

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 20, 2021

Attachment 1 – Pratt & Whitney Canada Accessories Accident Report

POWERPLANTS

CEN20LA402

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

Customer: Piper Aircraft
Engine Model: PT6A-34, **Serial No.:** RB0095
Time Since New (TSN): Unknown
Cycles Since New (CSN): Unknown
Time Since Overhaul (TSO): Unknown
Cycles Since Overhaul (TSO): Unknown
SI RFA No.: 20SIE00248 **P&WC File No.:** 20-133

This report is to support the engine review regarding an accident that occurred on 20 September 2020.

1.0 Event:

The pilot was cruising at FL190 when he reported engine problems and his intentions to divert. The airplane impacted near vertical ½ mile short of the diversionary airport. The pilot and 3 passengers received fatal injuries.

2.0 Summary of findings:

Investigation of the accessories involved inspection and testing of the fuel pump, flow divider valve (FDV) and over-speed governor (OSG), and inspection and disassembly of the fuel control unit (FCU) and propeller governor (CSU) in the presence of representatives from the Transportation Safety Board of Canada (TSB). Impact damage precluded testing of the FCU and CSU. Testing of the fuel pump was unremarkable. Testing of the OSG was conducted at Woodward in the presence of the National Transportation Safety Board. The results were unremarkable. Observations recorded during testing of the FDV indicated that the dump-valve was opening before the secondary transfer valve. This may have been a consequence of the impact. Had this condition been present prior to the event it could have contributed to a hung-start.

3.0 Conclusion:

Other than impact damage there were no defects or damage evident on the investigated accessories that would have prevented normal operation prior to the event.

EXPORT CONTROL CLASSIFICATION	LOCATION	U.S. REGULATION	
		EAR	ITAR
	U.S.	P-ECCN 9E991	P-USML NSR
	OUTSIDE U.S.	ECCN 9E991	USML NSR
		LOCAL REGULATION	
	CANADA	EIPA (ECL)	DPA (CG)
		5400	NSR

This document has been cleared for posting on the National Transportation Safety Board docket.

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

4.0 Investigation:

Conducted at: Pratt & Whitney Canada

Initiated on: 08 June 2021

In attendance:

Name	Representing
Thomas Armstrong	Transportation Safety Board of Canada
Dave Barnard	P&WC
Marc Hamilton	Transportation Safety Board of Canada

List of Accessories:

Accessory	P&WC P/N	Manufacturer	Supplier P/N	S/N	Times/cycles
Fuel pump	3034794	Eaton	386100	1403	Unknown
Fuel control unit (FCU)	3122696-03	Honeywell	3244809-8	C25444	Unknown
Flow divider and dump valve (FDV)	3019906	Triumph	25536-4	20368	Unknown
Propeller governor	3035926	Woodward	8210-002AF	12350694AE	Unknown
Over-speed governor (OSG)	None	Woodward	210632	1440813	Unknown

Accessory: Fuel pump

Note: This unit was on the engine at original engine delivery.

Investigation Results:

The exterior of the fuel pump was soiled (figure 1). The driveshaft turned with typical resistance, but rotation was restricted. The fractured fuel control unit (FCU) drive-body was attached to the mounting face of the pump (figure 2). One of the FCU attachment nuts was not completely tightened and the washer was missing. The FCU drive-body was removed to ascertain the cause of the restricted rotation. Following removal of the FCU drive-body remains from the fuel pump full rotation of the fuel pump driveshaft was restored. There was no evidence of bearing grease dilution at the fuel control unit mounting flange. There were gouges on the exterior of the outlet filter bowl. There was a label marked 1 INCH around the outlet filter bowl.

Lockwire was missing from the outlet filter bowl and the bowl could be removed by hand. The outlet filter element was present. The pleats were darkened but there was no obvious debris in the pleats (figure 3). There was typical dark powdered residue in the filter head and the filter bowl (figure 4). Lockwire was present at all other locations.

Prior to testing the fuel pump, the inlet screen was removed for inspection. No significant debris was present in the inlet screen. The fuel pump was tested in accordance with Eaton CMM 73-10-10 Rev. 4. The test was satisfactory.

