



Date: 5/30/13

Report Prepared for: Par Erixon  
Gothenburg, Sweden

Engine Information: R-1340-AN-1  
Engine Serial Number 13580  
Covington Work Order 11883  
Date of Disassembly 5/6/13

*Note: Par Erixon states that the engine was last flown in October 2010 by owner Niclas Amren of Stockholm. At that time the engine was reported to have 67 hours since major overhaul.*

Disassembly / Inspection Witness:  
Caleb Curry  
General Manager  
Radial Engines Inc.

Information Regarding this report:

Any reference to the engine IPC or Illustrated Parts manual is referring to Part Number 86013.  
Any reference to the engine manual or overhaul manual is referring to Part Number 123440.  
The American Bosch magneto also has Service & Parts manual. Any reference about American Bosch parts or instruction is taken from these manuals.



This report is in response to Par Erixon request after conferring with Covington Aircraft Engines since early 2011 with regards to concerns about the engines recent overhaul. Visible signs of corrosion, oil consumption, and leaks were areas of initial concern. The engine was shipped to Covington and disassembled in the presence of an external expert witness.

This report contains findings of that disassembly and inspection. The engine current status and our recommendations will also be stated in the report summary.



Incorrect Hardware (clamps) was used in all cylinder-to-cylinder drain lines. The clamps used appear to be general purpose hardware. The correct Part Number is 395296 as listed IPC Manual.



100% Incorrect cylinder base nuts were installed. The correct part number is 110514 as listed IPC Manual.

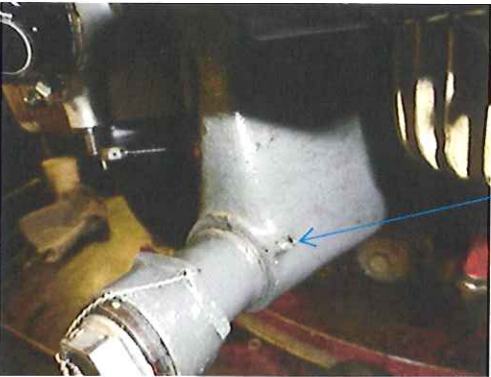


Incorrect hardware clamps used. The correct part number is 395297





Note : Incorrect engine hardware used. The clamp and drain nipple used are general hardware. The correct part number for drain nipple is P/N 14669 & the clamp part number is P/N 395296.

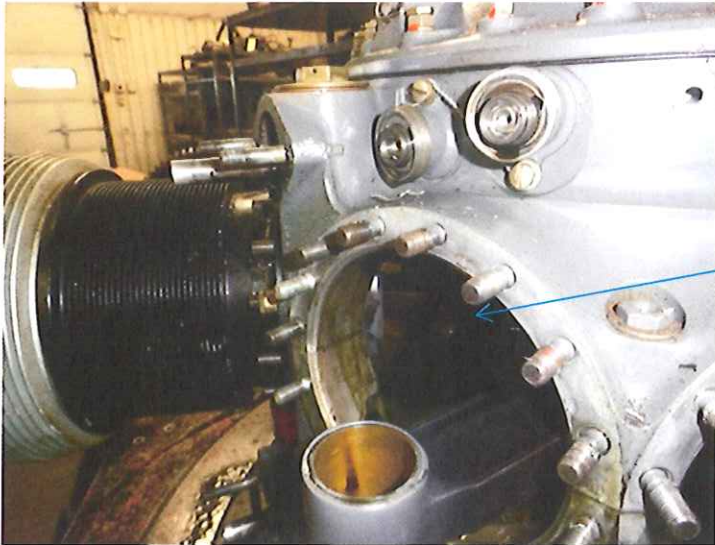


Note the oil sump "neck" is not safety wired & the safety wire lug is pulled through. No safety wire was evident at disassembly.



Note that the engine lifting eyes are located on the top of the case which is the configuration for helicopter installations. Fixed wing applications require the lifting eyes located behind the cylinders.

