




Continental Motors

ENGINE EXAMINATION REPORT

ENGINE MODEL	TSIO-520-JcNB
ENGINE SERIAL NUMBER	218873-R
AIRCRAFT MAKE & MODEL	Cessna 414A
AIRCRAFT SERIAL NUMBER	414A0821
AIRCRAFT REGISTRATION	N414RS
FILE NUMBER	18-357

NAME	SIGNATURE	DATE
Nicole L. Charnon		03/26/2019

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EXAMINATION		ACCIDENT DATA	
DATE	03/08/2019	NTSB ACCIDENT #	WPR19FA079
FACILITY	Air Transport	NTSB INVESTIGATOR	Maja Smith
ADDRESS	[REDACTED] Phoenix, Arizona 85009	FAA INVESTIGATOR	Benjamin Harris
		ACCIDENT DATE	02/03/2019
		ACCIDENT LOCATION	Yorba Linda, California

ENGINE INFORMATION

ENGINE POSITION	Left Engine
TOTAL TIME	3,965.0 hours
TIME SOH	124.4 hours
TYPE & TIME SLI	22.3 hours since last oil change (see information below)
BUILD DATE	11/05/1981
IN SERVICE DATE	Unknown

Significant logbook information:

Excerpts of maintenance records were provided by the NTSB investigator-in-charge (IIC). According to the provided excerpts, the engine underwent an overhaul on February 19, 2018 at an engine total time of 3,840.6 hours. During the overhaul, the engine was equipped with an overhauled fuel system and two overhauled magnetos. On April 3, 2018, the engine was installed in the accident airplane's left engine nacelle at a Hobbs time of 2,211.2 hours (and 3.3 hours since major overhaul). On October 1, 2018 at a Hobbs time of 2,283.0 hours, the engine oil was changed and the oil filter was inspected with no noted anomalies. The oil filter had a date of January 4, 2019 and a Hobbs time of 2,332.3 hours hand-written on the side, but an associated entry was not observed in the provided records. The Hobbs meter read 2,354.6 hours during the wreckage examination.

Report Summary:

Search Code(s):

15-12-68

The engine sustained significant impact-related damage that precluded the functional testing of most components. However, examination of the recovered engine items revealed no signs of pre-accident anomalies that would have precluded its ability to produce full, rated power.

NOTE: The propeller and turbo components were examined by a representative of Hartzell Engine Technologies (HET) under the supervision of the NTSB IIC. Please see the reports from HET for more information regarding those components.

Disposition of engine following exam:

The engine was retained at the aircraft recovery facility pending final release by the NTSB IIC.

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NAME	Nicole L. Charnon	NAME	Maja Smith
ADDRESS	Washington, DC	ADDRESS	Seattle, WA
ORGANIZATION	Continental Motors	ORGANIZATION	NTSB – Western Region
PHONE	251-753-4764	PHONE	253-874-7836
NAME	Andrew Hall	NAME	
ADDRESS	Wichita, KS	ADDRESS	
ORGANIZATION	Textron Aviation	ORGANIZATION	
PHONE	316-517-8735	PHONE	

EXTERNAL ENGINE CONDITION

The engine was separated from the nacelle and the propeller, left magneto, alternator, vacuum pump, starter motor, and throttle body were separated from the engine. There was a hole in the crankcase over the #5 connecting rod area, but the fractures appeared as though the case was punctured from the outside-in. Wood debris was observed in the area of the puncture. The oil sump was displaced up around the bottom of the engine. The crankshaft was fractured at the nose seal and the fracture surface was jagged and irregular, consistent with overload. The #2, #5, and #6 cylinders heads were fractured. There was no evidence of lubrication distress on any of exposed components.



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SYSTEM****Condition:**

The exhaust system components were separated from the engine.

**INDUCTION
SYSTEM****Condition:**

The induction system was fragmented.

IGNITION SYSTEM**LEFT
MAGNETO**

Manufacturer: Champion

P/N: 6320

S/N: Not Observed

Condition:

The left magneto was separated from the engine and was not observed.

**RIGHT
MAGNETO**Manufacturer: Champion
(O/H by Kelly Aerospace)

P/N: 6320

S/N: 10081910 / F-12262

Condition:

The right magneto remained attached to the engine and manual manipulation of the unit did not result in any slipping. The magneto's ignition harness was cut to remove damaged ends, and a functional test was performed. Rotation of the crankshaft resulted in an audible snap of the impulse coupling as well a spark from each ignition lead in firing order with no pre-accident anomalies noted.