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

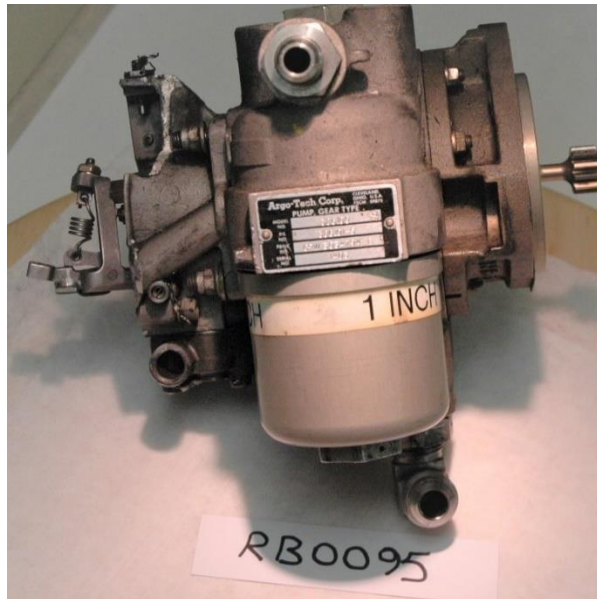


Figure 1
Fuel pump as received

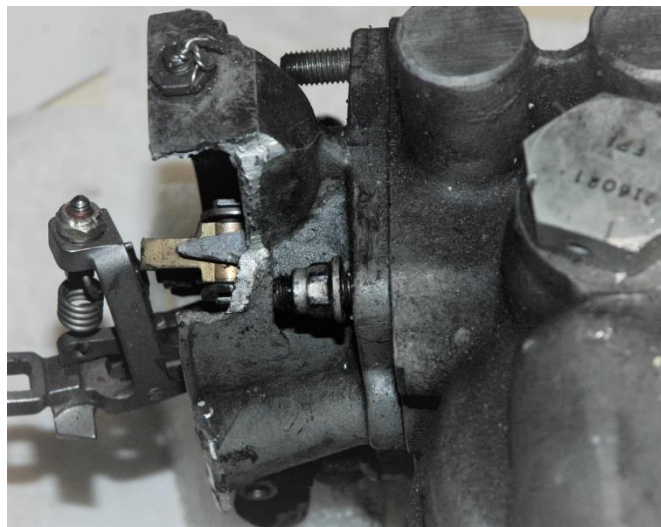


Figure 2
Remains of the fuel control unit drive-body attached to the fuel pump

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

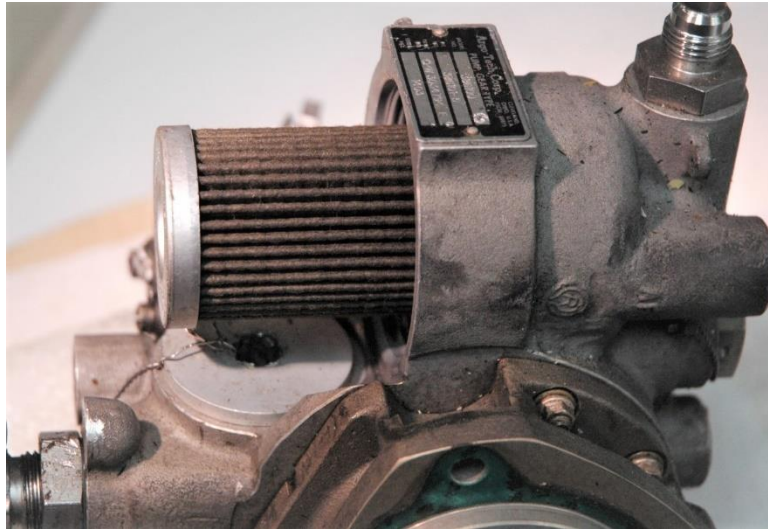


Figure 3
Fuel pump outlet filter

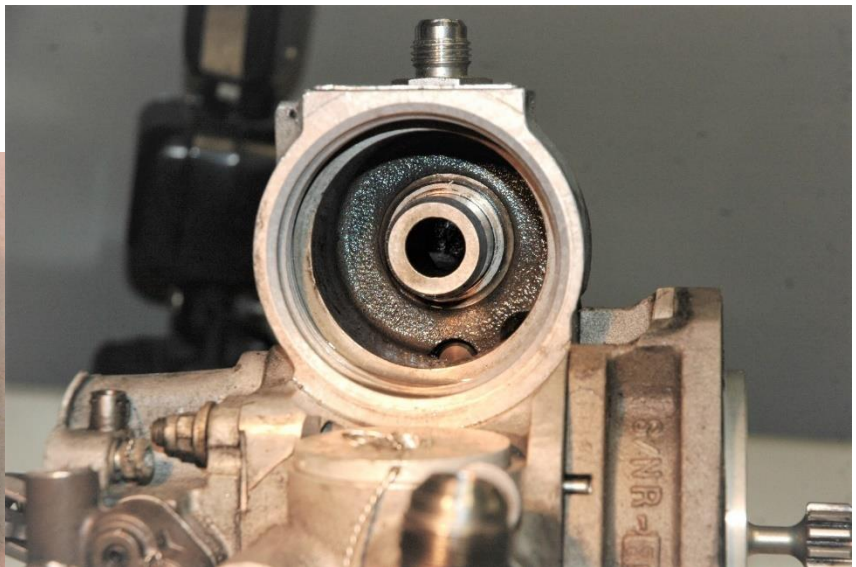
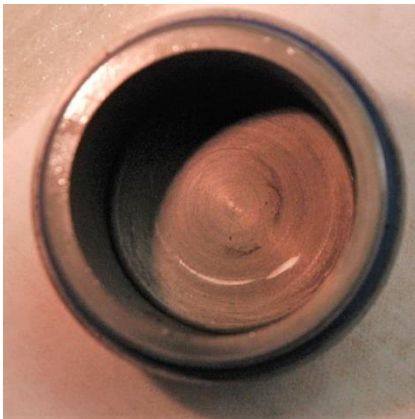


