



Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL: IO550R

ENGINE SERIAL: 821253

AIRCRAFT MODEL: U206F

SERIAL NUMBER: U20602825

REGISTRATION: N35952

Examiner	Signature	Date
Phillip Grice		March 11, 2014

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GENERAL INFORMATION

EXAMINATION		ENGINE RECEIVED	
Date	March 11, 2014	Date	02-07-2014
Facility	Continental Motors Inc.	RGA #	349822
Address	2039 Broad Street	FROM	Tanana Air Service
City	Mobile	NTSB/FAA Tagged	Yes
State and Zip	Alabama 36615	Box Sealed	Yes

ENGINE INFORMATION

Make	Continental Motors Inc.
Model	IO550R
Serial No.	821253
Engine Position	Single
Total Time	1554 from last log book entry dated 6/6/2013 1620 was reported not verified
Time SOH	No overhaul
Build Date	05/02/2001
In Service Date	01/31/2002
Removal Date	Not reported

AIRCRAFT / ACCIDENT INFORMATION

Aircraft Make	Cessna
Aircraft Model	U206F
Aircraft Serial No.	U20602825
Registration No.	N35952
Accident Date	August 23, 2013
Accident Location	Takotna Alaska

Significant logbook information: The log books indicated several alternator changes during the operational history of the engine. The number two cylinder was replace and the number four was repaired and reinstalled @ 1400.2 hours since factory rebuilt.

Report Summary:

Search Code:

06-01-36,06-01-21,13-02-03

The engine was placed in service 01/31/2002 and accumulated 1620 hrs. Since factory rebuilt. Normal maintenance was performed during the operational history of the engine. The number two cylinder was replaced at 1400.2 total time. The number four cylinder was repaired and reinstalled at the same Tach time. The number six cylinder was removed and replace with overhauled cylinder @ 1435.9 since factory rebuilt. The number two main bearing had rotated in the main bearing saddle and was fragmented and found in the oil sump. The number one, two and three main bearing exhibited lock slot elongation and bearing shift signatures. Both the number one, two and three main bearing parting surfaces on the crankcase exhibited fretting signatures. The crankshaft was fractured aft of number two main bearing. The fractured components were examined in the CMI Metallurgy lab and the report sent the NTSB IIC. The through bolt break-away torque was measured during disassembly and recorded in this report.

Disposition of engine following exam: Engine returned to Brooks Sheet Metal in Fairbanks Alaska on CMI shipper AD00702 03/12/2014.

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Inspection Witnesses			
Inspector	Phillip Grice	Mechanic	Johnny Little
Organization	Continental Motors Inc.	Organization	Continental Motors Inc.
Witness	Josh Cawthra	Mechanic	Gregory Eastburn
Organization	NTSB	Organization	Continental Motors
Witness	Will Johnson	Witness	
Organization	Yute Air Taxi Inc.	Organization	

EXTERNAL INSPECTION OF ENGINE:



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ENGINE COMPONENT EXAMINATION

Magneto to Engine Timing
CMI Spec. - 22° BTDC

Left Magneto: No Rotation

Right Magneto: No Rotation

Exhaust System Condition: The exhaust system components were not returned with the engine.

Starter Manufacturer: CMI

Part Number: 646275-1

Serial #: Z010026

Condition: The starter rotated by hand and was intact and undamaged.



Starter Adapter Part Number: Illegible.

Date Code: Illegible.

Condition: The starter adapter rotated by hand and was intact and undamaged.



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Crankshaft to Camshaft Timing

The crankshaft to camshaft timing was not verified by the alignment of the gear's timing marks due to the fractured crankshaft.

Ignition Harness Manufacturer: CMI Model/Part Number: Not Marked Serial #: Not Marked

Condition: All leads were free of frayed or damaged shielding and exhibited normal operating signatures.



L/H Magneto

Manufacturer: CMI

Model/Part Number: BL500556-1

Serial #: D03AA648R

Condition: The left-hand magneto turned freely with impulse coupling engagement.



