



CUSTOMER REPORT

Date: March 29, 2022

To: Mike J. Hodges, MS, CHP
Air Safety Investigator
National Transportation Safety Board
4760 Oakland Street, Suite 500
Denver, Colorado 80239-2793

From: Airflow Performance

Subject: Inspection and flow testing of FM-200A S/N 21422081 P/L 5020061
Reference CEN21LA351 (N1361S)

The subject fuel control was delivered by Daryl McMillan of the Columbia FSDO on March 24, 2022. Inspection of the fuel control showed much dirt in the venturi and throttle bore of the unit. The inlet filter fitting was loose. The throttle lever was loose on the throttle shaft but the teeth that engaged the lever to the shaft were engaged. There was approximately 5 to 7 degrees of radial play of the lever to the throttle shaft. All lockwire and seals were intact. A 5-degree FM-200 inlet adapter was connected to the inlet flange of the throttle body.



There were some chips and dents on the inlet of the throttle body casting. Throttle and idle valve linkage was intact and operated freely. Some sort of non-factory throttle return springs and bracket were installed on the opposite side of the throttle shaft.

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Fuel Metering
For Hi-Performance Engines

Overhaul And Calibration
Airflow Work
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Details of the history of this fuel control show that the unit was built and sold to a Len Morris of Goshen, Indiana and sent to Free Flight Composites in Peyton, Colorado on April 8, 2014. The install was for a Lycoming 360 in a Cozy aircraft.

After inspection of the fuel control, the unit was installed as it was on the air box test equipment. This piece of test equipment flows air through the fuel control while the fuel flow bench measures the fuel output of the unit as airflow changes. This effectively simulates an engine running at different power levels.

With the fuel control installed on the airbox, a wide-open throttle curve was run.



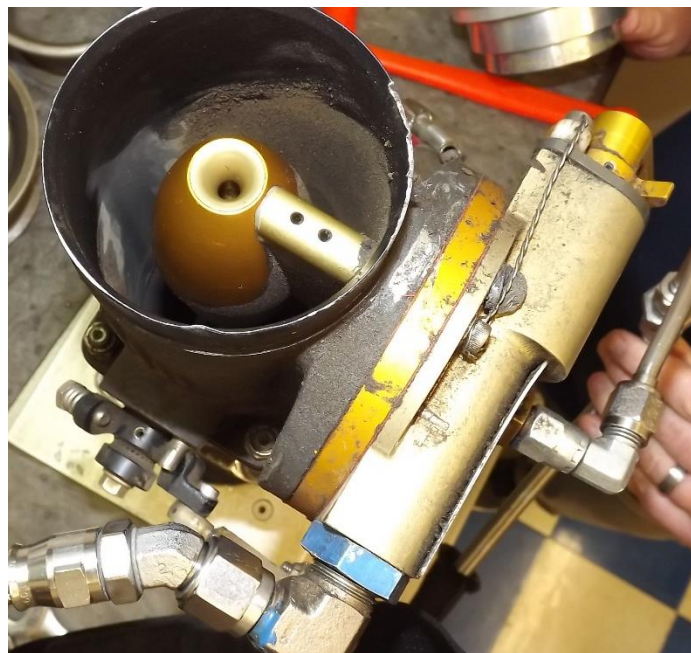
The standard air inlet was installed on the throttle body.

25 PSI inlet fuel pressure was applied to the fuel control. With the mixture control full rich and the throttle wide open, the fuel curve was run.

Airflow PPH	0	200	400	600	800	1000	1200	1400	1600	1800	2000	Idle
Fuel Flow PPH	24.3	26.5	35	46	61	77	91	108	122	138	152	9.4

Data shows that fuel flow responded to air flow inputs. Pressure sensitivity was checked at idle flow with idle flow responding to changes in inlet fuel pressure. 9.3 PPH @ 15 PSI, 9.4 @ 25 PSI and 9.5 PPH @ 45 PSI. This shows pressure sensitive being good as the fuel stays the same with inlet pressure varying from 15 to 45 PSI, indicating proper fuel regulator operation.

With the venturi having much dirt in the boost and main venturi, degradation of the signal generated by the venturi was evident by the leaner fuel flows. The venturi was cleaned using lacquer thinner and Q-Tips to clean the boost venturi and a wetted rag to clean the main venturi.



A repeat wide open throttle curve was run with the relatively clean venturi.

Airflow PPH	0	200	400	600	800	1000	1200	1400	1600	1800	2000	Idle
Fuel Flow PPH	22.8	25.6	35.2	49	66	84	102	120	134	152	166	9.3
As Calibrated 4-9-2014	23.9	26.4	37.3	50	68	86	104	122	138	156	172	7.6
Lycoming new parts fuel flow limits	22 28			48 52				120 125				

Looking at the fuel flow as a fuel air ratio, the test with the dirty venturi gave a fuel air ratio .077. Lycoming gives a best power fuel air ratio of .075 to .085. Typically, Lycoming naturally aspirated engines run a full rich mixture .088 to .09 fuel air ratio. This gives additional fuel to the engine for detonation margin and cooling, at a slight decrease in power. It can be seen from the chart after the venturi was cleaned that the fuel flow was almost identical to the fuel flow when the unit was calibrated in 2014. The slight lean mixture could be due to the venturi not being completely cleaned but even then, the fuel flows were within the new parts limits recommended by Lycoming for an IO-360 engine.