Figure 4
Fuel pump outlet filter bowl and filter cavity

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

Accessory: Fuel control unit (FCU)

Note: This unit was on the engine at original engine delivery.

Investigation Results:

The fuel control unit (FCU) was soiled (figure 5). The FCU drive-body was fractured and was received attached to the fuel pump. Rotation of the FCU driveshaft was restricted due to interference between the governor flyweights and the governor lever (figure 6). The governor lever was bent and side-loaded against one of the eccentric pivot screws. The plastic drive-coupling was present and intact (figure 7). The air adapter inlet was fractured. The condition lever bracket was fractured from the top of the flow-body. The fracture surface was clean with no obvious smearing. The condition lever linkage was deformed at many locations. The throttle lever shaft was bent, and movement of the throttle lever was restricted. The part-power trim stop was in the stowed (flight) position. The minimum pressurizing valve housing was incomplete, and the valve was exposed. The index mark of the Sg dome was in-line with the datum line on the bypass valve collar. The manual override (MOR) lever linkage was attached to the MOR. The MOR was bent, and the deformation restricted the movement of the lever. The MOR stop screw was missing. Lockwire was present at all locations. The lockwire seals were marked AEL (Honeywell).

The remains of the FCU were disassembled (figure 8). There was no debris in the Py outlet. There was no obstruction in the Pa bleed, Py orifice and Py bleed. The cut-off valve was correctly orientated. The bypass valve diaphragm was marked 4Q99 indicating that it was manufactured in the 4th quarter of 1999 (figure 9) and was not within the 6-year life limit recommended by Honeywell at the time of the event. The rubber of the diaphragm was pliable and there was no evidence of blistering or leaks. There was no debris or broken wires in the fuel inlet screen. There were no burrs or obstructions in the bypass valve sleeve. There was no obstruction in the metering valve and the metering valve fell freely in the sleeve. The torque-tube was tested and confirmed to have no leaks. The ratio levers were straight. The length of the acceleration bellows was within 0.007in of the length marked on the end plate confirming that the acceleration bellows was not leaking (figure 10). The governing bellows was tested and confirmed to have no leaks. There was no marking on the back of the identification plate. This in combination with the marking on the lockwire seals indicates that the FCU had not been serviced since it was issued from Honeywell.

