



The National Transportation Safety Board

Office of Aviation Safety
Central Region
Memorandum for the Record
Engine Accessories
Examinations
CEN19FA161
Butler, Missouri
June 10, 2019

Detailed examinations of the engine accessories were conducted at Pratt & Whitney Canada, under the direct supervision of the Accredited Representatives of the Transportation Safety Board (TSB) of Canada. The accessories were examined and returned to Dodson International, Rantoul, Kansas. The examination findings were reported to the NTSB by the TSB.

In Attendance:

Name	Representing	Title
Jimmy Cancino 15 December 2020	Transportation Safety Board of Canada	Regional Senior Investigator - Technical / Air Investigations- Quebec
Thierry Bélanger 17 June 2021	Transportation Safety Board of Canada	Regional Senior investigator Technical / Air Investigations- Quebec
Jean-Marc Limoges	Pratt & Whitney Canada	Air Safety investigator

Components Examined

Items	P&WC P/N	Manufacturer	Manufacturer P/N	Serial Number	Times/cycles
Engine S/N: 12387 Position: Right					
FCU	3027049	Honeywell	3244745-2	A72825	Unknown
Fuel Pump	3031791	Sundstrand	025323-150	416	Unknown
Propeller Governor	3074156-01	Woodward	8210-025-01	2455736	Unknown
Overspeed Governor	None	Woodward	210624Y	1287474	Unknown
Engine S/N: 12389 Position: Left					
FCU	3027049	Honeywell	3244745-2	A91262	Unknown
Fuel Pump	3031791	Sundstrand	025323-150	1170	Unknown
Propeller Governor	3074156-01	Woodward	8210-025-01	2456541	Unknown
Overspeed governor	None	Woodward	210624Y	1810139	Unknown

SUMMARY

- Both left engine and right engine fuel control units (FCU's) that were disassembled showed no pre-existing mechanical anomalies that could have prevented operation. Some contaminants were found in the Py air sections of both FCU's. According to the manufacturer, if an FCU's Py bleed was partially restricted with debris, modulation of power could be altered. However, even though some contaminants were found, the Py bleed were found free of restriction or blockages at the time of the examinations.
- Examinations of the fuel pumps, propeller governors, and overspeed governors of both engines did not reveal any mechanical anomalies that could have prevented operation.

DETAILS

Right Engine FCU S/N A72825

- Note: This unit was on the engine at initial engine delivery
- Due to the impact damage, the fuel control unit could not be tested.
- The fuel pump was attached to the FCU. The fuel line between the FCU and the fuel pump was present. A partially illegible rubber assembly date label was present on the flow body housing (xx-xx-95). The FCU external surface was covered with a gray and black deposit. The throttle shaft was bent but was moving by hand with a good resistance. The airframe bracket installed on the FCU condition lever was bent. The condition lever was rotating on its entire travel. The fuel outlet fitting, and the cut-off valve assembly seat were missing. The bolt head of one of the two bolts of the outlet port fitting retaining plate was sectioned. The sectioned bolt head was attached to the lockwire. The threaded portion of the sectioned bolt was in the housing bolt hole. The flow body housing was fractured at the outlet port. A section of the housing was missing. The fuel line going from the fuel pump to the FCU was removed to allow separation of both units. Fuel remain was present. The fuel pump was separated from the FCU. The coupling was present and in good condition.
- Lockwire and seals were present. The idle adjustment lockwire was from a different size and not done adequately. There was no lockwire from the adjustment screw to the adjustment jam nut. The throttle adjustment screw lockwire was from a different size.
- The FCU driveshaft was rotated by hand and no resistance in the rotation was noticeable. Usually, the driveshaft will not spin freely, some resistance will be felt. This condition could be due to a lack of grease in the bearings. The condition lever assembly with the airframe bracket along with the throttle stop lever assembly were removed and the unit was sent to the machine shop to cut-off the bent throttle shaft. During the throttle shaft removal, a punch and a hammer was used to push out the shaft from the housing. Throughout the removal process, the lever harm governor spring attaching point was fractured. The fracture surface was clean, and the surface had the characteristic of an overload fracture. The air inlet adaptor was removed and visually inspected. The P3 inlet port revealed presence of debris concentrated in the vicinity of the Py orifice. The Pa orifice in the P3 port was not obstructed but there was black deposit present. The Px fluted pin and cap were dirty. The Py orifice was dirty. The orifice was not obstructed but the deposit was reducing the orifice size. The Py port showed presence of an oily liquid, a large black deposit, a large whitish crystal and several of a smaller size brownish crystal. The Py bleed in the drive body housing on the air inlet adaptor was dirty but not obstructed. The Py bleed section in the drive body was covered with black deposit. The black deposit was mainly on the mating

face with the governor lever pad. The governor lever Py pad was also showing a thick layer of black deposit.