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R/H Magneto

Manufacturer: CMI

Model/Part Number: BL500556-1

Serial #: D03AA062R

Condition: The right-hand magneto turned freely with impulse coupling engagement.



Oil Cooler

Manufacturer: Niagara NDM

Model/Part Number: 6564585

Serial #: H02-200638

Condition: The oil cooler was undamaged and exhibited normal operating signatures.



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Oil Pump

Condition: The oil pump drive was intact. The oil pump cavity contained light scratches and exhibited normal operating signatures. The oil pump gear teeth exhibited normal operating signatures. The oil pressure relief valve and seat contained no obstructions and exhibited signatures of proper seating.



Oil Filter

Manufacturer: Tempest

Part number: AA48109-1

Condition: The oil filter housing was cut open using the cutting tool and the filter element was cut from the canister to allow examination. The oil filter element was examined and contained abundance of flakes and slivers from the damaged internal engine components.



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Throttle and Fuel Control / Metering Assembly

Manufacturer: CMI

Part Number: 653353-1

Serial #: A01CA193R

Condition: The fuel metering unit exhibited normal operating signatures



Fuel Pump

Manufacturer: CMI

Part Number: 649364-4

Serial #: B01CA317R

Condition: The fuel pump turned freely and there were no abnormalities present. The fuel pump drive was fractured due to the loss of support at the rear of the crankshaft which the drive coupling is inserted.



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Fuel Manifold Valve Manufacturer: CMI Part Number: 646435-3A1 Serial #: B01CA317R

Condition: The fuel manifold valve exhibited normal operating signatures. There was no indication of leakage observed from the cover vent port. The fuel nozzles were unrestricted and exhibited normal operating signatures. The fuel lines were intact and undamaged.



Spark Plugs Manufacturer: Autolite Part number: URHB32E

Condition: The number spark plugs The remaining top and bottom sparkplugs had normal wear signatures in accordance with the Champion aviation check-a-plug comparison chart.



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Alternator/Generator Manufacturer: T&W overhaul Part Number: 646843 Serial #: A140317

Condition: The alternator turned through freely and exhibited normal operating signatures. The drive coupling was intact and undamaged.



Oil Sump Condition: The oil sump drain plug was safety wired. The oil sump was undamaged and exhibited normal operating signatures. The oil sump contained residual oil.



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Oil Pick-up Tube & Screen

Condition: The oil pick-up tube was undamaged. The oil suction screen was unrestricted.



Induction System

Condition: The induction risers were undamaged and exhibited normal operating signatures.



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Cylinder #1 Part Number: 654928

Head Date: 12-00

Barrel Surface: Steel

Serial #: N/A

Work Order Numbers: None

Condition: The spot putty was evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



Cylinder #2 Part Number: 655465

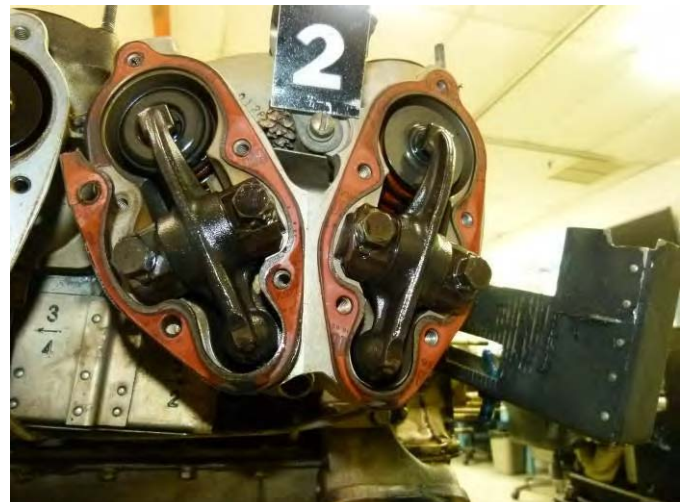
Head Date: 1-03

Barrel Surface: Steel

Serial #: N/A

Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



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Cylinder #3 Part Number: 654928 Head Date: 3-01 Barrel Surface: Steel
Serial #: N/A Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