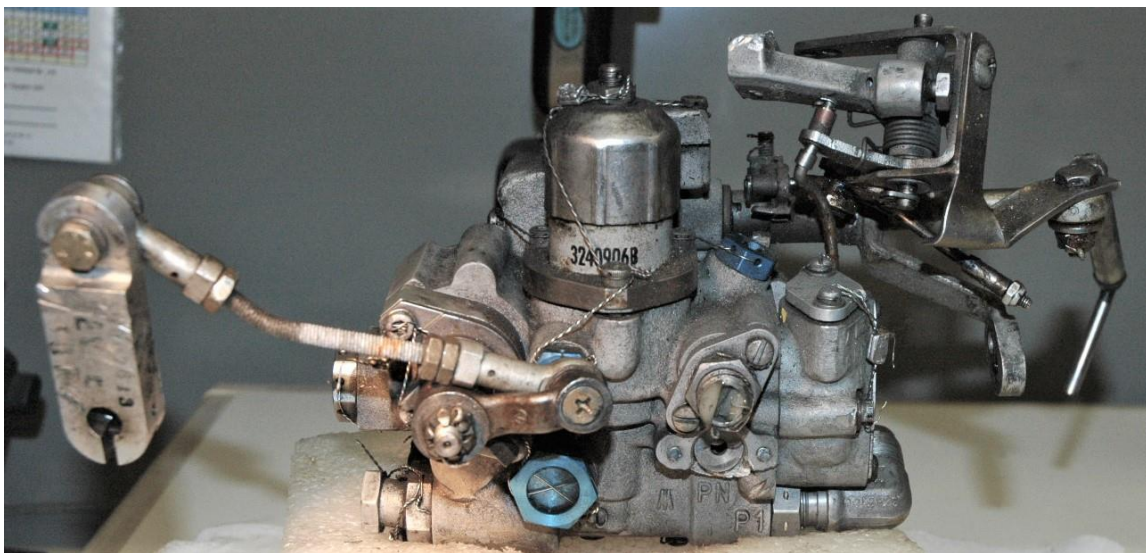


Figure 5
Fuel control unit (FCU) as received

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021



Figure 6
FCU drive-body

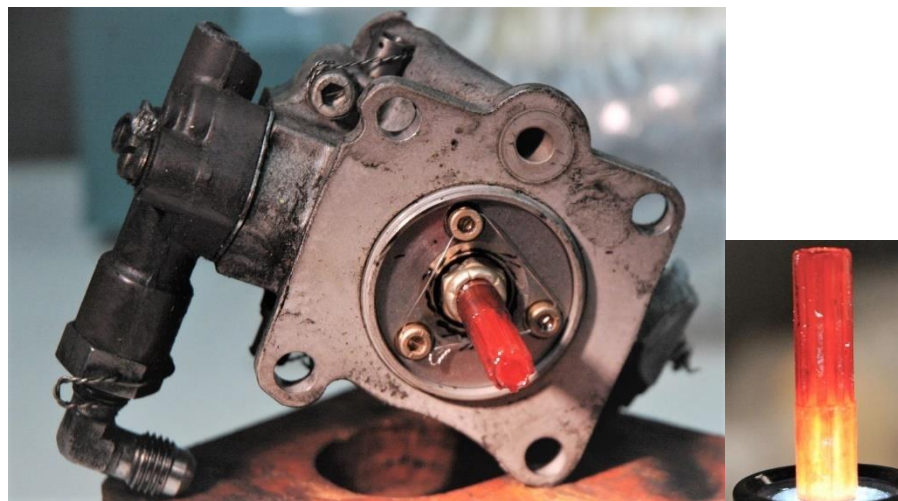


Figure 7
FCU plastic drive-coupling

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021



Figure 8
FCU disassembled

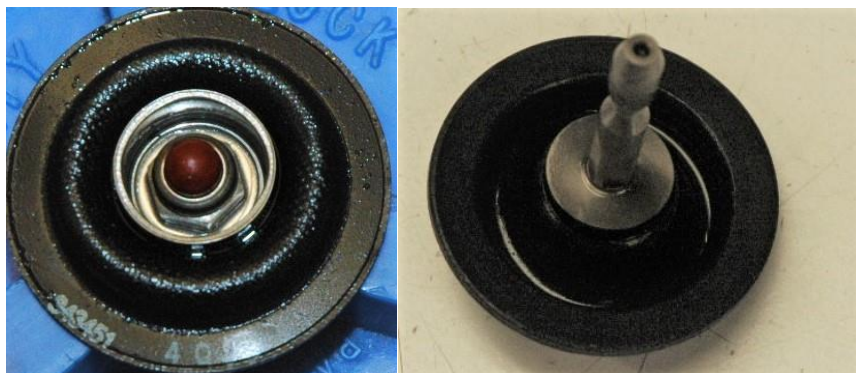


Figure 9
FCU bypass valve and diaphragm

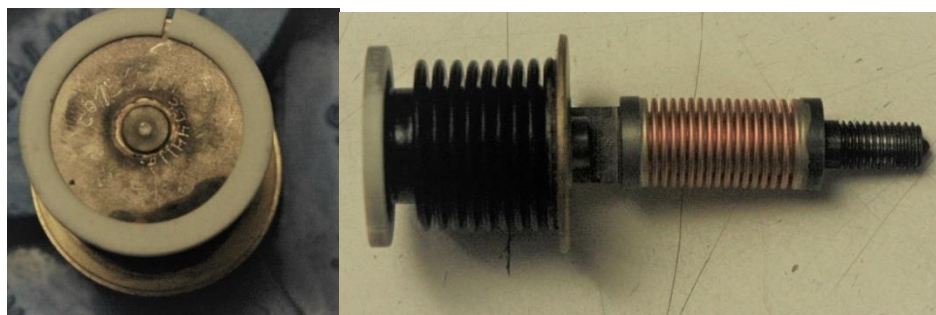


Figure 10
FCU bellows

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

Accessory: Flow divider valve (FDV)

Note: This unit was on the engine at original engine delivery.

Investigation Results:

The exterior of the flow divider valve (FDV) was lightly soiled (figure 11). The valve body appeared to be slightly distorted. The packings were present and intact in the bores of the fuel manifold adapter mating face. There were no significant scratches on the adapter mating face. A fractured end of the fuel inlet pipe was present in the nipple at the fuel inlet elbow. Lockwire was present at all locations.

The FDV was tested in accordance with Triumph overhaul manual 73-10-01 Rev. 7. It was not possible to complete the test program because the FDV dump valve was opening before the secondary transfer valve.