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IGNITION HARNESS

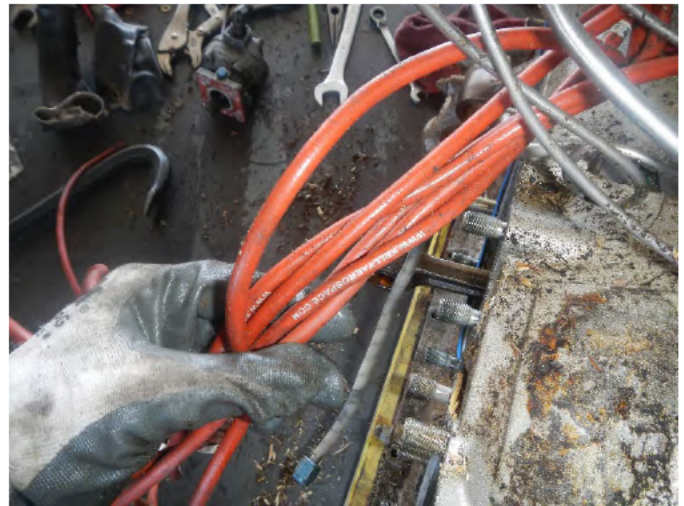
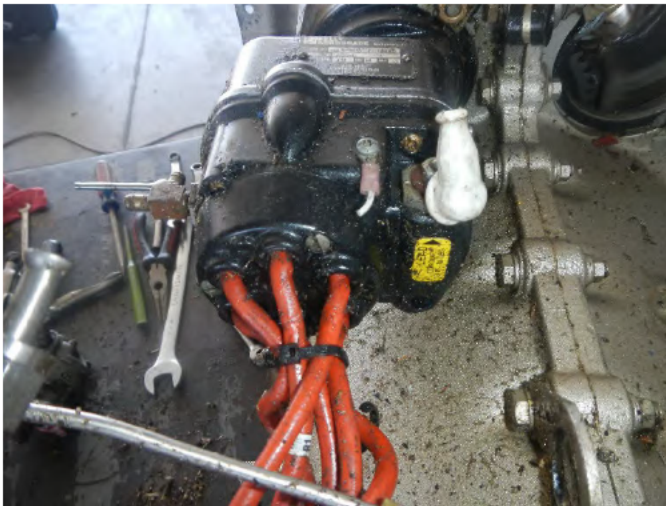
Manufacturer: Kelly Aerospace

P/N: Unknown

S/N: Unknown

Condition:

The right ignition harness remained attached to the magneto. The leads were damaged near their terminal ends. The right ignition harness was used for functional testing of the right magneto with no pre-accident anomalies noted. The left ignition harness was separated from its magneto but most of the leads remained attached to their respective sparkplugs.



SPARK PLUGS

Manufacturer: TEMPEST

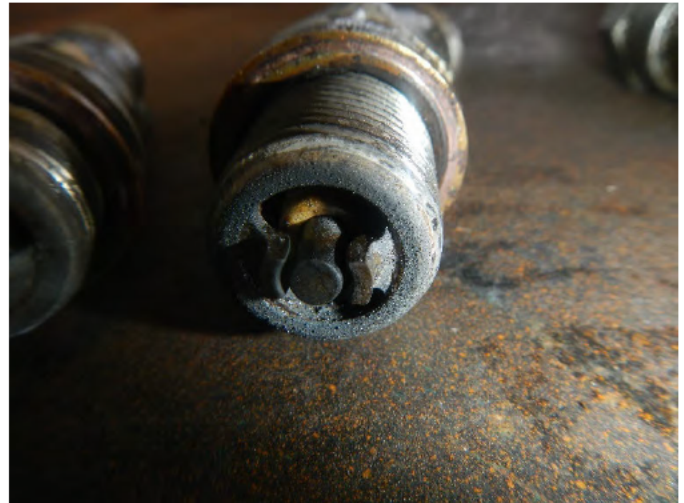
P/N: URHB32E

Condition:

The sparkplugs remained attached to their respective cylinders with the exception of the #5 top sparkplug (only the outer electrodes remained threaded into the cylinder). Examination of the sparkplugs revealed normal wear and combustion deposits with no pre-accident anomalies noted. NOTE: the outer electrodes of the #5 top sparkplug were mechanically damaged by investigators during a borescope examination of the cylinder.