The master rod (P/N 39737) is located in the No. 1 cylinder location. This is direct contrast to the overhaul manual which states "Be certain that masterrod fits in the opening for the No. 5 cylinder"



As shown, Link Rod (P/N 3469) located in the No. 5 cylinder position.



Lockwire securing lock bars require no less than .051 per the overhaul manual. The lockwire used on this assembly is .041.

It is widely accepted to accomplish SB1546 which allows for the corners of the master rod bearing lip to be dressed. This aids in reducing crack causing stress points in the bearing. Covington Aircraft observes this S.B. And will not release a repair or overhaul that has not had this S.B. accomplished.



Corrosion found on the rod as pictured. It appears there were attempts to clean the corrosion, however by Covington tolerance & our understanding of the functionality of this part, this part is rejected and not repairable. See inspection letter attached.

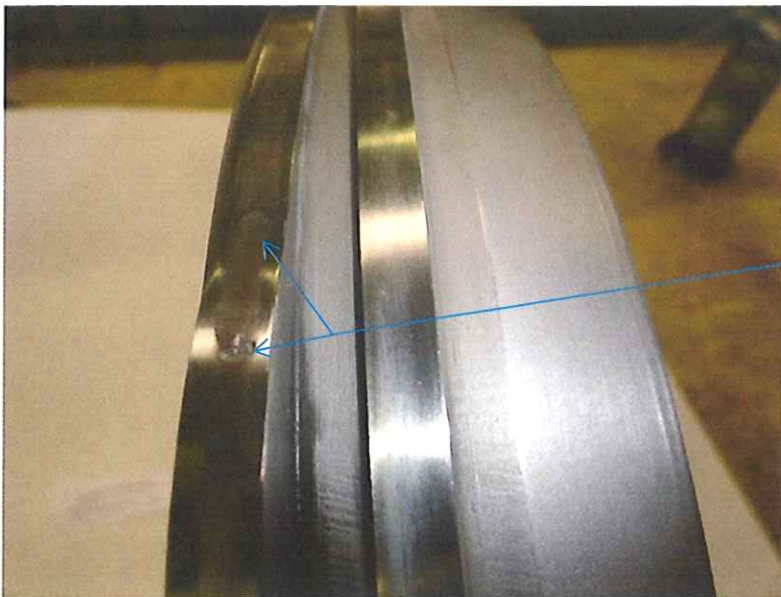


Engine Serial Number 13580

Disassembled 5/6/13



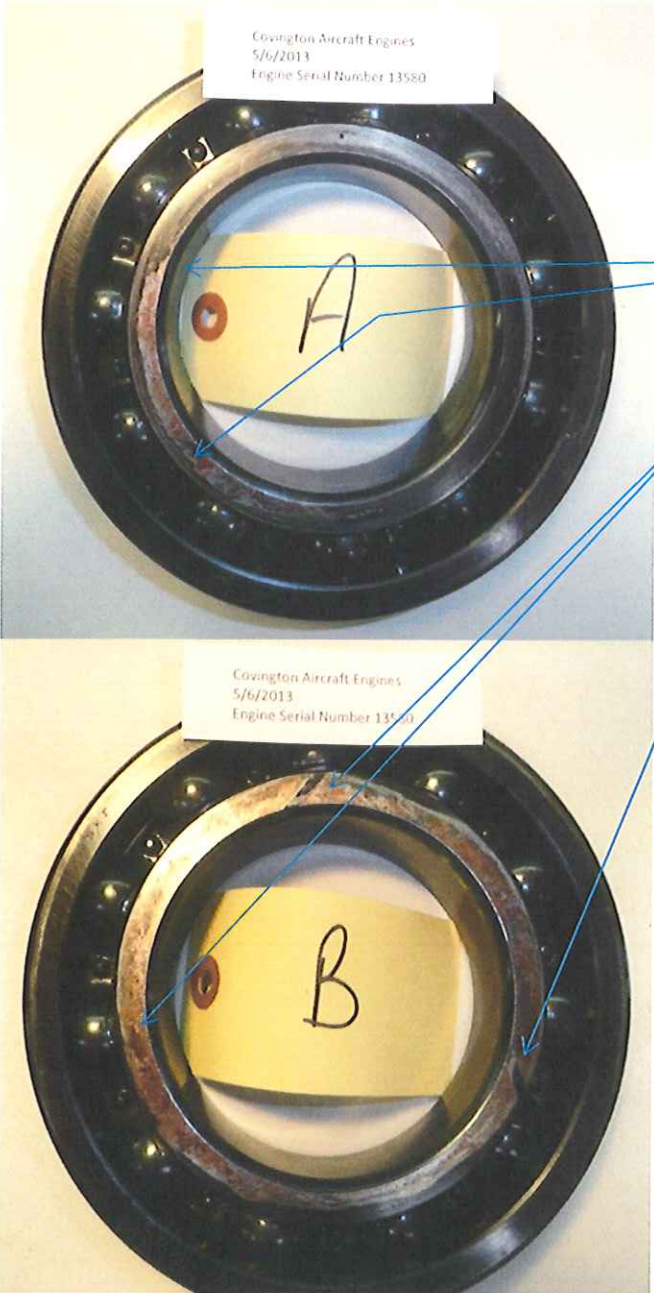
Closer view of the corrosion in question.