The FDV was disassembled in-order to determine why the dump valve was opening prematurely (figure 12 and 13). The packings were present and intact. The primary valve did not slide freely in the housing due to distortion of the housing.

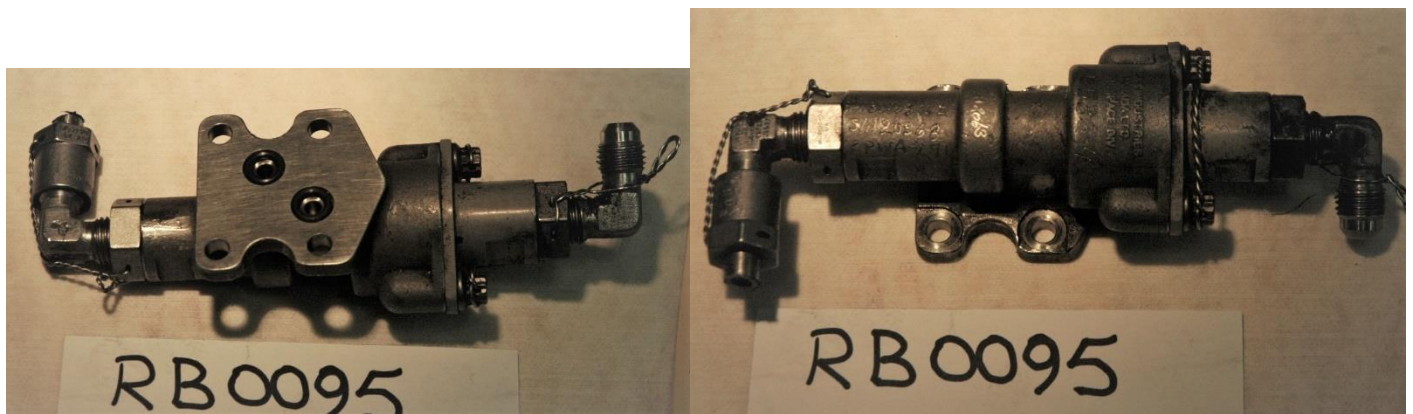


Figure 11
Flow divider valve (FDV) as received



Figure 12
FDV primary valve in the housing

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

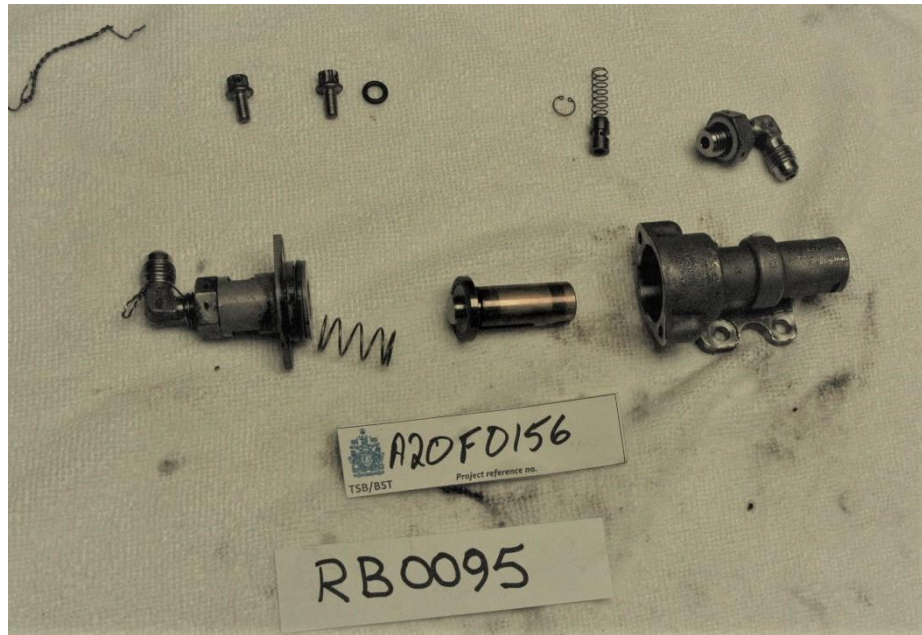


Figure 13
FDV disassembled

Accessory: Propeller governor (CSU)

Note: This unit was on the engine at original engine delivery.

Investigation Results:

The exterior of the propeller governor (CSU) was soiled, and the cover and the pilot-valve were incomplete (figure 14). The rotation of the driveshaft was restricted. There were numerous impact marks on the main body. The reset post was incomplete. The ends of the beta-valve clevis were missing (figure 15). The reset arm moved freely over the full range and returned under the influence of its spring. The speed setting lever moved freely in the remains of the cover and returned under the influence of its spring (figure 16). The driveshaft bearing inner and outer races were present on the driveshaft, but the balls and ball-cage were missing. There was debris inside the ball-head cavity. A bent section of linkage was attached to the speed-setting lever. The clevis of the beta-valve was fractured. The fracture surfaces were clean with no evidence of smearing. Minor debris was present in the base-gasket screen.

