

CEN22LA312

POWERPLANTS

Group Chair's Factual Report - Attachment # 1

PWC Service Investigation Accident/Incident Report No.: 23ECN00007, Engine
Accessories Investigation

October 24, 2023



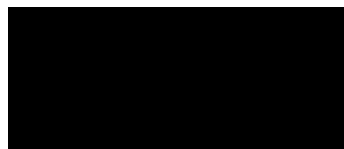
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Engine Controls Accessories Technical Support
Accessories Investigation

Report No.: 23ECN00007

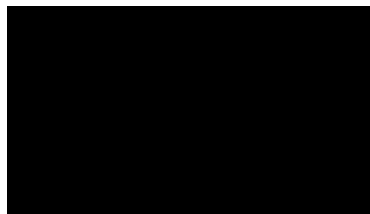
Adams aerial solutions LLC
Air tractor AT502B, N5850R
USA
Event Date 11 July 2022
PT6A-34AG, Serial No. PH0288

Written By:



Air Safety Investigator, Engine Controls Accessories Technical Support

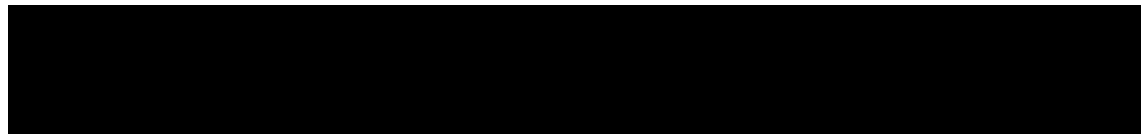
Approved By:



Manager, Service Investigation Department

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This report is in support to the engine review.

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EXPORT CONTROL CLASSIFICATION		LOCATION	U.S. REGULATION	
			EAR	ITAR
		U.S.	P-ECCN 9E991	P-USML NSR
		OUTSIDE U.S.	ECCN NSR	USML NSR
			LOCAL REGULATION	
Date of marking		CANADA	EIPA (ECL)	DPA (CG)
			NSR	No



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1. Accident synopsis:

On 11 July 2022, aircraft N5850R was involved in an accident. The pilot reported a loud bang followed by a loss of power on the takeoff leg and made a forced landing into a bean field. The aircraft struck an airport perimeter fence causing damage to both wings. The pilot was not injured.

2. Summary of findings and discussion:

The investigation encompassed the as received visual inspection, and as received testing of the fuel nozzle set and the fuel control unit (FCU) listed in the table Hardware investigated in the report section 4. The FCU was partially disassembled to inspect the bellows, governing system and the air section. The visual inspection and testing of the fuel nozzle set showed typical deviations of units in operation being returned for maintenance as reflected by light black deposit on some of the nozzle tips including presence of streaks and voids in the spray pattern. The FCU external surface was dirty mainly on the bellows side. The as received testing showed that the acceleration schedule including the minimum fuel flow were above the component maintenance manual (CMM) requirements. The maximum Ng speed and the idle speed were above the CMM requirements. Those adjustments are permissible field adjustment per the engine maintenance manual (EMM). The idle reset speed was adjusted low, being also a permissible field adjustment. The manual override fuel flow output was above the CMM requirements. Except for the governing drop slope, the FCU was calibrated back to the manufacturing settings using the permissible field adjustments, the metering valve sleeve and minimum fuel flow adjustment. Partial disassembly of the FCU revealed an unremarkable bellows and governing system. Light dark deposit was observed on the governor lever Py pad. Testing and partial disassembly showed that the FCU was fully operational, however it was recalibrated, and field adjusted with the possibility of delivering fuel flow output slightly above the manufacturing settings.

3. Conclusion:

There were no defects or damage evident that would have prevented normal operation prior to the event.

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4. Investigation results:

Conducted at: Pratt & Whitney Canada Saint-Hubert facility.

Initiated on: 26 April 2023

In attendance:

Name	Representing	Title
[REDACTED]	Transportation safety board of Canada	Senior Technical Analyst / Systems and Engineering Science
[REDACTED]	Pratt & Whitney Canada	Air Safety investigator

Hardware investigated.