As shown deep pitting and tracking are evident on the Cam (Serial Number 118418). The cam is operationally failing and unable to be repaired and put back into service.



Starter Gear (P/N 3278) as removed. No rust or corrosion was present however deep surface pitting is present on the gears shaft.



Trust bearing (P/N 326197) show witness marks from the engines slinger ring (P/N 303732). This does not reject this bearing however it would appear that this bearing has been installed more than one time.



Front Main Bearing (P/N 288941) as removed. This bearing is in serviceable condition. Note the witness marks on the inner race of the bearing. This is caused by an access port on the crankshaft. There is only one port on the shaft that lines up with this bearing race. This bearing would appear to have been installed more than one time.



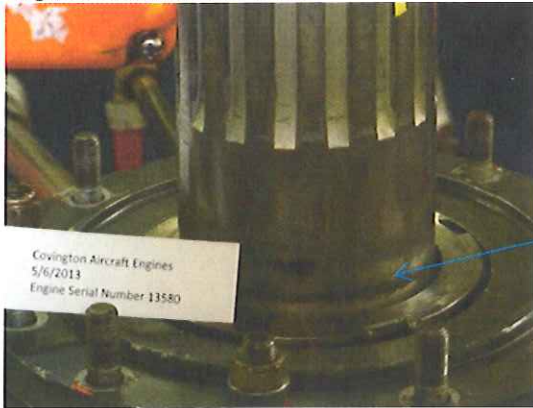


The rear main bearing as photographed (P/N288941) is in serviceable condition. Please note that the part numbers from the inner race does not match the part number of the outer race and retaining ring. Although this is acceptable, it would indicate that the bearing was not new when installed.



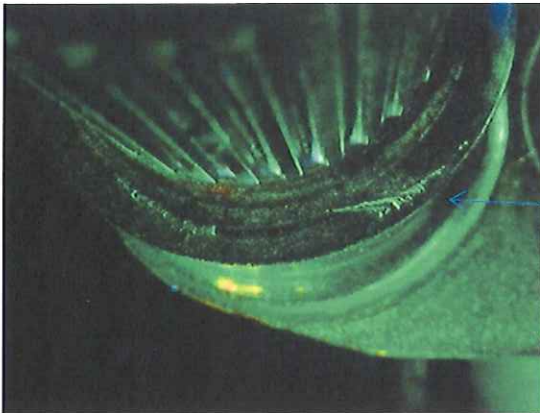
Engine Serial Number 13580

Disassembled 5/6/13



Corrosion and Pitting are evident on the crankshaft forward of the thrust nut (behind the propeller splines). The crankshaft is repairable by hard chroming this journal in accordance with Pratt & Whitney Plating Manual 238649.

Note: At 67 since major overhaul, it appears that no plating work was done to address the corrosion issues.