Cylinder #4 Part Number: 654928 Head Date: 3-01 Barrel Surface: Steel
Serial #: N/A Work Order Numbers: None

Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



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Cylinder #5 Part Number: 654928 Head Date: 3-01 Barrel Surface: Steel

Serial #: N/A Work Order Numbers: None

Condition: The spot putty was evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



Cylinder #6 Part Number: 655465 Head Date: 7-05 Barrel Surface: Steel

Serial #: N/A Work Order Numbers: 022211-12

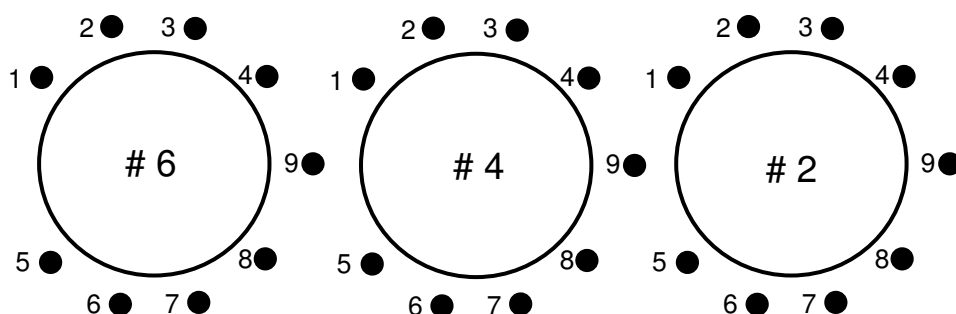
Condition: The spot putty was not evident on the cylinder hold-down nuts. The cylinder combustion chamber had a normal amount of combustion deposits and the bore condition was free of scoring and undamaged. The cylinder skirt was intact and undamaged and there were no hone marks visible in the cylinder bore ring travel area. The intake and exhaust valve heads exhibited normal deposits and operating signatures. The rocker box area had an oil residue indicating lubrication to the overhead. The cylinder overhead components (valves, rocker arms, guides, springs, retainers and shafts) were lubricated and undamaged.



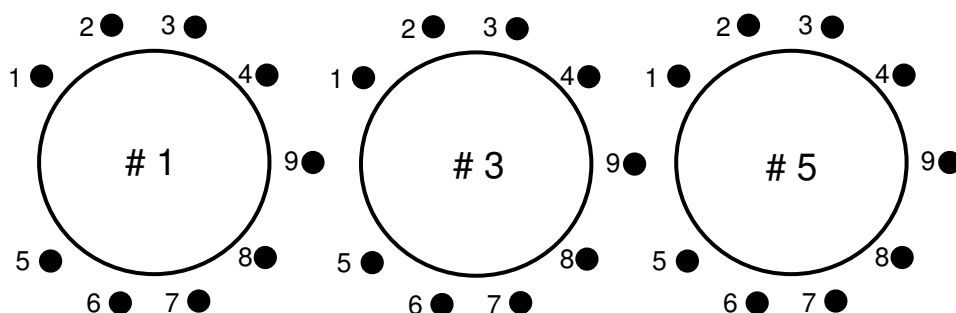
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Cylinder Through-Bolt (Tightening / Loosening) Torque Measurements – Inch Pounds
(Position numbers 1 and 5 are through-bolts)

	Bolt 1				Bolt 5				
	Tight / Loose				Tight / Loose				
Cylinder #2	904/757				916/693				
Cylinder #4	949/ 643				870/614				
Cylinder #6	934/869				864/760				



	Bolt 1				Bolt 5				
	Tight / Loose				Tight / Loose				
Cylinder # 1	883/784				1138/786				
Cylinder # 3	1088/908				1067/837				
Cylinder # 5	1154/911				1150/789				



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Rocker Arm and Shaft

Condition: The intake and exhaust rocker arms and shafts exhibited normal operating signatures.



#1 Piston, Rings and Pin

Piston Part Number: Illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was free of scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.