1T



2T

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3T



4T



5T



6T

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FUEL SYSTEM

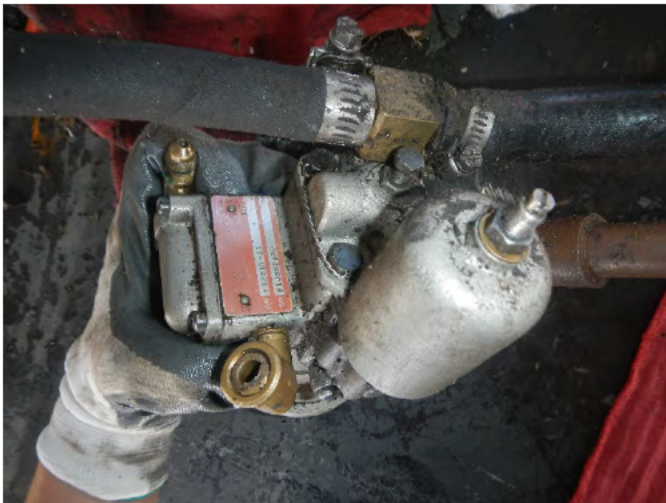
FUEL PUMP

Manufacturer: Continental
(field overhauled)

P/N: 632818-11

S/N: F148605RB

Condition: The engine-driven fuel pump remained attached to the backside of the engine. The inlet fuel line fitting was fractured. The pump was removed and the drive coupling was intact. The drive coupling was manually rotated and the pump shaft rotated freely with no binding noted. The pump was disassembled with no pre-accident anomalies noted.



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FUEL PRESSURE REGULATOR

Manufacturer: Continental

P/N: Unknown

S/N: Unknown

Condition:

The fuel pressure regulator was not observed.

THROTTLE BODY METERING UNIT

Manufacturer: Continental
(field overhauled)

P/N: 632916-11

S/N: IO28839AR

Condition:

The throttle body was separated from the engine. The throttle control cable rod end remained attached to the throttle lever. The mixture control cable was separated from the lever. Manual rotation of the levers resulted in smooth rotation of the shafts with no binding noted. The inlet and outlet fuel fittings were separated from the metering unit. The metering unit was disassembled and no pre-accident anomalies were noted with the throttle and mixture cams or the metering plug. The fuel inlet screen was clear.



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FUEL MANIFOLD VALVE

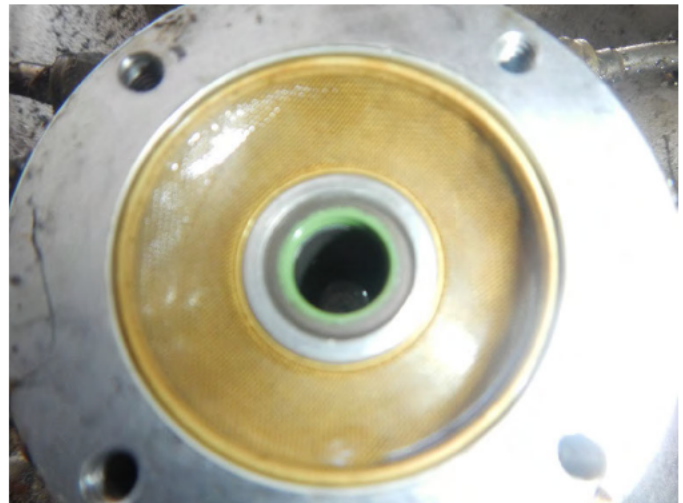
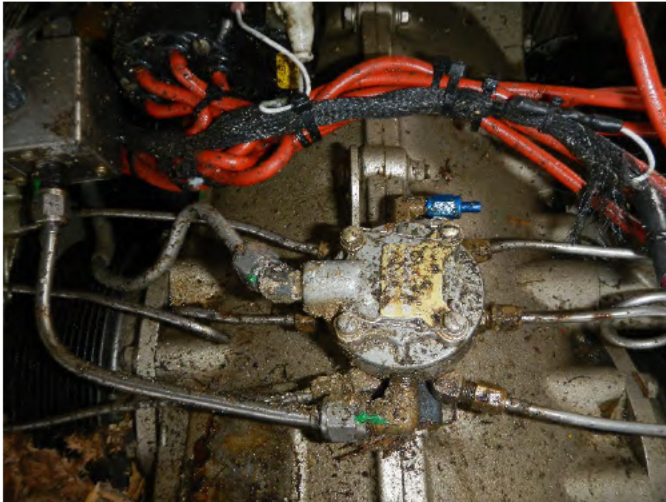
Manufacturer: Continental
(field overhauled)

P/N: 634326-4A10

S/N: G279904C

Condition:

The fuel manifold valve remained secured to the topside of the engine and all fuel lines remained secured in place. The cap was removed and the spring, diaphragm and plunger remained intact. The screen was clear and blue aviation fuel was observed in the housing.