Lockwire was present at the beta-valve nut, identification plate, speed setting lever and stop screws, pressure relief valve and front blanking plate. The lockwire seal at the pressure relief valve was marked WG (Woodward).

The remains of the CSU were disassembled (figure 17). The base-packing was present and intact (figure 18). There was gear-wipe evident in the driven-gear pockets (figure 19). There were no scars in the ball-head cavity. The ball-head pins, bearings and retaining clip were present. The toes of the ball-head were present and intact, and the flyweights fell freely and evenly. Organic debris was present under the ball-head. Organic debris was present in the reset post pocket. Surface corrosion was present on the lower end of the pilot-valve. There was no surface corrosion observed on the remains of the beta-valve.

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

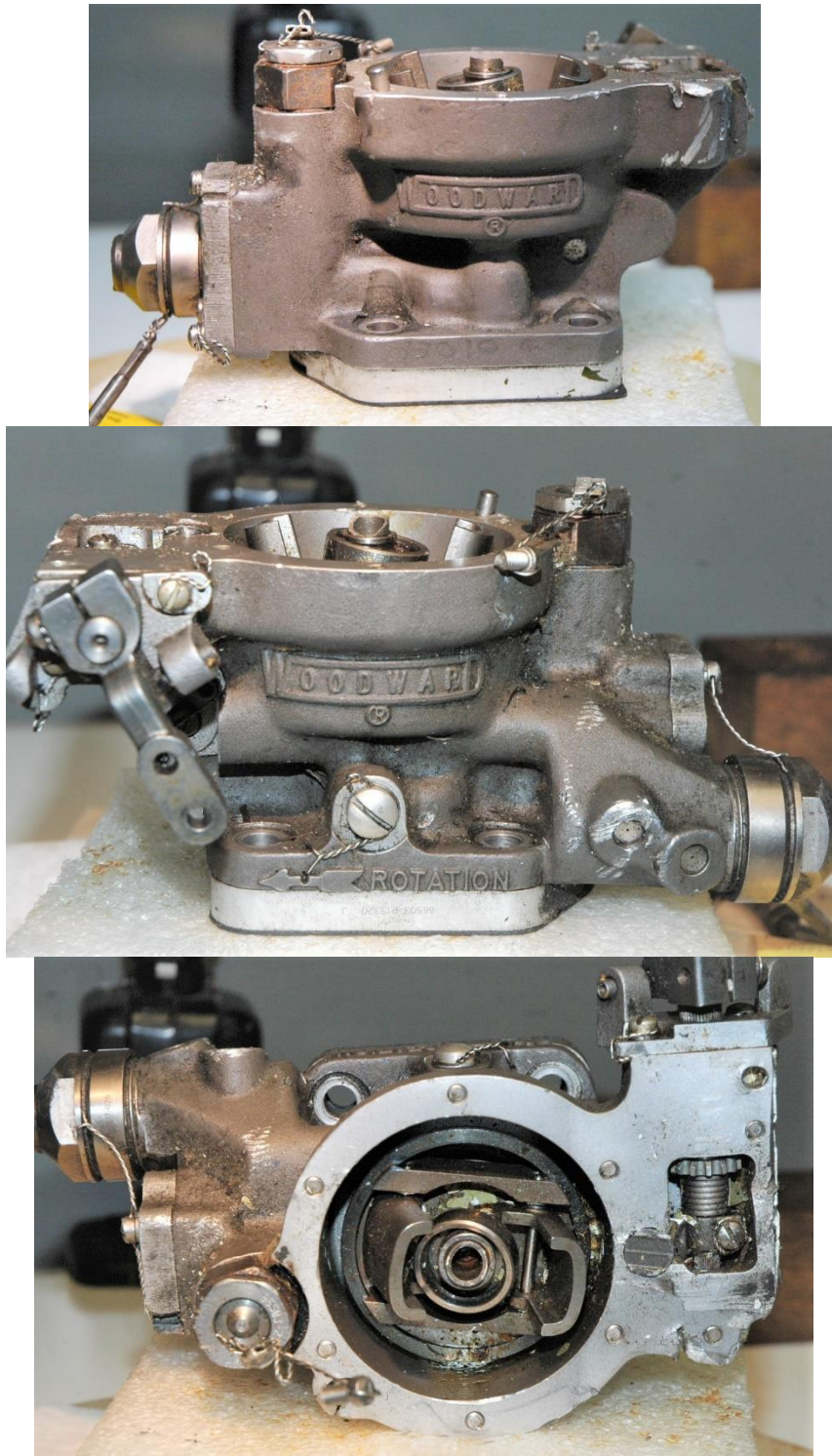


Figure 14
Propeller governor (CSU) as received

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021



Figure 15
CSU beta-valve

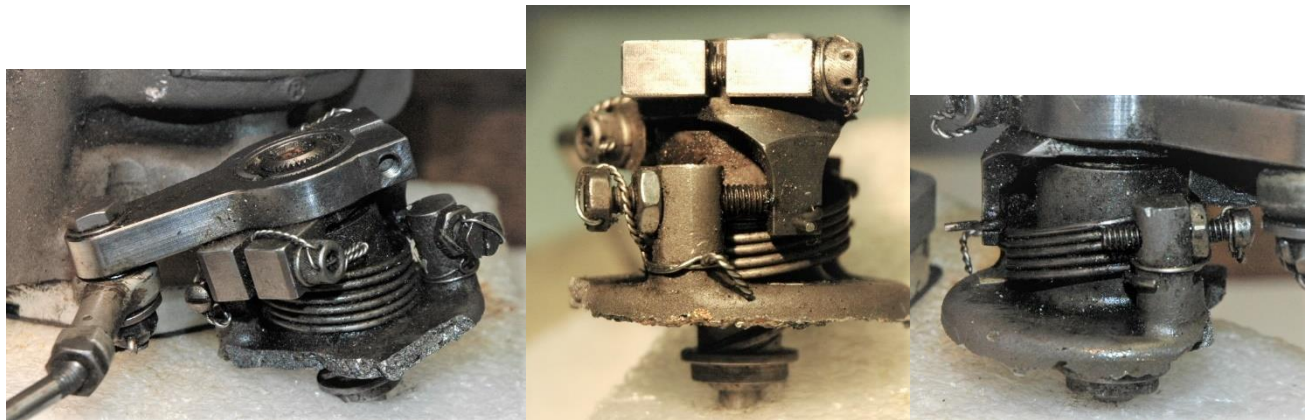
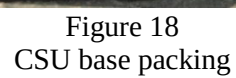
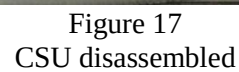


Figure 16
CSU speed setting lever and remains of the cover

Date issued: 13 October 2021



ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

