



ENGINE RUN REPORT

ENGINE MODEL	IO-550-P (converted to a turbo normalized engine by Vitatoe Aviation)
ENGINE SERIAL NUMBER	1009768-R
AIRCRAFT MAKE & MODEL	Cessna P210N
AIRCRAFT SERIAL NUMBER	P21000018
AIRCRAFT REGISTRATION	N210PF
FILE NUMBER	18-162

NAME	SIGNATURE	DATE
Kurt Gibson		04/18/2019

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EXAMINATION		ACCIDENT DATA	
DATE	04/03/2019 – 04/04/2019	NTSB ACCIDENT #	CEN19LA363
FACILITY	Continental Aerospace Technologies	NTSB INVESTIGATOR	Jim Silliman
ADDRESS	2039 S Broad St Mobile, AL 36615	FAA INVESTIGATOR	Rick Love
		ACCIDENT DATE	09/01/2018
		ACCIDENT LOCATION	Crete, Nebraska

ENGINE INFORMATION

ENGINE POSITION	Front (Single engine)
TOTAL TIME	309.7
TIME SOH	N/A
TYPE & TIME SLI	40.1 since the last annual inspection
BUILD DATE	01/21/2014
IN SERVICE DATE	03/01/2014

Significant logbook information:

The engine had been converted from a normally aspirated IO-550-P to a turbo normalized IO-550-P by Vitatoe Aviation under STC SA02918CH on 03/01/2014 at a tachometer time of 3549.6. The engine was disassembled, inspected, and reassembled for an unpowered propeller strike on 02/02/2015 at an unknown tachometer time. On 07/27/2015 the Continental Motors fuel injectors were removed and GAMI injectors were installed per an STC (SE09963??). On 05/10/2017 the wastegate and exhaust system were repaired by Swink Aircraft Services at an engine total time of 193.4. The last annual inspection was performed on 05/16/2018 at an engine monitor time of 585.3 (engine total time of 272.1)

Report Summary:

Search Code(s):

15-12-68

The engine had been converted from a normally aspirated IO-550-P to a turbo normalized IO-550-P by Vitatoe Aviation un an STC. The engine was placed on a test cell and demonstrated the ability to operate normally and produce rated horsepower.

Disposition of engine following exam:

The engine was returned to JD Aviation in Crete, Nebraska

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NAME	Kurt Gibson	NAME	Phillip Grice
ADDRESS	Mobile, Alabama	ADDRESS	Mobile, Alabama
ORGANIZATION	Continental	ORGANIZATION	Continental
PHONE	██████████	PHONE	██████████
NAME	Jim Silliman	NAME	Ricardo Asensio
ADDRESS	Central Region	ADDRESS	Wichita, Kansas
ORGANIZATION	NTSB	ORGANIZATION	Textron Aviation
PHONE	██████████	PHONE	██████████
NAME	Lisa Jersild	NAME	Randy Bryant
ADDRESS	Mobile, Alabama	ADDRESS	Mobile, Alabama
ORGANIZATION	Continental	ORGANIZATION	Continental
PHONE	N/A	PHONE	N/A

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EXTERNAL INSPECTION OF ENGINE

The engine was sent in a crate and was mounted properly on all four engine mounts. The engine displayed minor impact damage signatures to the induction and the exhaust. The crankcase remained intact and there were no signs of a catastrophic internal engine failure. The propeller flange remained attached to the crankshaft and was undamaged. All six cylinders remained attached to their cylinder bays and were undamaged.

Both of the magnetos remained attached to their installation points and the magnetos were undamaged; however, one of the pressurization lines had broken free from one of the magnetos. The ignition harness remained attached to both of the magnetos and to each of the spark plugs; there were no signs of damage to the harness. All of the spark plugs remained installed in their cylinders and were undamaged.

The fuel pump remained attached to its installation point and was undamaged; the mixture control arm remained attached to the control shaft and was capable of normal movement. The throttle and metering assembly remained attached to its installation point and was undamaged; the throttle control arm remained attached to the control shaft and was capable of normal movement. The fuel manifold valve remained attached to its installation point and was undamaged. The fuel lines and nozzles remained secured and were undamaged. There were no signs of fuel leaks around any of the fuel components.

The turbocharger had been removed and was placed in the crate. The turbocharger was undamaged, and both the compressor and turbine blades were undamaged and were capable of normal rotation. The wastegate had been partially removed and was undamaged; it was noted that the pin that connects the actuator to the wastegate valve was missing (according to the FAA they had removed the pin during their initial examination and the pin was lost). The controller was secured to the engine by hoses and was undamaged. The overboost valve remained attached to its installation point and was undamaged.

The induction system displayed impact damage signatures to the rear induction pipes. Both of the intercoolers remained attached to the engine and displayed minor impact damage. There were no signs of induction leaks noted.

The exhaust system remained attached to the engine and displayed impact damage signatures. There were no signs of exhaust leaks or blockages noted.

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ENGINE PREPARATION PRIOR TO RUN

There were a number of airframe related items removed in preparation for operation on the CMI test bed.

Items removed:

1. Propeller governor
2. Both vacuum pumps
3. Backup alternator

The following substitute or repaired parts were required for engine operation:

1. Wastegate actuator to wastegate valve pin
2. Oil filter
3. Right side cylinder drain lines
4. Turbocharger oil return fitting
5. Induction scoop

The cylinders were borescoped and the following was observed:

All of the cylinder bores, valve heads and piston faces displayed normal operating and combustion signatures. There were no anomalies noted.

The top spark plugs were removed and visually inspected. All of the top spark plug electrodes were black in color and displayed significant soot deposits. The bottom spark plugs were inspected using a lighted borescope and displayed similar deposits.