Accessory	P&WC P/N	Manufacturer	Manufacturer P/N	S/N	Times/cycles
FCU	N/A	[REDACTED]	4138008-3	C75144	Unk
Fuel nozzles	3010036	PW&C	N/A	N/A	Unk

Fuel control unit:

External condition and attachments:

The as received condition showed dirty external surfaces mainly on the bellows side, which was exposed to the starter generator, a thicker layer of black deposit was observed (Figure 1). The identification (ID) plate revealed that the unit was overhauled by [REDACTED] on 12-02-20. There was an [REDACTED] Federal Aviation Administration (FAA) repair station [REDACTED], EASA Part-145 Approval, service label on the acceleration adjustment cup. The indexing mark on the acceleration adjustment cup was in line with the datum on the bypass valve housing. The part power trim was in the stowed position (normal). There was a rubber assembly label present on the flow body housing marked 02/2020 indicating that the rubbers, O-rings, and diaphragm, were replaced in February 2020, corresponding to the overhaul date on the ID plate. All levers were moving by hand on their full travel. The driveshaft was rotating by hand with the typical resistance. No signs of bearing wash out were visible on the drive shaft bearing retaining plate. The maximum Ng stop adjustment screw was measured to 0.235", indicating that it was adjusted to increase the maximum Ng governing speed (permissible field adjustment). The idle speed adjustment lockwire was of a different size compared to the other ones suggesting that the idle speed was adjusted (permissible field adjustment). The air inlet adaptor P3 port was clean. The Py port showed some debris in the threads (Figure 2), though the Py port bottom cavity was clean.



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The lockwire seals were installed at the right locations per the [REDACTED] (CMM) 73-20-64 Rev. 02; however, they were not installed correctly. The seals were installed between the two attaching points instead of being fitted after the last attaching point (Figure 3).

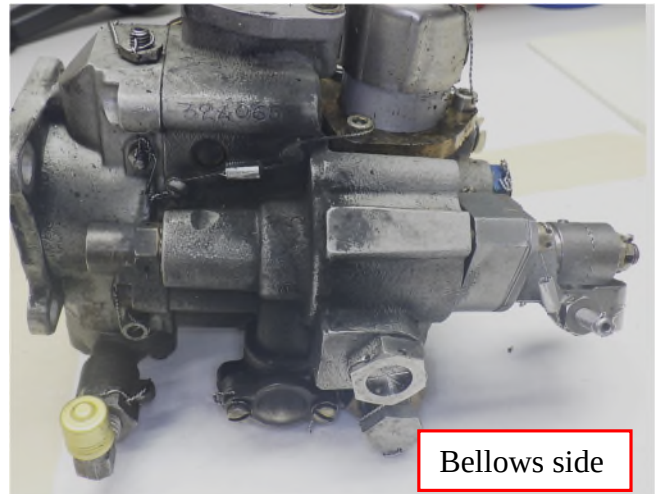


Figure 1



Figure 2



Figure 3

Test results:

Prior testing the unit, once installed on the test bench (Figure 4), the air leak check, using the Leak-Tech fluid, identified light bubbling coming from the torsion shaft adjustment screw on the bellows side (Figure 5). The FCU setting were adjusted to a high-power condition. The fuel flow was monitored for 5 minutes and no fluctuation nor increase or decrease was noted, indicating that the bellows are not leaking. The FCU was tested per the [REDACTED] CMM 73-20-64 Rev.02 and the following observation were noted.

The metering valve orifice and bypass valve differential pressure setting test point (T.P.) 2.01 was 4 pounds per hour (PPH) above the CMM maximum limit.

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T.P. 2.02, minimum fuel flow was 5 PPH above the CMM maximum limit. T.P. 2.03 was 14 PPH above the CMM maximum limit. T.P. 2.04, maximum fuel flow, was 30 PPH above the CMM maximum limit. The enrichment spring setting T.P. 3.02 was 13 PPH below the CMM minimum limit. T.P. 4.01 was 7 PPH above the CMM maximum limit. The governor spring setting T.P. 5.01 was 45 PPH above the CMM maximum limit. This is a permissible field adjustment. The drive shaft speed was increased by 100 RPM to bring the fuel flow within limit. T.P. 5.02 was 22 PPH below the CMM minimum limit. The idle speed setting and throttle pick-up angle T.P. 6.01 was 14 PPH above the CMM maximum limit. This is a permissible field adjustment. The low-end acceleration and throttle movement effect T.P. 7.02 was one PPH above the CMM maximum limit.