The driveshaft and cap bearing were from the first generation (open on one side) and the grease present was minimal explaining the free rotation of the drive shaft. One of the two driveshaft flyweights was not moving under the gravity effect. The other one had some limited movement. The Teflon tube was in good condition. There was an orange particle in the air side ration arm cover. The fuel inlet screen was clean. Both ration arms were straight. The bellows S/N: 3523631 was removed. The governor bellows leak test was satisfactory. The acceleration bellows dimension "A" stamped on the governor bellows end plate was 1.0167" and was measured to 1.0192" which was meeting the CMM requirement. The torsion shaft assembly was removed, and satisfactorily pressure tested. The bypass valve diaphragm manufacturing date was 1995 matching the 95 on the rubber assembly date label. The diaphragm was in good condition.

Right Engine Fuel Pump S/N 416

- Note: This unit was on the engine at initial engine delivery.
- Due to the impact damage, the fuel control unit could not be tested.
- The external surface was covered with gray and black deposit. The input shaft was rotating using pliers. The input coupling splines had black deposit. An illegible rubber assembly date was present on the filter bowl.
- The lockwire between the filter bowl and the main housing was missing. The other lockwire were present and in good condition.
- Prior to testing the unit, the fuel filter bowl was removed, and the fuel remain was collected. The fuel sample did not show any particles in suspension nor presence of water. There was no debris between the fuel filter pleats. The inlet screen was removed and was visually inspected. There was no contaminant present. The fuel filler and fuel inlet screen cavities were both clean. The unit was tested in accordance with the Hamilton Sundstrand CMM 73-10-02 rev 17. The filter bypass valve leakage was 35 cc above the limit. There was no leakage at the beginning of the test All the other test were satisfactory.
- The bypass valve was removed. Burnishing on the plunger and the sleeve was observed. There were circular contact marks at the mating surface of both components. The spring was in good condition. There were 2 spacers present.

Right Engine Propeller Governor S/N 2455736

- Note: Unable to determine if this unit was on the engine at initial engine delivery. Not recorded in the build sheet.
- There was localized black deposit on the external surface. The inlet screen was clean. The reset lever linkage was still attached to the reset lever. The reset lever was moving by hand on its entire range and was returning to the maximum speed stop under the internal spring tension. The speed lever was moving freely and returning to the maximum speed setting under the spring tension. The beta valve was moving on its full travel. The input shaft was rotating by hand. The pilot valve was moving. The Py port fitting was clean. There was an IGS label on the electrical cover. The connector and contact pins were in good condition.

- The relief valve lockwire seal was not at the right location. There were remains of the anti-tamper paint at the reset lever maximum stop, speed adjusting shaft assembly and the eccentric adjustment.

Right Engine Overspeed Governor S/N 1287474

- Note: Unable to determine if this unit was on the engine at initial engine delivery.
- The external surface was covered with black deposit. On some portion of the unit the black deposit was also oily. The feathering and reset solenoids connectors shell and contacts were in good condition. There was one screw missing on the feathering solenoid connector. The oil inlet and outlet port were clean. The input shaft was rotating by hand and the pilot valve was also moving.
- There was a seal on a lockwire between two cover bolts. There were remains of Yellow anti-tamper paint on the speed adjustment screw. The other bolts were properly secured.