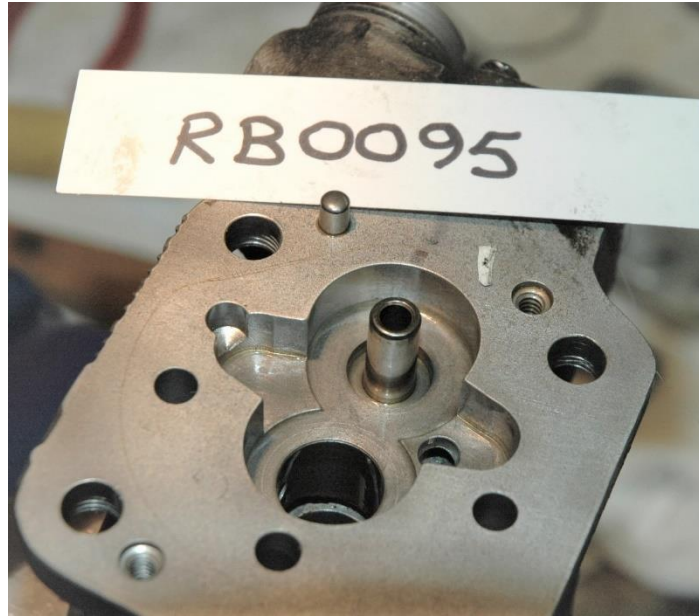


Figure 19
CSU gear pockets

Accessory: Over-speed governor (OSG)

Note: This unit was not on the engine at original engine delivery.

Investigation Results:

The exterior of the over-speed governor (OSG) was soiled (figure 20). The driveshaft turned with slight resistance initially, but freed-up after a few rotations. There was broken yellow anti-tamper paint on the pilot-valve stop screw. There was a dent in the identification plate. The identification plate was marked 00-08 indicating that the OSG had been serviced in August 2000. The end of the reset solenoid electrical connector was missing.

Lockwire was present at all locations. The lockwire seal on the cover was marked IGS (International Governor).

The OSG was forwarded to Woodward, the manufacturer, for investigation in the presence of a representative of the National Transportation Safety Board (NTSB). Their results are as follows:

The unit was received and an as received visual inspection was conducted. During the inspection it was noted that all lockwire, seals, and torque sealant were foreign indicating the originals had been removed after leaving the Woodward facility. Also, it was noted that the unit was dirty and had a damaged reset solenoid. However, the damage was not significant enough to prevent running an as received test on the unit (Figure 20).