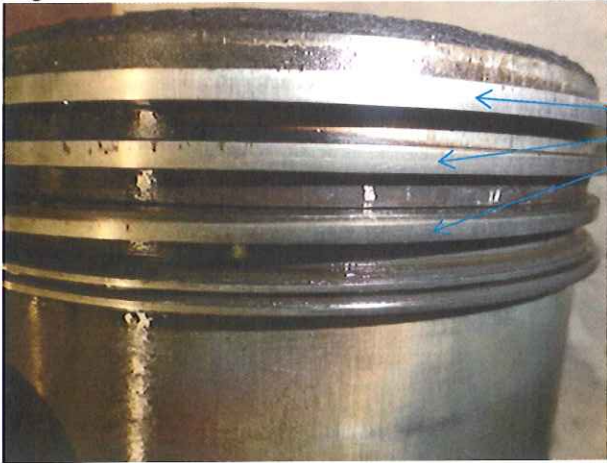
Crankshaft (S/N 20A6670) as photographed under a black-light (magnetic particle inspection). The crankshaft does show small crack indications that we feel can be addresses as per Pratt and Whitney repair instructions. We will need to remove the crack and measure to verify the serviceability of the part.



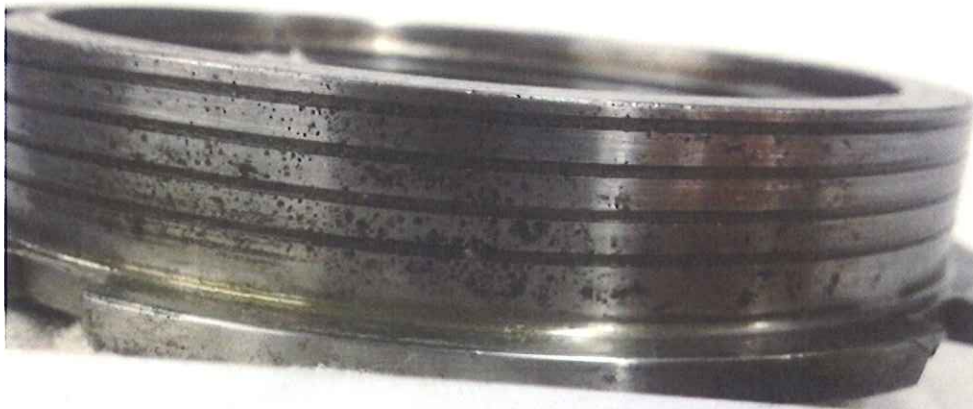
Piston Pin (P/N 234220) as removed from position (cylinder / piston) #3. Comparable to the remaining eight piston pins. The pins do not exhibit any corrosion however are pitted. The pin size in as removed condition is within service limits, however once the pitting is removed the pin sizing will need to be inspected and verified.

Engine Serial Number 13580

Disassembled 5/6/13



Piston as removed from cylinder #3.  
Comparable to the remaining eight pistons.  
The rings show excessive wear however  
side clearance / tolerance are within limits.



Photographed thrust nut  
(P/N 12719) as removed.  
No Rust or corrosion  
was found on the part,  
however there is  
significant pitting that  
condemns the part.

Covington Aircraft Engines  
5/6/2013  
Engine Serial Number 13580

Covington Aircraft Engines  
5/6/2013  
Engine Serial Number 13580



Photographed Thrust Plate (P/N 37970) as removed. Heavy scoring / gouging are present at the I.D. of the plate that will condemn the part. There is not found an operational cause for the condition of the part as the thrust nut shows no sign of corresponding damage.