The maximum idle reset stop adjustment T.P. 8.01 was 68 PPH below the CMM minimum limit. This is a permissible field adjustment. The manual override T.P. 9.01 was 28 PPH above the CMM maximum limit. The dimension “X”, distance from the bypass valve collar and the acceleration adjustment cup, was measured to 0.460”.

Following the as received test, the permissible field adjustments were calibrated to the manufacturing settings except for the governing drop that was slightly below the CMM minimum limit. Further testing was carried out to understand the deviations noted on the acceleration schedule. The acceleration adjustment (permissible field adjustment) was rotated one full turn counterclockwise to reduce the fuel schedule. The reduction in fuel flow brought some of the acceleration schedule test points within limit. To calibrate the fuel schedule within the CMM specification, the metering valve sleeve (not a permissible field adjustment) was slightly rotated inward to reduce the fuel flow output, and the acceleration adjustment cup was returned to three click counterclockwise from the datum mark on the bypass valve housing. The metering valve calibration corrected the manual override maximum fuel flow output and the low-end acceleration T.P 7.02, meeting the CMM requirements. The minimum fuel flow was adjusted to the CMM limit using the metering valve minimum stop (Not a permissible field adjustment).

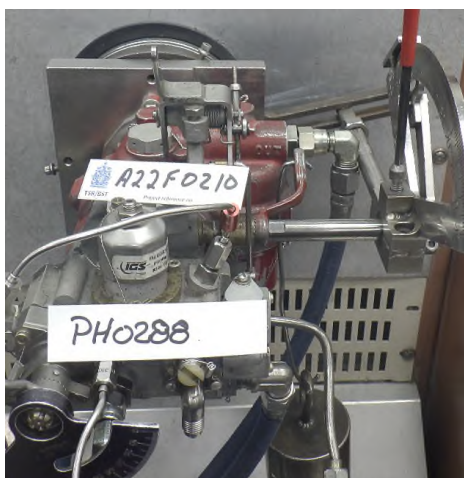


Figure 4

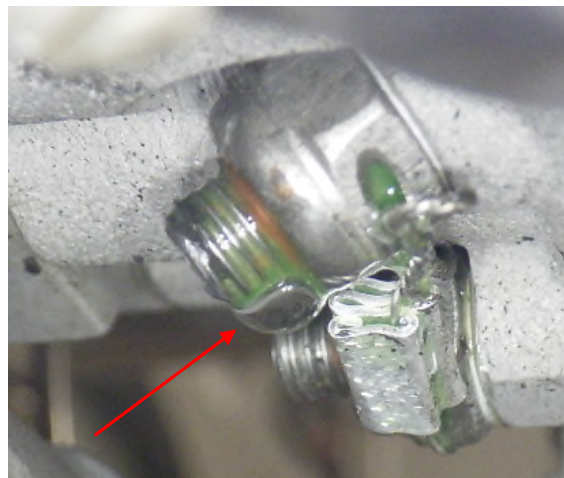


Figure 5

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Disassembly:

The FCU was split at the drive / flow body flange to inspect the governing system components and the FCU air system cleanliness. The governor system components were in good conditions. The governor lever Py pad showed some black deposit (Figure 6). The bleeds and orifices were not obstructed (Figure 7). The governor lever Py pad along with the bleeds and orifices were cleaned. The unit was re-assembled, and the governing drop was checked without change. A Py orifice class change would be required to calibrate the FCU within the CMM requirement. Finally, the bellows S/N: C19452 manufactured in 2016 was removed (figure 8). The dimension “A”, evacuated bellows length, stamped on the governor bellows end plate was 1.0166”, the measured dimension “A” was 1.0222”, meeting the CMM limits. The governor bellows leak check was satisfactory (Figure 9).