FUEL NOZZLES AND LINES

Condition:

All of the fuel injectors remained in place with the exception of the #5, which was fractured. The upper deck reference lines remained attached to the #1, #4, and #5 fuel injectors and were separated from the rest. The fuel injector lines remained secured to their respective nozzles with the exception of the #3 and #5. There was no sign of fuel staining around any of the nozzles.

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LUBRICATION SYSTEM

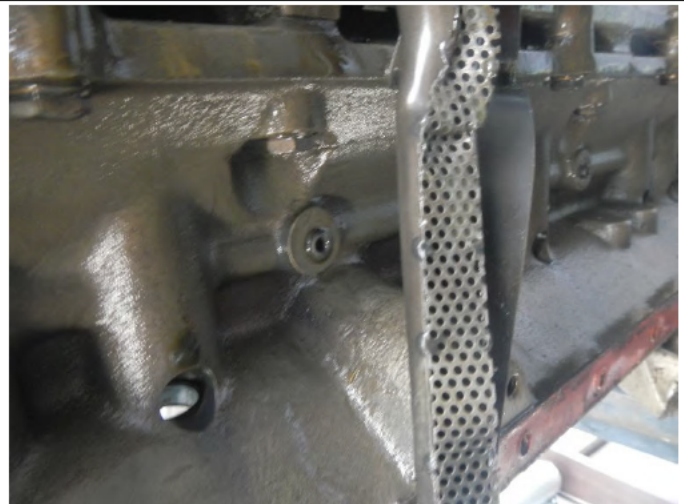
OIL SUMP

Condition: The oil sump was displaced up around the bottom of the engine. Removal of the sump revealed residual oil in the pan. There was no sign of metallic debris in the sump.



OIL PICK-UP TUBE & SCREEN

Condition: The pickup tube and screen were deformed and displaced up toward the bottom of the engine. No pre-accident anomalies or blockages were noted.



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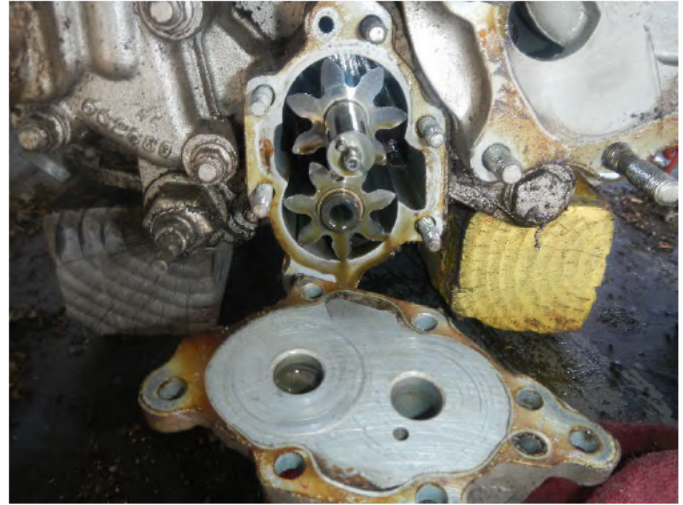
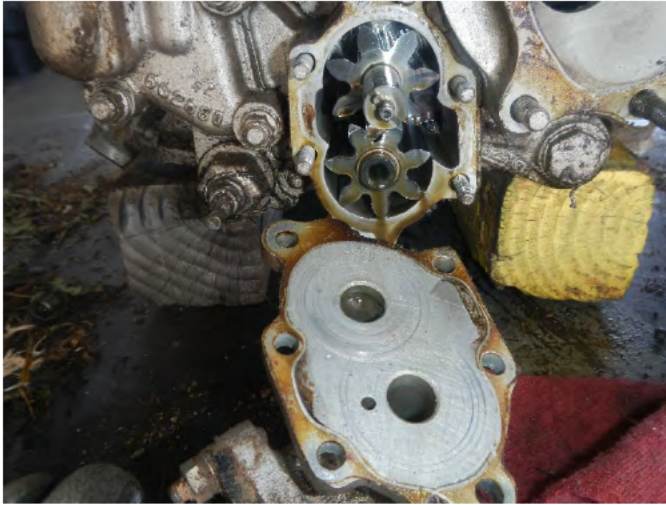
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OIL PUMP

Condition:

The oil pump remained attached to the crankcase. The pump was disassembled and all components were covered with residual oil. The gears were intact and there was no sign of hard particle passage on the pump walls. Rotational scoring was noted on the pump housing cap.

The scavenge pump remained attached to the back side of the starter adapter. The pump was disassembled and no pre-accident anomalies were noted.