Engine Serial Number 13580

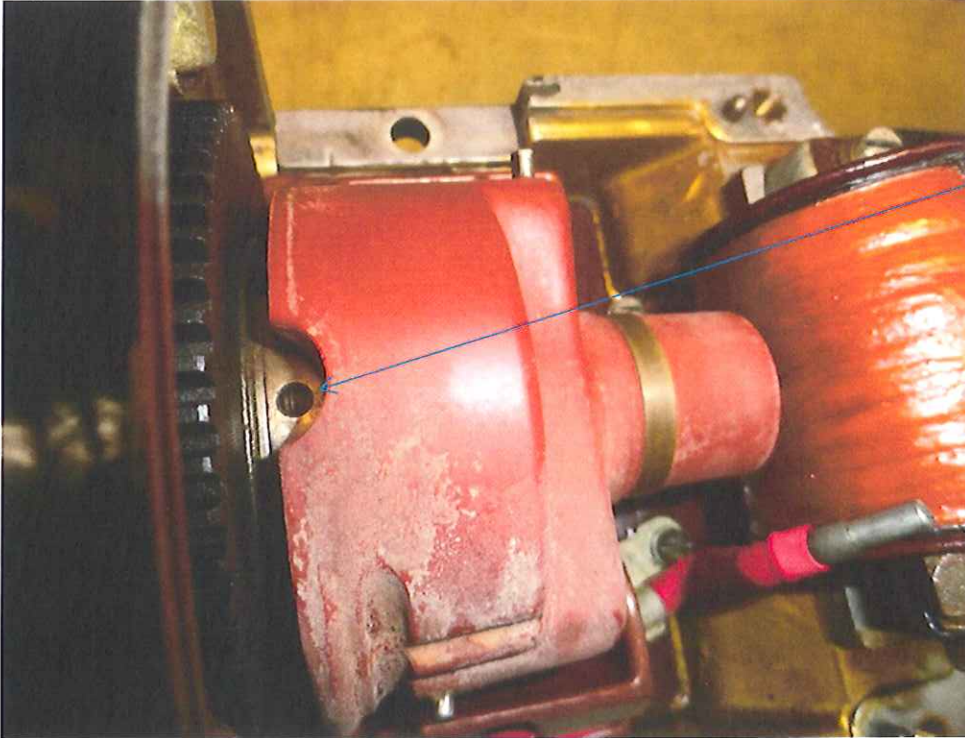


Disassembled 5/6/13

Photographed are seals (P/N 24230) located in the engine oil pump. The leather seals appear to be well worn and are semi-recessed in the housing.

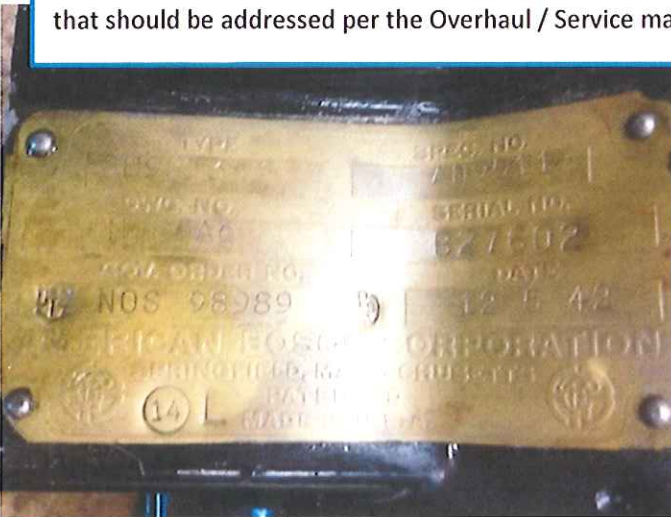


Magneto (American Bosch)  
Type: SB9RC3  
Serial Number BB12928



Note the following:  
The manual for the American Bosch (SB9RU3 / C3) magnetos require that the rotor fastening screws (P/N SC5294) be staked. Both fastening screws were un-staked as photographed.