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#2 Piston, Rings and Pin Piston Part Number: Illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt exhibited scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.



#3 Piston, Rings and Pin Piston Part Number: Illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was free of scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.



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#4 Piston, Rings and Pin Piston Part Number: Illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was free of scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.



#5 Piston, Rings and Pin Piston Part Number: illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was free of scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.



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#6 Piston, Rings and Pin Piston Part Number: Illegible

Condition: The piston head exhibited a normal amount of combustion deposits and the piston skirt was free of scoring and damage. The piston rings were intact, free in their grooves, exhibited normal wear and operating signatures. The piston pin and plug assembly was intact and undamaged.

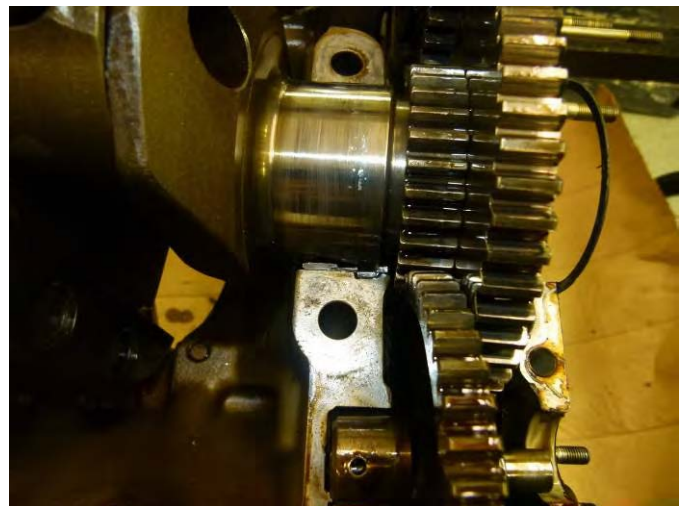
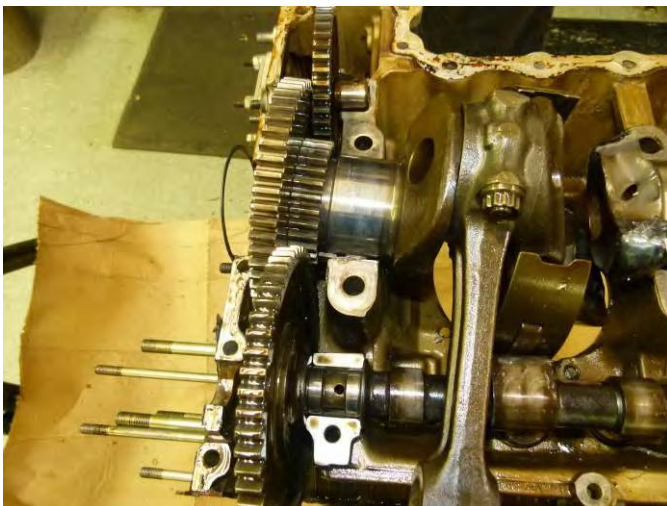


Lifter	#1	#3	#5	#2	#4	#6
Intake	653888	653888	653888	653888	653888	653888
Exhaust	653877	653877	653877	653877	653877	653877

Condition: The lifter faces were undamaged and exhibited normal operating signatures. The lifter bodies were undamaged and exhibited normal operating signatures.

Crankshaft Forging number: illegible Serial number: N01AA316 Heat code: Illegible

Condition: The crankshaft was fractured at the number two main bearing journal. The connecting rod journals, main journals and thrust surfaces were undamaged and showed no signs of abnormal wear or lubrication distress. The crankshaft counterweight pins, plates and snap-rings were intact. The counterweights were undamaged and had free and unrestricted movement on the hanger blades. The gear bolts were tight and safety wired and the gear teeth were undamaged. The fractured parts were examined in the CMI Metallurgy lab and report provided to NTSB IIC.