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OIL FILTER

Manufacturer: Champion

P/N: CH48108-1

Condition:

The oil filter remained secured to the oil filter adapter and the safety-wire was intact. The filter was removed and cut open to find relatively clean residual oil and no observable metallic debris between the filter pleats.



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OIL COOLER

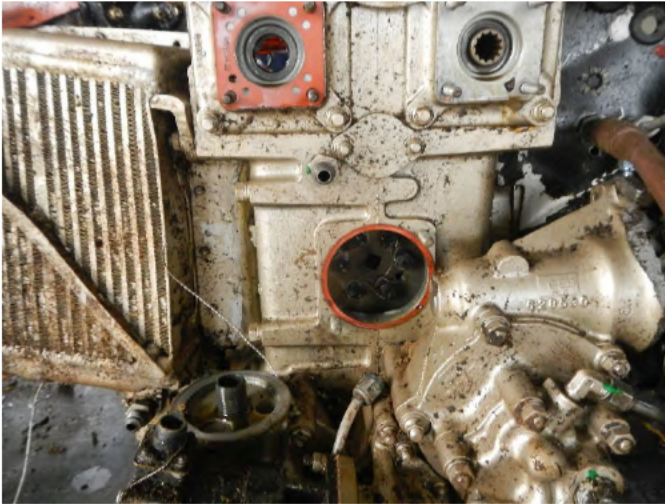
Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The oil cooler sustained impact-related deformation damage and its mounting bracket was fractured. Removal of the cooler from the engine revealed no pre-accident anomalies.



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CYLINDERS

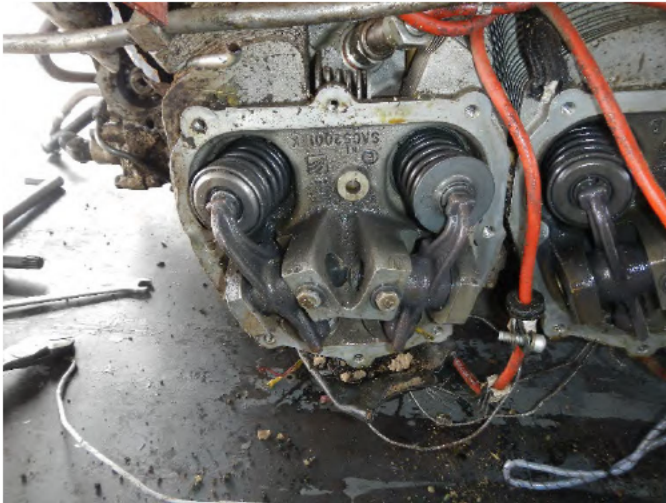
CYLINDER #1

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition:

The cylinder remained secured to the crankcase with no external pre-accident anomalies noted. The rocker cover was fractured on the exhaust side. Removal of the remaining cover revealed no pre-accident anomalies with the rockers and valve springs. Removal of the cylinder revealed corrosion on the piston, barrel and cylinder, but no pre-accident anomalies with any of the cylinder components.



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CYLINDER #3

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition:

The cylinder remained secured to the crankcase with no external pre-accident anomalies noted. The rocker cover was fractured on the bottom side. Removal of the remaining cover revealed no pre-accident anomalies with the rockers and valve springs. Removal of the cylinder revealed no pre-accident anomalies with the piston, barrel cylinder head, valves, or valve seats.



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CYLINDER #5

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition:

The cylinder remained attached to the crankcase, but numerous cooling fins were fractured as was the bottom area of the cylinder head (in the pushrod area). Wood fragments were embedded in between some fractured cooling fins. There were no pre-accident anomalies noted with the rockers or valve springs. Removal of the cylinder revealed no pre-accident anomalies with the piston, barrel, cylinder head, valves and valve seats.



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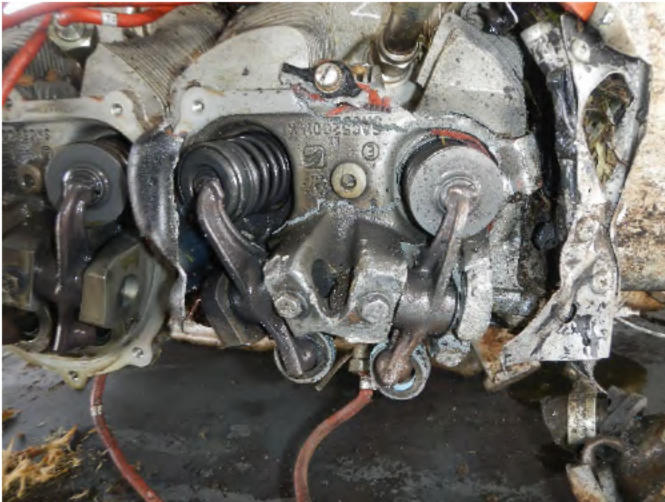
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CYLINDER #2

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition: The cylinder remained secured to the crankcase with no external pre-accident anomalies noted. The rocker cover was fractured as was the bottom of the cylinder head. The cylinder head had another irregular and jagged fracture line that intersected the intake valve area and displaced the intake valve. There were no pre-accident anomalies with the rockers and valve springs. Removal of the cylinder revealed corrosion on the piston, barrel and cylinder, but no pre-accident anomalies with any of the cylinder components.