Note that the hardware has not been plated or addressed, also the housings show chips and imperfections that should be addressed per the Overhaul / Service manual



Magneto (American Bosch)  
Type: SB9RU3  
Serial Number B27602

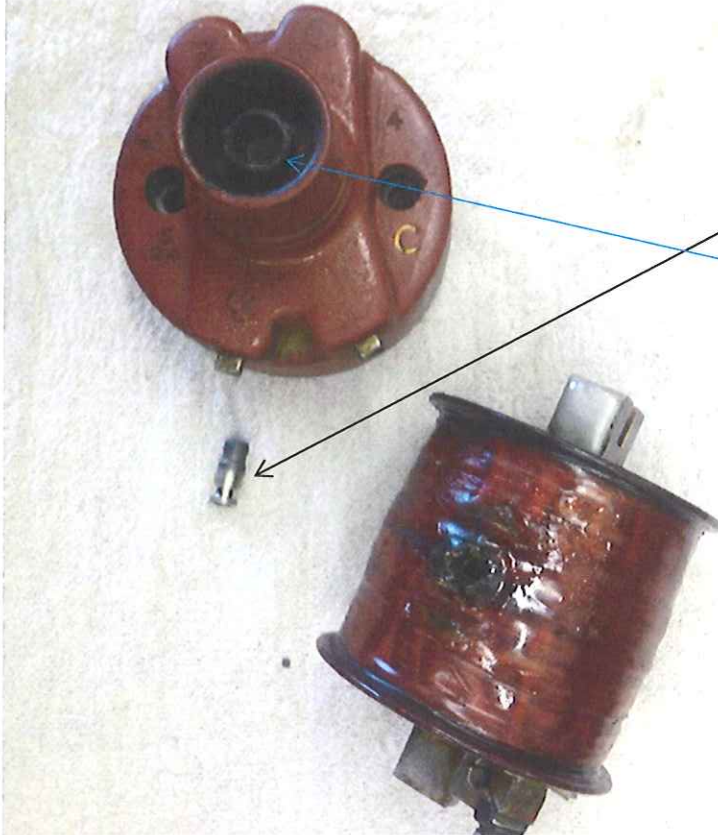


Cam (P/N CA5241) is pitted and rejected.

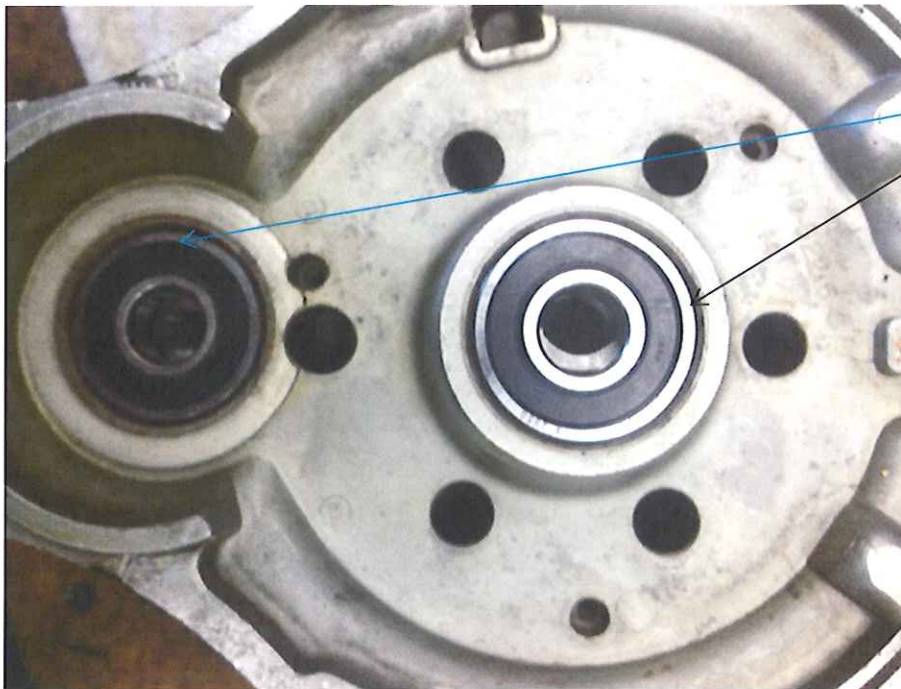


Gear (P/N GE52198) is pitted & has one gear tooth damaged. This part is rejected.





Rotor (P/N RT52137) & Coil (P/N CL5250) are rejected due to the coil terminal breaking loose from the coil. This terminal fits into the inner diameter of the rotor, because this terminal is loose it will (as the magneto is operating) damage the inner diameter of the rotor as photographed. It is possible for the magneto to keep operating with this failure, however most magnetos fail completely or exhibit high rpm drop when magneto checks are performed.



