



## Memorandum For Record

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**Date: 10/24/2023**  
**NTSB Accident Number: ERA23FA067**

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Examination of the right fuel injection servo (fuel servo), model RSA-5AD1, parts list 2524145-11<sup>1</sup>, serial number 4647 revealed the nylon stops for the throttle and mixture controls were in place and both throttle and mixture control levers which were tightly secured to their respective shafts. An attached airframe air duct was removed and after removing it both levers moved freely; the mixture control lever was slightly bent. The regulator cover was safety wired and the regulator hex plug was stamped with the letter "G" indicating compliance with Precision Airmotive LLC Service Bulletin PRS-107, dated July 16, 2008, and Federal Aviation Administration (FAA) Airworthiness Directive (AD) 2008-06-51, with an effective date of March 12, 2008. No lead seal was present on the safety wire securing the regulator cover. The mixture adjustment was centered (normal). The gap between the closed throttle valve and the housing bore measured 0.017 inch<sup>2</sup>.

Inspection of the Venturi area revealed it appeared clean. The venturi was safety wired. Following removal of the venturi assembly, part number (P/N) 367969, which was correct for the application, it was very clean. The impact tubes and the bleed passages for the impact air were clean and free of obstructions.

Examination of the inlet fitting revealed it was finger loose and light tan colored material was observed at the inlet opening, while blue colored material was noted on the inside. The foreign material was mechanically removed from the fitting and was consistent with holes noted in the box, black plastic bag, blue shop towel, and paper used for transport. The fuel inlet strainer could not be removed until the blue AN "pressure port" fitting was loosened. The end of the AN fitting was longer than an exemplar fitting used in that same location and was contacting the inlet strainer. Once the blue AN fitting was loosened the inlet strainer popped out. The AN fitting should have been a restrictor fitting and should have been modified to allow travel

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<sup>1</sup> The latest version is a -12.

<sup>2</sup> At overhaul it is set to 0.006 inch.

of the fuel strainer. Inspection of the inlet strainer revealed slight contamination. Once the AN fitting was removed the inlet strainer moved freely.

The fuel servo was placed on a test bench as received without any adjustment and flowed to the Service Limits. At the start of the operational testing, leakage was immediately noted from the mixture control assembly, but the leakage stopped after continued and prolonged testing. The following Test Points were performed at fuel inlet pressure of 20 psi + or - 1 psi.

Test Point 1 – Throttle Lever Wide Open, Mixture Control Full Rich, No metering suction, or airflow at the impact tubes in terms of pounder-per-hour (PPH). The unit flowed within limits.

Test Point 2<sup>3</sup> - Throttle Lever Wide Open, Mixture Control Idle Cut Off (ICO), No metering suction. There was no fuel flow noted.

Test Point 3 - Throttle Lever Wide Open, Mixture Control Full Rich, Metering suction simulating airflow at the impact tubes at 500 PPH. The unit flowed within limits.

Test Point 4 - Throttle Lever Wide Open, Mixture Control Full Rich, Metering suction simulating airflow at the impact tubes at 900 PPH. The unit flowed within limits.

A check of regulator hysteresis was within limits.

Pressure sensitivity of the regulator section of the fuel servo was performed and while it passed, some friction in the regulator section was noted. The pressure sensitivity was performed at the prime fuel flow. Testing in idle was not possible because the idle fuel flow was erratic.

### Idle Circuit Test

Although not specified for testing by the service flow sheet test protocols, a check of the idle circuit was performed. This test determined how the fuel servo behaved when moving the throttle valve from wide open to idle while monitoring the fuel flow and Metered Head Pressure in Terms of Inches of Fuel. The test criteria are:

throttle valve gap: 0.006” shim in bore  
mixture control: full rich  
metering suction: 0” H2O (no air flow)  
calibration fuel flow: 6-7 pph mixture wheel centered

The test was performed to check for metering head increase by:

step 1: set idle fuel flow to 6-7 pph - record metering head  
step 2: close throttle so fuel flow decreases to 4-5 pph

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<sup>3</sup> This was a check to make sure there was no fuel flow with the mixture control placed in the Idle Cutoff Off (ICO) position. The maximum leakage allowed was 5 cc's per minute.

metering head to not increase more than 5” of fuel from step 1 to step 2

For this test the throttle valve was not adjusted from its measured value of 0.017 inch<sup>4</sup>. With the throttle position moved from Wide Open to idle, the highest noted fuel flow was about 12.0 PPH and the Metering Head Pressure in Terms of Inches of Fuel was about 45. The lowest fuel flow when tapping the regulator was about 4.5 PPH at 0.017 inch throttle valve gap, and the metering head was 3.0 inches of fuel. This test of moving the throttle control from wide open to idle was repeated numerous times and during each time the Metered Head Pressure remained much higher than specified and was inconsistent and did not result in the same repeated value.

As a result, the regulator section (fuel and air as a unit) were removed from the fuel servo. Following removal, foreign debris was noted in the fuel side of the regulator section. The foreign debris was photographed, removed, and retained for NTSB examination. Following removal of the foreign material, the regulator section was reassembled onto the fuel servo which was placed back onto the test bench. Following removal of air from the fuel servo, a check of the idle circuit was performed multiple times. During each check, the fuel flow consistently decreased to 4.5 PPH while the Metering Head Pressure consistently decreased to the same value (was not hanging up) and was consistent with that value being within limits.

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<sup>4</sup> It should be noted that at overhaul the throttle plate setting is 0.006 inch and the specified fuel flow at idle is between 6.0 and 7.0 PPH.