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CYLINDER #4

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition: The cylinder remained secured to the crankcase with no external pre-accident anomalies noted. The rocker cover was fractured. Removal of the remaining cover revealed no pre-accident anomalies with the rockers and valve springs. Removal of the cylinder revealed corrosion on the piston, barrel and cylinder, but no pre-accident anomalies with any of the cylinder components.



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CYLINDER #6

Manufacturer: Superior Air Parts

P/N: SA52006-A1

Condition: The cylinder remained attached to the crankcase, but numerous cooling fins were fractured as was the left side of the cylinder head. The exhaust rocker, valve stem, and valve springs were deformed. Wood fragments were embedded in between some fractured cooling fins and around the top sparkplug. There were no pre-accident anomalies noted with the rockers or valve springs. Removal of the cylinder revealed corrosion on the piston, barrel and cylinder, but no pre-accident anomalies with any of the cylinder components.



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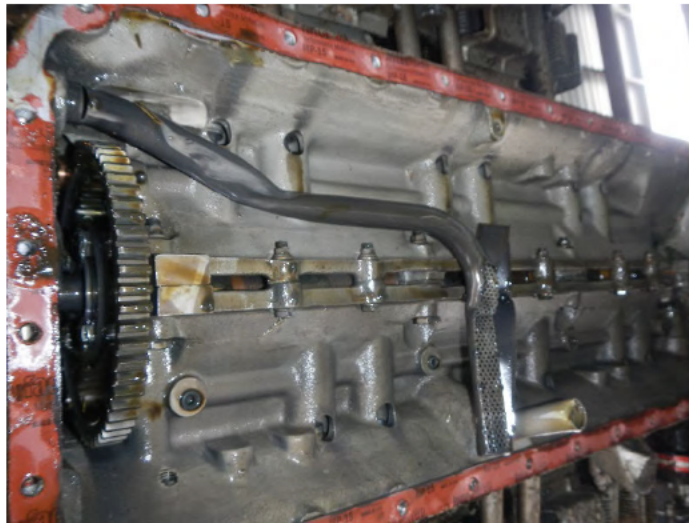
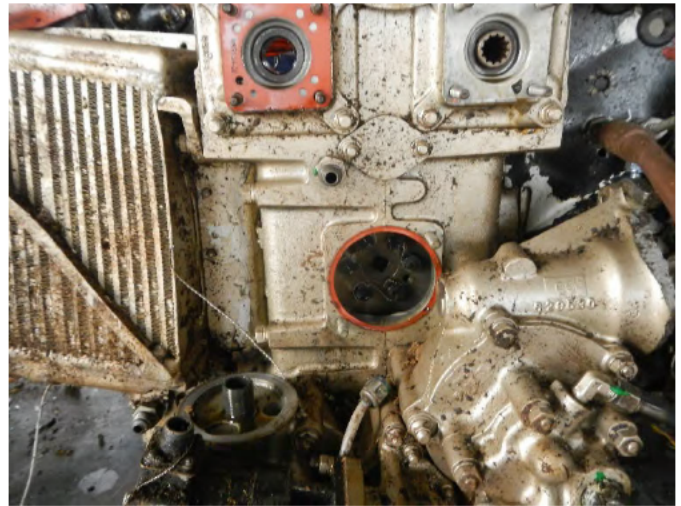
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CRANKCASE ASSEMBLY

CRANKCASE	Casting Number:	1-3-5: AEC653921	2-4-6: AEC653920	S/N: 2G382
Condition:	The crankcase halves remained attached and all the cylinders remained secured in place. There was a puncture from the outside-in over the #5 connecting rod area and wood debris was observed inside the crankcase in that area.			