Incorrect bearings used. The manual calls for BB1019 & BB5210 slotted bearing. The bearings used appear to be SKF0201, which I cannot reference.

Also note that the sealer is nearly removed from the housing.



Reference "Rear Case Attachment". This is an enlarged illustration showing the relationship of the starter drive gear and the generator / alternator drive gear on the R-1340 engine rear case. The illustration contains item identification numbers, two of which I wish call your attention to; Item 215 and Item 219. Item 215 is the fit of the alternator drive gear housing to the rear case and Item #219 is the gear backlash between the starter jaw generator drive gear teeth and the generator drive gearshaft.

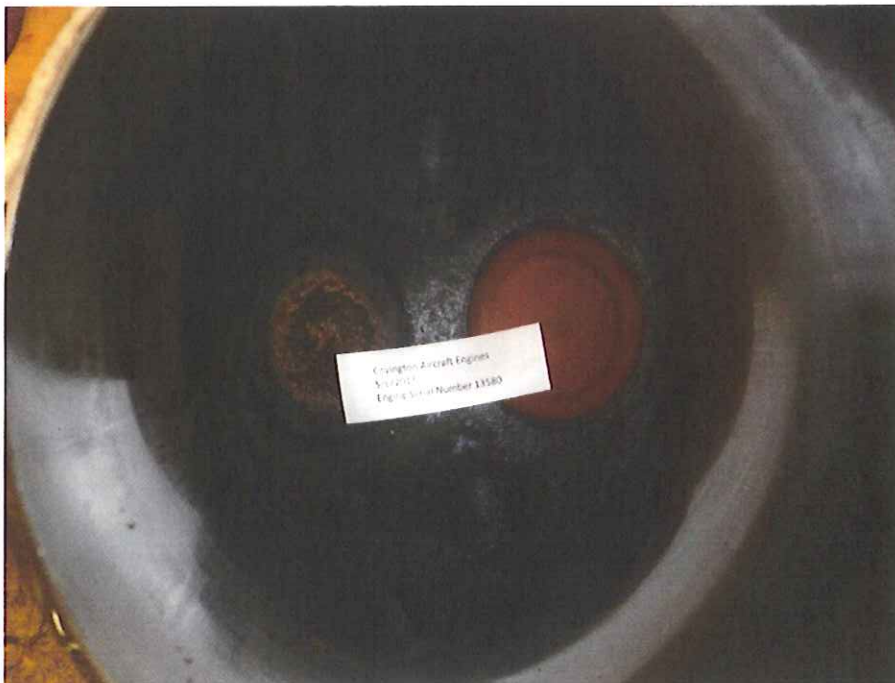
Item #215 is identified in the Limits Section of the R-1340 / Wasp Engine Overhaul Manual, Page 249 as; Generator Drive Housing – Rear Case, Minimum: .000" – Maximum: .004". Item #219 states: Starter Jaw – Generator Drive Gear Backlash, Minimum: .002" – Maximum: .030". Please study the illustration taking note of the Metal-to-metal placement of the generator drive gear housing (Item 215) and the relationship of the housing to the rear case itself. It becomes clear that accidental placement of a generator mount gasket between the generator drive gear housing and the rear case would alter the gear backlash (item #219) between the generator gear-shaft and the starter jaw resulting in excessive gear backlash.

Sustained operation of these gears with excessive gear backlash would result in a "hammering" effect, especially at engine idling speeds, and would result in premature failure of one or both gears. It is imperative that this gasket is placed in the proper location.



Cylinder Bore

Cyl #	Bore size over standard	Work Needed
1	.002 oversized bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.
2	Standard Bore	Should be fitted with appropriate piston.
3	.002-.004 Step in Bore & Cracked Guide Boss	Possible weld repair. If successfully repaired, cylinder should be chromed ground to plus size and fitted with appropriate piston.
4	.001 oversized bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.
5	Standard Bore	Should be fitted with appropriate piston.
6	.001 oversized bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.
7	.004 oversized bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.
8	.002 Step in bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.
9	.003 oversized bore	Cylinder should be chromed ground to plus size and fitted with appropriate piston.