After the visual assessment, the unit was sent for an as received test. During testing the unit was started up slowly to check for any audible signs of internal damage to the unit. There were no anomalies during start-up, so the unit proceeded through the test as received. The unit's "Max Speed" and "Internal Leakage" test points were slightly out of limits high. The shift in the test data and non-Woodward lockwire suggest that these settings were adjusted in the field. The "Min Reset Speed" test point was not run due to the damage to the reset solenoid. Lastly, there was some external leakage noted during testing. Although, there were some test points slightly out of limits there were no significant anomalies that appeared to contribute to the reported event. Due to these

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

findings, it was determined between the NTSB representative and Woodward engineering that a disassembly of the unit was not necessary.

In summary, the unit had evidence of being adjusted in the field. However, even with those adjustments all indications from testing suggest that the unit was functioning properly.

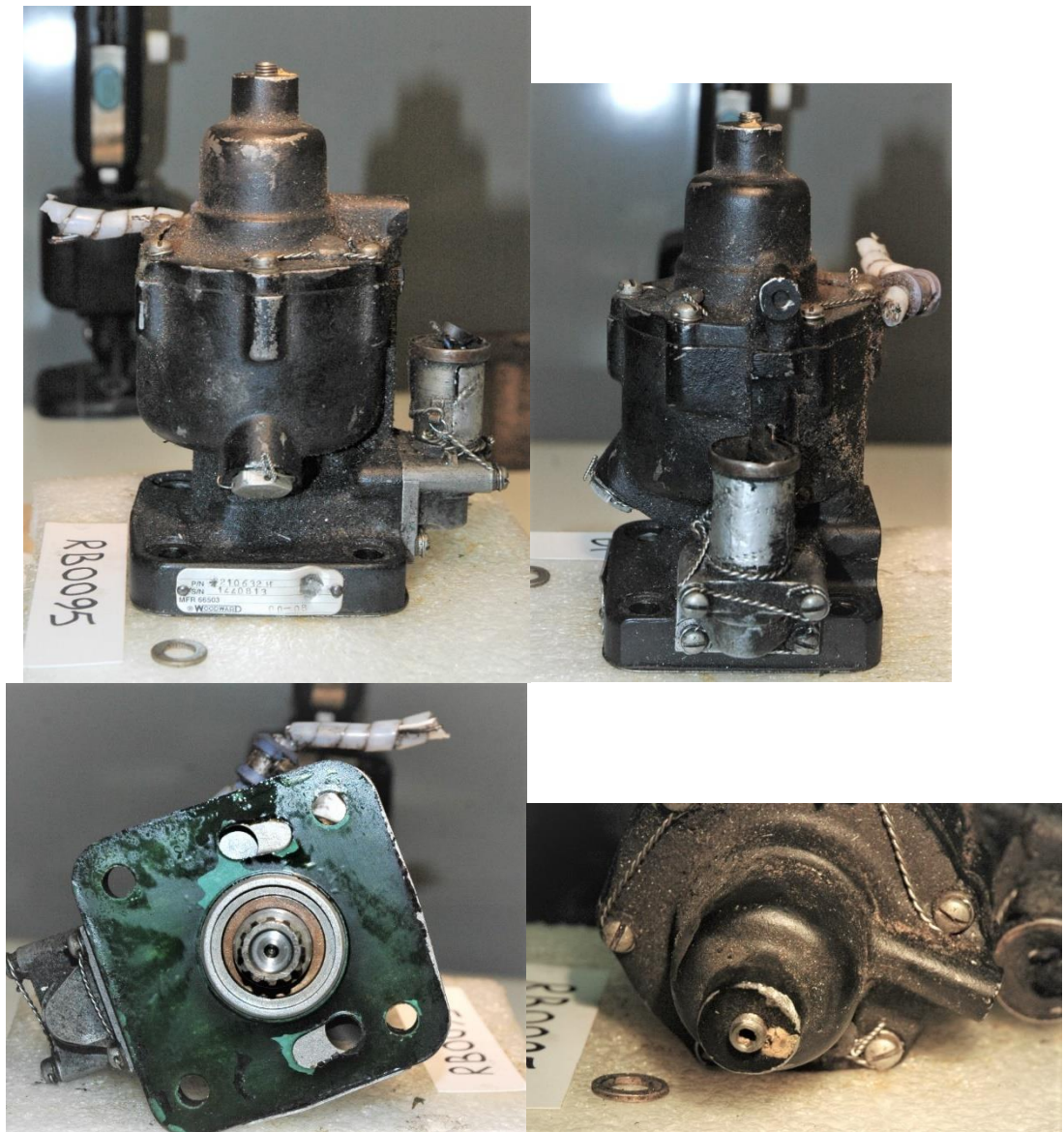


Figure 20
Over-speed governor as received

ACCESSORIES ACCIDENT REPORT

Date issued: 13 October 2021

5.0 Attachments: Woodward report 1172280

6.0 Closing Statement

The data contained in this report, collected at the time of the review may be altered or corrected on the basis of further information.



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