The magneto-to-engine timing was checked and with the following results:

Magneto-to-Engine Timing (Specified):	Left Magneto:	Right Magneto:
22°BTDC	23°BTDC	22°BTDC

A cylinder leakage test was performed prior to the test run in accordance with the latest revision of CMI Service Bulletin SB03-3 with the engine at room temperature with the following results (master orifice reading – 42 PSI):

Cylinder #1 - 30/80 PSI (rings)

Cylinder #2 - 27/80 PSI (exhaust valve)

Cylinder #3 - 11/80 PSI (exhaust valve)

Cylinder #4 - 62/80 PSI (rings)

Cylinder #5 - 14/80 PSI (exhaust valve)

Cylinder #6 - 61/80 PSI (rings)

(*) – Leakage Source

The engine was not disassembled prior to the engine run. The crankshaft end-play measured 0.012" and the run-out was 0.005". The deflection was measured to be 0.008"

The engine was then prepared for operation by installing the appropriate thermocouples, pressure lines and test pads for monitoring purposes. The engine was then moved to CMI test cell number 43 and mounted for operation. The engine was fitted with a test club propeller for the IO-550-P engine model.

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DESCRIPTION OF RUN

The engine started without hesitation or stumbling. The engine was warmed up to operating temperature and the engine was advanced; it was noted that the engine began to stumble at higher RPM and manifold pressure settings. It was determined that the turbocharger installation required induction scoop to prevent the compressor from cavitating in the test cell. An induction scoop was installed onto the turbocharger and the engine was restarted. The engine RPM was advanced to 1200 RPM and was held for five minutes to stabilize. The engine was then advanced to 1600 RPM and held for five minutes to stabilize. The engine RPM was then advanced to 2100 RPM and held for five minutes to stabilize; during this period a magneto check was performed, and the magnetos operated normally. The engine RPM was then advanced to 2450 RPM and held for five minutes to stabilize. The engine throttle was then advanced to full open and held for five minutes to stabilize. The engine RPM stabilized at 2676 RPM and the manifold pressure stabilized at 32.54" Hg. The fuel flow at full throttle was noted to be 201.68 lbs/hour (approximately 33.61 gallons per hour), and the unmetered fuel pressure was 20.31 psi. The specifications in the Vitatoc STC Instructions for Continued Airworthiness specified an RPM of 2700 RPM (+/- 25 RPM), a maximum manifold pressure of 31.0" Hg (+/- .2" Hg), a full throttle fuel flow of 35-37 GPH, and full throttle unmetered fuel pressure of 19-23 psi. According to the Continental Motors M-0 standard practices manual the IO-550-P should have the following: maximum RPM of 2700 RPM, unmetered fuel pressure of 28.0-30.0 psi, and a fuel flow of 25.6-27.3 gph. There is no specification for manifold pressure for an IO-550-P due to the engine being a normally aspirated engine.

After running the engine at full power, the engine RPM was brought back to a lower RPM and was advanced quickly to full throttle several times. The engine did not stumble or hesitate and was capable of normal operation.



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POST ENGINE RUN DESCRIPTION

A cylinder leakage test was performed after the test run in accordance with the latest revision of CMI Service Bulletin SB03-3 with the engine hot with the following results (master orifice reading – 42 PSI):

Cylinder #1 - 60/80 PSI (rings)

Cylinder #2 - 54/80 PSI (rings)

Cylinder #3 - 55/80 PSI (rings)

Cylinder #4 - 62/80 PSI (rings)

Cylinder #5 - 59/80 PSI (rings)

Cylinder #6 - 51/80 PSI (rings)

(*) – Leakage Source

After the engine run had concluded it was decided to ship the controller, wastegate, and overboost valve to Hartzell for examination and testing. Refer to the Hartzell Report for additional information.

ENGINE RUN PARAMETERS

Time		RPM	MP / TDP "Hg	Oil		Fuel				Cell °F	Cylinder Head Temperature °F					
Reading	Minutes			PSI	°F	Lbs/Hr	Nozzle PSI	Pump PSI	Fuel °F		# 1	# 2	# 3	# 4	# 5	# 6
1	5	1200	12.55/30.20	64	145	21.87	4.21	10.46	64	59	279	237	269	217	217	149
2	5	1600	16.70/30.23	58	137	36.48	4.45	13.97	65	59	324	264	289	244	231	186
3	5	2100	24.49/30.32	59	85	89.63	6.22	19.36	66	59	334	291	307	265	247	208
4	5	2450	27.64/30.43	58	77	139.18	8.75	24.85	67	59	372	320	338	294	288	242
5	5	F/T 2676	32.54/30.31	35	81	201.68	12.98	20.31	67	58	387	362	349	271	298	245
6	5	Idle 675	14.71/30.17	12	70	9.93	4.18	7.5	63	59	294	278	239	240	191	169
7	5		/													
Ambient Air Temperature °F		Ambient Air Pressure		Transfer Collar Δ P		Maximum Rated Power Engine Operational Parameters for an IO-550-P without being modified by a STC										
63.8		29.67		IN	OUT	RPM		"Hg MP		Fuel Flow Lbs/Hr		Metered PSI		Unmetered PSI		
				20	24	2700		-		150 – 160		19.0 – 21.3		28.0 – 30.0		

Notes: Operator – Lisa Jersild. Transfer collar pressure delta measured at full throttle power setting. Oil temperature reading became unreliable.

Engine Performance Test				
Test RPM	Left Magneto	Left Magneto	Right Magneto	Right Magneto
	RPM	RPM Drop	RPM	RPM Drop
2100	2080	20	2068	32