Left Engine FCU S/N A91262

- Note: This unit was not on the engine at initial engine delivery.
- The FCU was assembled with the fuel pump. The fuel line connecting the fuel pump to the FCU was bent towards and touching the fuel pump. The fuel line elbow connecting to the fuel pump was bent. The FCU external surface was lightly soiled. The rubber assembly date label was peeling off and was illegible. There was a damaged Dallas Airmotive label present. The throttle shaft was bent but moving with some resistance. The bracket installed on the condition lever was slightly bent. There was a gap at the mating flange of the flow and drive bodies. The fuel line going from the fuel pump to the FCU was removed to allow separation of both units. Fuel remain was present. The fuel pump was separated from the FCU. The coupling was present and in good condition.
- The lockwire on the idle speed adjustment was not properly done. The wire going from the adjustment screw to the locking nut was missing. The other lockwire were at the right location and in acceptable condition.
- The FCU driveshaft was rotated by hand and no resistance in the rotation was noticeable. Usually, the driveshaft will not spin freely, some resistance will be felt. This condition could be due to a lack of grease in the bearings. The air inlet adaptor was removed and visually inspected. The P3 inlet port revealed presence of debris, brownish crystals that were covering most of the internal passage surface. The Pa orifice in the P3 port was not obstructed but there was black deposit and brownish crystals present. The Px fluted pin and cap were dirty. The Py port showed presence of an oily like liquid with white crystals of different size. The Py orifice was dirty. The orifice was not obstructed but the deposit was reducing the orifice size. The Py bleed in the drive body housing on the air inlet adaptor side was dirty but not obstructed. The Py bleed section in the drive body was covered with black deposit. The black deposit was mainly on the mating face with the governor lever pad. The governor lever Py pad was also showing a layer of black deposit.

The driveshaft and cap bearings were from the first generation (open on one side) and the grease present was minimal explaining the free rotation of the drive shaft. Both driveshaft flyweights were not moving under the gravity effect. The flyweights were removed from the drive shaft revealing a black deposit at the pivot point. The Teflon tube was in good condition. The fuel inlet screen showed present of light contamination, similar to fibers. Both ration arms were straight. The bellows S/N: FVF17A3569 was removed. The governor bellows leak test was satisfactory. The acceleration bellows dimension "A"

stamped on the governor bellows end plate was 1.0229” and was measured to 1.0262” which was meeting the CMM requirement. The torsion shaft assembly was removed, and satisfactorily pressure tested. The bypass valve diaphragm manufacturing date was 1995. The diaphragm was in good condition.

Left Engine Fuel Pump S/N 1170

- Note: This unit was not on the engine at initial engine delivery.
- The external surface was lightly soiled. The mounting flange was fractured, and the missing pieces were not received. The input coupling was fractured. The splines section mating with the engine gear was missing. There was an illegible label on the fuel filter bowl. The input shaft was rotating using a plier. Due to the impact damages the fuel pump could not be tested.
- The lockwire were present and in good condition.
- The fuel filter bowl was removed, and the fuel remain was collected. The fuel sample did not show any particles in suspension nor presence of water. There was no debris between the fuel filter pleats. The inlet screen was removed and was visually inspected. There was no contaminant present. The fuel filler and fuel inlet screen cavities were both clean. The fuel pump cover was removed to get access to the bushing and gears. There was light pitting on the bushing faces in contacting with the gears. Light circular score marks were visible. The drive gear input shaft was slightly bent. There was no pitting in the housing gear pocket and the gear wipe marks in the housing was normal. The bypass pressure regulating valve and the fuel filter bypass valve were noted with burnishing on the plunger and the sleeve. There were circular contact marks at the mating surface the plungers and sleeves. The springs were in good condition. There were 2 spacers present in the fuel filter bypass valve plunger.

Left Engine Propeller Governor S/N 2456541

- Note: Unable to determine if this unit was on the engine at initial engine delivery. Not recorded in the build sheet.
- The external surface was generally clean. There was an IGS label on the cover protecting the electrical components. The reset linkage was attached to the reset lever. The reset lever was rotating by hand on its full travel and was returning to the maximum speed stop by the internal spring tension. The beta valve was moving freely. The speed lever was moving by hand on its full travel and was returning to the maximum speed stop under the spring tension. The input shaft was rotating by hand and the pilot valve was moving. The inlet screen was clean.
- The high-pressure relief valve lockwire seal was not at the right location. The yellow anti-tamper paint was present on the eccentric adjustment, the maximum reset adjustment screw and the speed adjusting shaft assembly.

Left Engine Overspeed Governor S/N 1810139

- Note: Unable to determine if this unit was on the engine at initial engine delivery.
- There was light black deposit on the reset solenoid adaptor. The remaining of the unit external surfaces was lightly dirty. There was an IGS label on the cover housing. The input shat was rotating by hand and

the pilot valve was moving. The oil inlet and outlet ports were clean. The reset and feathering solenoid connectors were both in good condition.

- There were remains of yellow anti-tamper paint on the speed adjustment. There was one seal between two cover bolts. The other lockwire were present and in good condition.
-

Alexander Lemishko



Senior Air Safety Investigator
NTSB Central Region Aviation