. Our production engine come with them installed. The original Corvair rear tins can be used with slight modification. The one next to the distributor can be used as is while the one on the left side will need to be trimmed to go around the starter. A couple pictures below will show you our installation.



Tin (black) between starter and head/cylinder #2



Tin (Black) Between the distributor and head/cylinder #1

Pre-Oiling and Test Running:

Now that you have completed assembling the engine it will be ready to mount on the airframe or test stand and run. We have many of the details concerning those steps in our **“Service and Operations Manual”**. A used distributor (minus gear) can be used as a pre-oiling device. You can also contact us for a loaner unit. The success of your build and the longevity of the engine are dependent on how well you pay attention to the small details concerning this next stage.

Storage:

If you are not planning to run the engine for some time we recommend that you prepare the engine for storage. It is best to leave the plugs loose, spray a little bit of WD40 or equivalent into each cylinder and then install the plugs. Tape up all the exhaust and intake ports. Make sure the oil plugs are closed up. Cover the engine in a bag, or Saran Wrap it. Keep it in a dry and clean location if possible. Once every couple of months, remove the plugs, spray a bit of WD40 in each cylinder and turn the engine over a couple times. A bit of research on other ways to improve storage will help as well.

Conclusion

If you have made it to this page in your assembly, congratulations!

An engine assembly is a tedious and precise operation and you did it. As you proceed to the next phase remember to maintain that same sense of care you had during this time.

We here at Azalea Aviation are please with the Spyder Engine products that we are producing and hope we have lived up to your expectation. If there is any way that we can help you as a builder during the next phases please let us know. We are available via phone and email for any questions you may have. We also ask that if you have any input that would improve our build or this manual that you specify it in writing to us. We are also available for visits here at our shop on an appointment basis.

Again, we thank you for supporting us and using our products.

Bill Clapp

CEO Azalea Aviation LLC AzaleaAviation.com

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Email: mail@azaleaaviation.com

Phone: (229) 834-8996

Specification and Torque Charts

These are basic specifications that are used for Spyder engines .

Engine Model	100 IFB
Horsepower and Torque	100 HP @ 3200 RPM / 160 ft/lbs
Compression Ratio / PSI	9:1 / 120-145 psi
Ignition Timing	30 - 32 BTDC (Maximum Advance)
Valve adjustment	Hydraulic (¾ turn from Zero lash)
Maximum Oil Temp	260 F. (220 F normal)
Maximum Cylinder Head Temp	450 F. (265-320 cruise)
Oil Pressure Range	15 psi (min - idle) 45 psi (maximum)
Spark Plugs	AC 44F - copper gaskets
Spark Plug Gap	.035"
Points Gap	.019 (new) .016 (service)
Oil	Rotella T / Castrol 10W40 or equivalent (summer) 10W30 or equivalent (winter)
Oil Quantity	4 quarts min – 6.0 maximum (average)
Charging System	12 Volt / 32 amp Internally regulated
Fuel	Aviation 100LL or 93Non-alcohol mix
Weight	215 lbs - 225 lbs (average)

Bore and Stroke	3-7/16" + .040 oversize / 2-15/16"
Pistons	Forged Std + .040 Oversize
Rings	Hastings Chrome rings +.040
Bearings	Clevite
Camshaft	LS1 / OT10
Lifters	Hydraulic Sealed Power
Valves and grind	Stainless and three angle grind
Springs	New Stock

Engine Hardware Torques

Case Main Bolts / IFB bolts	55 ft. lbs. (in stages) 10/20/40/55
Rod Nuts	28 ft. lbs.
Head Nuts	30 ft lbs. (in stages) 10/20/30
Front Cover Bolts	20 ft lbs.
Accessory Housing	13 ft lbs.
Oil Pickup Bolt	12 ft lbs.
Oil Pan bolts	100 inch lbs.
Rear Puck Alternator bolt	50 ft. lbs.
Top Cover Bolts	90 inch lbs.
Starter/Alt Brackets	12 ft lbs.
Valve Cover Bolts	60 inch lbs.
Ring Gear Adapter Bolts	20 ft. lbs.
Spark Plug	10 ft. lbs.
Oil Drain Plug	20 ft. lbs. (safety wire)
Exhaust Nuts	25 ft. lbs.

For all tolerances required for an engine rebuild please refer to our Engine Disassembly and Conversion Manual. Most pertinent data if needed is also available in a Corvair Chassis Shop Manual.

SPYDER ENGINE ASSEMBLY CHECKLIST SHEET

Date: _____

Customer: _____

S.N. _____ COLOR: _____ MODEL: _____

CHECK	DESCRIPTION	INSTALLED	NOTES
	SHORTBLOCK		
	IFB CASE - Cleaned and Prepped		SN _____
	IFB Crankshaft		Mains _____ Rods _____
	Camshaft		Model _____
	Main Bearings		Size and make _____
	Galley Plugs Installed		
	IFB Bearings		Size _____
	IFB Seal		
	Crankshaft and camshaft installed		
	Timing gear Alignment		
	Case Assembled and Torqued		
	Rear spacer/gear/slinger installed		
	IRA Clean and Prepared		
	Rear seal installed		
	Oil Pump and Valve Installed		
	IRA Installed and Torqued		
	Stator Installed		
	Starter Plate Installed and Torqued		
	Rear Puck Installed and Torqued		
	Oil cooler cover plate Installed		
	Carberator mount to bottom studs		
	Alternator Drum and Ring Gear		
	Starter Installed - check alignment		
	Final torque of ring gear		
	IFB oil lines and fittings		
	TOP END		
	Piston / Cyl Assemblies Prepped		Size _____
	Pis/Cyl Assy Installed		
	Baffles Installed		
	Lifters Installed		
	Head Assemblies Prepared		
	Head Gasket Installed		Thickness _____

	Heads Installed		
	Pushrod tubes Installed		
	Head Torqued		
	Valve Train Installed and Adjusted		
	Valve Covers Installed		
	Oil Pickup Installed and Bolt torqued		
	Oil Pan Installed and torqued		
	Dipstick Installed		
	FINAL		
	Oil Lines and filter Installed		
	Engine Pre-oiled		
	Top Cover Installed and Torqued		
	Distributor Installed and Adjusted		
	Exhaust		
	Intake		
	Propeller		
	Electrical		
	Test Run Info		