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CRANKSHAFT ASSEMBLY

CRANKSHAFT

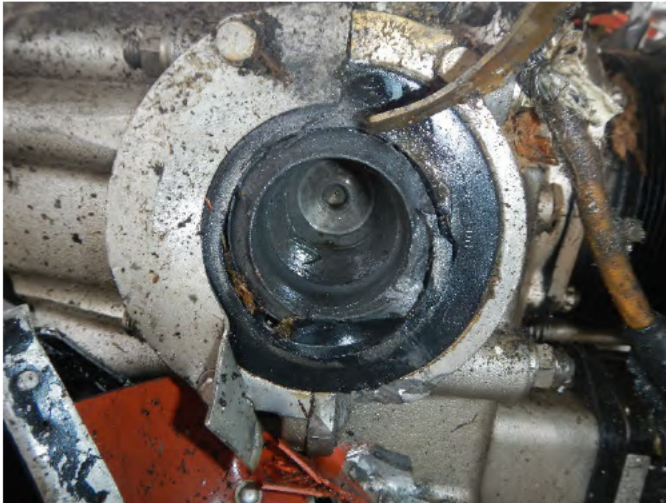
Forging Number: Unknown

S/N: N05DA110

Heat code: Unknown

Condition:

The crankshaft was fractured at the nose seal. The fracture was irregular and jagged consistent with overload. The alternator face gear remained attached to the crankshaft and no pre-accident anomalies were noted with the gear teeth. The crankshaft gear was bolted in place and the safety-wire was intact. The connecting rods remained secured in place and all rotated freely on the crankshaft when they were manually manipulated with no signs of discoloration or thermal distress. Once the wood debris was removed from the front of the crankcase, the crankshaft rotated freely with no binding noted from any of the main bearings.



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TRANSFER COLLAR

Condition:

The oil transfer collar was in place and did not display any pre-accident anomalies.



COUNTER WEIGHTS

Condition:

The counterweights remained secured to the crankshaft. There were no pre-accident anomalies noted with the counterweights.



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#1 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



#3 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



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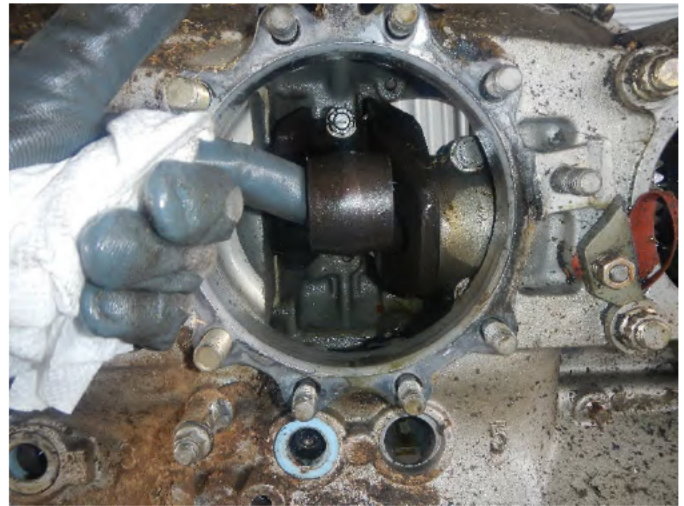
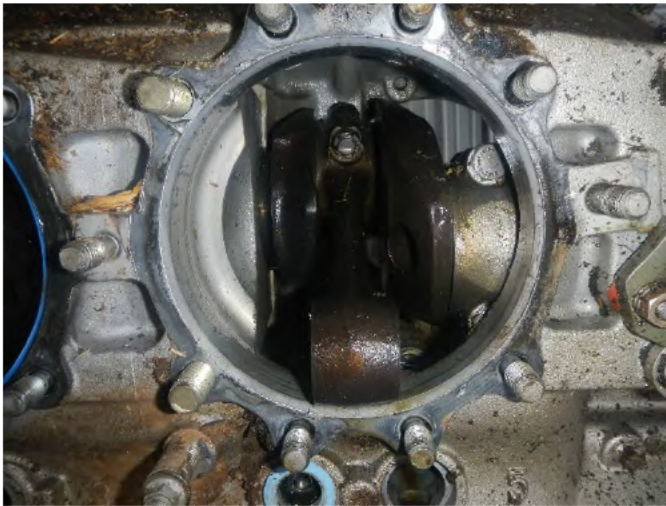
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#5 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