Figure 6



Figure 7



Figure 8



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Figure 9

Fuel nozzles:

External condition and attachments:

The as received visual inspection showed that the fuel nozzles installed from position 10 to 14, pilot view clockwise, had a light film of black deposit on the nozzle tips (Figure 10). The fuel nozzles position # 3, # 8, and # 13 locking tab washers were not installed as per the CMM requirements. The locating pin on the adaptor position # 11 was slightly shorter compared to the other ones.

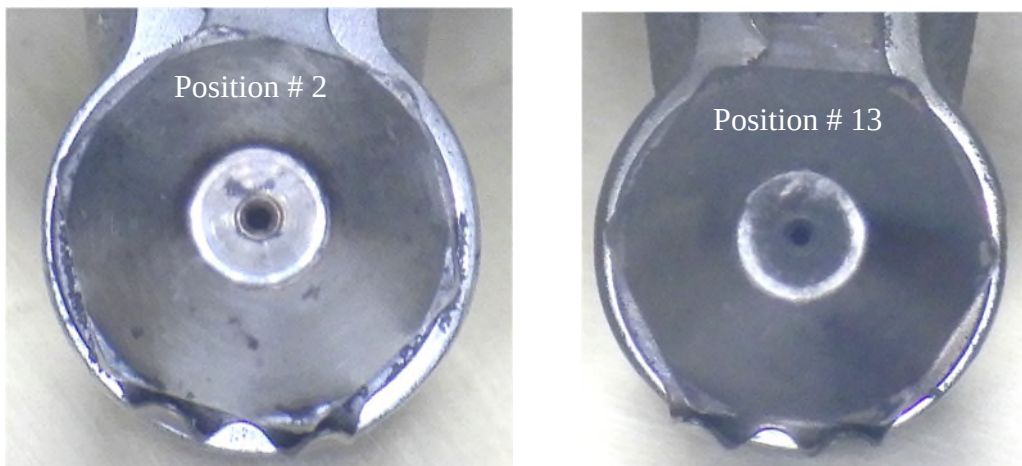


Figure 10



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Test results:

Testing demonstrated that the fuel nozzle installed at the position # 6 was 0.2 PPH below the minimum limit. The fuel nozzle installed at the position # 4 showed a spray angle of two degrees below the minimum limit. The spray quality of each nozzle's tips showed streaks and voids to different degrees typical of nozzles that had accumulated running time (Figure 11). There was no spitting nor drooling detected and the pressure test was satisfactory for each of them.

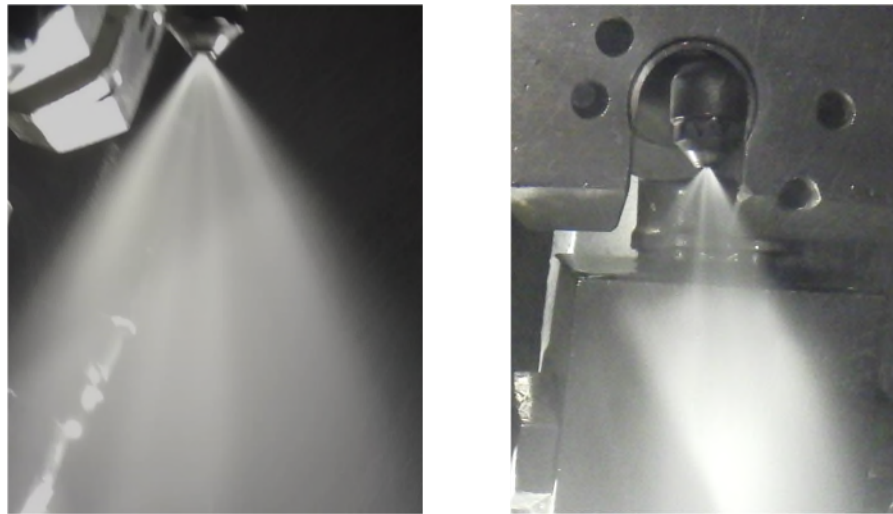


Figure 11