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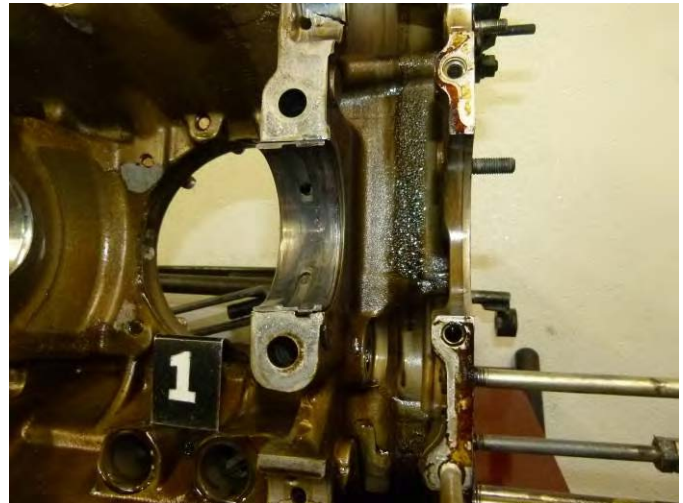
#1 Main Bearings

Part #: 634503M010

Date Code: 11-97

Condition

The #1 (rear) crankshaft main bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lock slot elongation in the crank case and bearing shift.



#2 Main Bearings

Part #: 634503M010

Date Code: 11-97

Condition

The #2 (intermediate) crankshaft main bearings exhibited lubrication distress and thermal smearing of the surface babbitt down to the copper layer. The bearings were fragmented and extruded from the bearing support. Fragments were recovered from the oil sump.



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#3 Main Bearings

Part #: 634503M010

Date Code: 11-97

Condition

The #3 (intermediate) crankshaft main bearings exhibited contamination imbedded in the surface layer. The bearings exhibited lock slot elongation in the crank case and bearing shift.



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#4 Main Bearings

Part #: 653547M010

Date Code: 5-00

Condition

The #4 (intermediate or front) crankshaft main bearings exhibited normal operating and lubrication signatures. The bearings were intact and exhibited an insignificant amount of contamination and hard particle passage. The bearings exhibited contamination imbedded in the surface layer. The bearings exhibited wear down to the copper layer.



#5 Main Bearings

Part #: 653547M010

Date Code: 5-00

Condition

The #5 (front) crankshaft main bearings exhibited normal operating and lubrication signatures. The bearings were intact and exhibited an insignificant amount of contamination and hard particle passage. The bearings exhibited contamination imbedded in the surface layer. The bearings exhibited wear down to the copper layer.



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#1 & 2 Connecting Rod

Part #: 655001

Forging #: 646126F

Serial #: Not applicable

Condition: The number one connecting rod assembly was intact and undamaged. The connecting rod nuts and bolts were intact and secure. The connecting rod bushing exhibited normal operating and lubrication signatures. The number two connecting rod assembly was intact and exhibited mechanical damage on the rod cap and was bent along the I-beam section of the rod. The connecting rod nuts and bolts were intact and secure. The connecting rod bushing exhibited normal operating and lubrication signatures.

#1 & 2 Connecting Rod Bearings

Part #: 642398M010

Date Code: 11-99

Condition: The connecting rod bearing exhibited lubrication distress and thermal smearing of the surface babbit, exposing the copper layer.



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#3 & 4 Connecting Rod

Part #: 655001

Forging #: 646126F

Serial #: Not applicable

Condition: The connecting rod assembly was intact and undamaged. The connecting rod nuts and bolts were intact and secure. The connecting rod bushing exhibited normal operating and lubrication signatures.

#3 & 4 Connecting Rod Bearings

Part #: 642398M010

Date Code: 11-99

Condition: The connecting rod bearing exhibited normal operating and lubrication signatures. The connecting rod bearings were intact and exhibited an insignificant amount of contamination and hard particle passage. There were no signs of lubrication distress.



#5 & 6 Connecting Rod

Part #: 655001

Forging #: 646126F

Serial #: Not applicable

Condition: The connecting rod assembly was intact and undamaged. The connecting rod nuts and bolts were intact and secure. The connecting rod bushing exhibited normal operating and lubrication signatures.