#2 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



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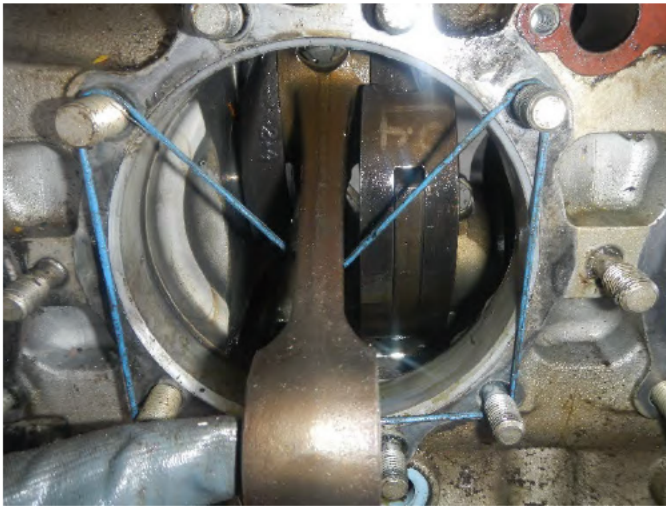
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#4 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



#6 CONNECTING ROD

Forging or Serial Number: 632041

Condition:

The connecting rod remained in place on the crankshaft with no signs of thermal discoloration or operational distress. Manual manipulation of the connecting rod during crankshaft rotation revealed no binding of the connecting rod bearing.



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CAMSHAFT

CAMSHAFT

P/N: Unknown

S/N: Unknown

Condition:

The camshaft remained intact with no pre-accident anomalies noted. Rotation of the crankshaft resulted in a coinciding rotation of the camshaft with no pre-accident anomalies noted on the gear teeth and lobes.

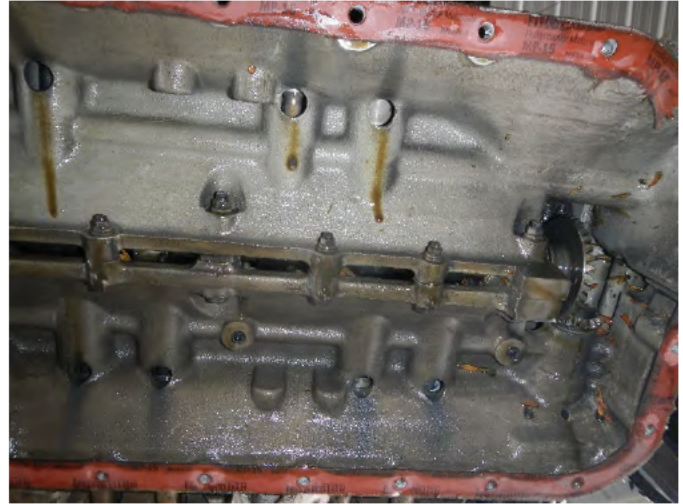


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Condition: The lifters did not display and pre-accident anomalies that would have affected their operation.

ACCESSORY GEARS

Condition: The accessory gears rotated freely during manual rotation of the crankshaft with no pre-accident anomalies or binding noted.

ACCESSORIES**STARTER**

Manufacturer: Not Observed

P/N: Not Observed

S/N: Not Observed

Condition: The starter was separated from the adapter and was not examined as part of this investigation.

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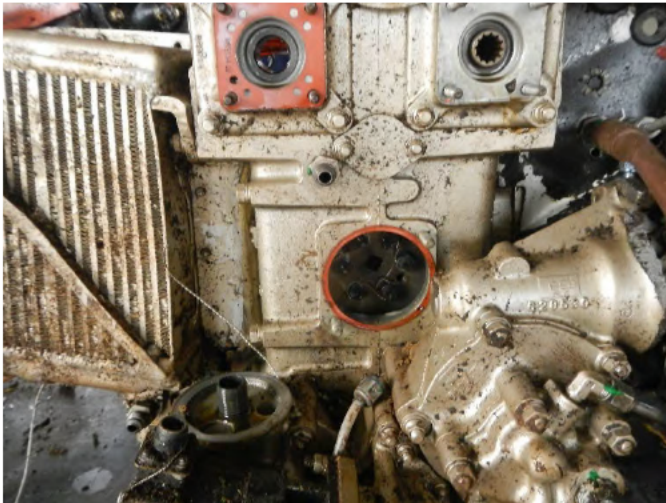
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STARTER ADAPTER

Condition:

The starter adapter remained secured to the backside of the engine and manual rotation of the crankshaft resulted in rotation of the adapter gear and scavenge pump.



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ALT/GEN #1

Manufacturer: Unknown

P/N: Unknown

S/N: Unknown

Condition:

The alternator was separated from the engine and the housing was fractured. There were no pre-accident anomalies noted with the alternator. The drive coupling remained secured in place, though it sustained impact damage to one side that deformed the cup and elastomer.



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VACUUM PUMP

Manufacturer: Airborne

P/N:442CW

S/N: 52733

Condition:

NOTE: the vacuum pump was disassembled at a separate wreckage examination and the photos below are from that examination (courtesy: Textron Aviation).