Note: The combustion chamber seems to have a high amount of combustion residue that would indicate that the engine did use (consume) more than average amounts of oil. This would be consistent with the marginal bore to piston sizing, apparent lack of honing, and excessively worn rings. To complete an inspection of the cylinders, valves, bearings & springs, full disassembly will be required.



## REPORT SUMMARY



Date: 5/30/13

### Report Summary

Engine Information: R-1340-AN-1  
Engine Serial Number 13580  
Covington Work Order 11883  
Date of Disassembly 5/6/13

Disassembly / Inspection Witness:  
Caleb Curry  
General Manager  
Radial Engines Inc.

### Report Summary:

- Incorrect Hardware used in assembling the engine.
- Masterrod Located in the wrong cylinder position.
- Pitting found on the Masterrod Assembly, Crankshaft, Starter Gear, Piston Pins, Thrust Nut, Magneto cam & GE52198 Gear.
- Engine Cam is failed.
- Engine Main Bearings & Thrust Bearing appears to have been installed more than once.
- Safety features for the Sump & Magneto were not used.
- Heavy scoring of the thrust plate. No operational reason for this is evident.
- Worn leather oil pump seals, recessed in the housing.
- Gear-tooth Damage to GE52198 Gear.
- Damaged magneto parts (possible failure).
- Incorrect Bearings used in the American Bosch Magnetos.
- Incorrect placement of Alternator / Generator Gasket.
- Many cylinder bores are oversized and must be chromed. This is cause for overhaul of the cylinders.
- Possible repairable cracking in the mating area of the crankshaft. Possible repairable cracking in the exhaust boss of #3 cylinder.
- Rings are excessively worn and must be replaced.

Many of the listed parts are not repairable and must be replaced. Major parts would (but not limited to) the magneto gearing, magneto cam, coil, distributor rotor, magneto cam, engine cam, thrust bearing, thrust plate, masterrod assembly (slave rod), & piston rings. The crankshaft and #3 cylinder require additional work to verify the serviceability of the parts.

## REPORT SUMMARY

### Engine Current Status

The Engine is currently disassembled and preserved.

Major parts:

- The crankshaft is waiting to have additional grind, inspection, & plating work accomplished.
- The Cam is red tagged (reject).
- The Cylinders are waiting for complete disassembly, final inspection & plating work. #3 is waiting for weld work to begin.
- Engine Cases are preserved.
- Magnetos are completely disassembled.

### Covington Recommendations

Covington Aircraft recommends that the engine be given a complete overhaul. With most of the major components in need of major repair or replacement, it would be more economical and (in our opinion) reliable. I also recommend the replacement of all the pistons or at the very least replace them with used pistons that we machine. I also recommend replacing the starter gear & generator gear due to the gasket that was installed under the drive pad. The masterod assembly must be completely disassembled and the corrosion issue dealt with, but Covington would also require that S.B. 1546 be complied with.

With respect to the recent overhaul it is very concerning that the masterod was located in the wrong position as this is basic R-985 & R-1340 overhaul & repair knowledge. In my eighteen years experience in working with R-1340 engines, I cannot remember seeing the masterod located in the wrong position.

Report Completed By:  
Rob Seeman  
Covington Aircraft Engines





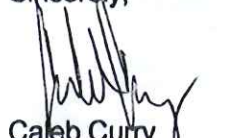
May 6, 2013

Covington Aircraft Engines, Inc.  
Attn: Rob Seeman  
P.O. Box 1344  
Okmulgee, OK 74447

To Whom It May Concern:

On May 6<sup>th</sup>, 2013 I witnessed the teardown and inspection of one P&W R-1340-AN-1, serial number 13580 at Covington Aircraft Engines facility in Okmulgee Oklahoma. I agree with the findings detailed in their report and assigned work order number 11883.

Sincerely,



Caleb Curry  
General Manager