#5 & 6 Connecting Rod Bearings

Part #: 642398M010

Date Code: 11-99

Condition: The connecting rod bearing exhibited normal operating and lubrication signatures. The connecting rod bearings were intact and exhibited an insignificant amount of contamination and hard particle passage. There were no signs of lubrication distress.



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Camshaft Part number: 655008

Serial Number: Z01CR498

Condition: The camshaft lobes exhibited normal operating signatures. The camshaft cluster gear was intact and exhibited normal operating signatures. The gear bolts were tight and safety wired and the gear teeth were undamaged.



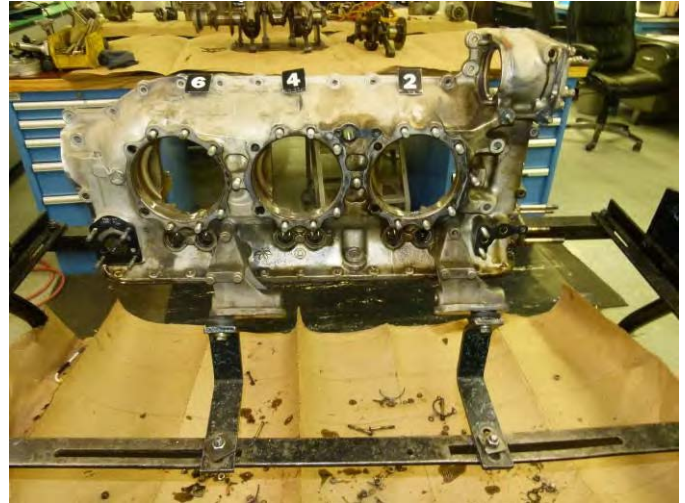
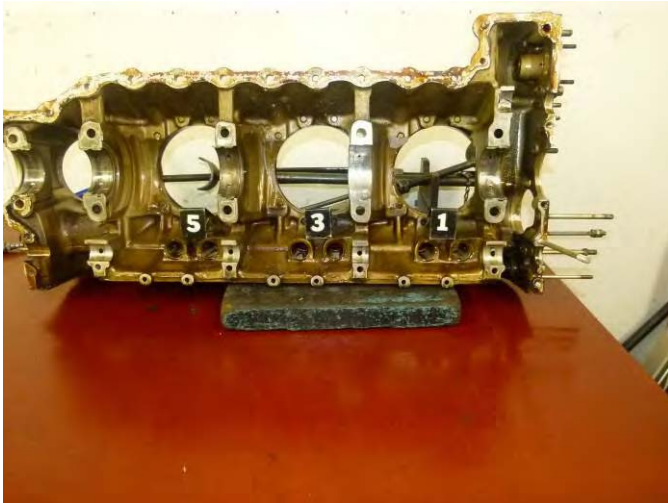
Crankcase Casting Number 1-3-5 Side: 646201 2-4-6 Side: 646200 Serial number: A159003RPL

Work Order Numbers: None

Condition: The crankcase exhibited minimal exterior damage. The cylinder bays were intact and undamaged. The oil galleries and passages in the left and right crankcase halves were intact, clear and unrestricted. The number one, two and three main bearing support exhibited lock slot elongation and bearing shift signatures. The number one, two and three main bearing parting surfaces exhibited rough surface and fretting. The number two main bearing support exhibited bearing rotation signatures. The number two bearing was fragmented and found in the oil sump. The lower rear section of the crankcase (below the fracture area of the crankshaft) exhibited mechanical damage from the internal rotating components of the engine.



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Accessory Gears

Condition: The accessory gears had continuity. The teeth were undamaged and exhibited normal operating signatures.



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Propeller Governor Part number: C290D4??/T3

Serial Number: 940111

Condition: The propeller governor could be rotated by hand, was intact and undamaged.



Vacuum Pump Part number: AA216CW

Serial Number: N17713

Condition: The vacuum pump could be rotated by hand, was intact and undamaged.

