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Subject: ERA24LA211, Exhaust Valve Examination

The NTSB IIC and another NTSB investigator visited the wreckage at the owner's hangar on October 7, 2025, to further examine the engine.

As viewed, the rocker box covers were already removed, and the spark plugs were hand tight in their respective cylinder heads. The fuel injector for the engine was run with the engine at the engine manufacturer's facility and found to have low air flows, this could result in a higher fuel to air ratio.

The process performed was similar to what is described in the latest version of Lycoming Service Instruction (SI) 1425. Lycoming Service Bulletin (SB) 388 also describes a similar process.

The spark plugs were removed, and the electrode wear appeared normal. The spark plugs electrodes were visibly darker than normal which is indicative of rich engine operation or an excessively rich fuel to air ratio.

The rocker arms were removed from all cylinders, and the exhaust valve rotating caps were in place. Using compressed air, the exhaust valve keepers were removed, and the exhaust valve springs were also removed. The exhaust valve springs were dark in color and were intact on all cylinders. The exhaust valves were pushed into their respective cylinder heads and pulled through a spark plug hole on cylinder 1, 2, 5, and 6. The exhaust valves for cylinders 3 and 4 were not fished through the spark plug holes due to limited rotation of the crankshaft from the already removed exhaust valves, which were impeding

piston movement, but were documented through the spark plug holes. The exhaust valve stem of cylinder 1 appeared clean with no build up or residue noted. The exhaust valve stems for cylinders 2, 3, 4, 5, and 6 visually had moderate buildup of carbon at the combustion chamber side of the exhaust guide. The exhaust valve stem of cylinder 4 caught and was tight when it was pushed into the cylinder head. A material similar to coked oil was observed in the exhaust valve guide of cylinder 4.

The latest version of Lycoming Service Instruction 1009 states that the recommended time between overhaul (TBO) for this engine is 2000 hours or 12 years, whichever occurs first.

From Lycoming SI 1009:

"All engine models are to be overhauled within twelve (12) calendar years of the date they first entered service or of last overhaul. This calendar year time period TBO is to mitigate engine deterioration that occurs with age, including corrosion of metallic components and degradation of non-metallic components such as gaskets, seals, flexible hoses and fuel pump diaphragms.

For FAA Part 91 or EASA Part NCO (non-commercial) or equivalent operations, only an appropriately rated and qualified maintenance person (or international equivalent) can allow the twelve (12) calendar year TBO to be exceeded with concurrence from the controlling civil aviation authority to verify agreement with this provision and after thoroughly examining the engine for corrosion and degradation in accordance with 14 CFR 43 Appendix D (or international equivalent) and determining that the engine remains in an airworthy condition. This inspection is to be repeated annually or as necessary to ensure continued airworthiness. The twelve (12) calendar year TBO must not be exceeded if the engine is affected by AD 2012-19-01 and not in compliance with AD 2012-19-01."

From Lycoming SI 1425:

"Field experience has shown that engine oil contamination increases the possibility of sticking and/or stuck valves. This situation occurs when the contaminants in the engine lubrication oil become deposited on the valve stems, restricting the valve movement, and resulting in intermittent

engine hesitation or miss. If corrective action is not taken to remove the deposits, a valve could become stuck causing engine damage. Since the rate of oil contaminant accumulation is increased by high ambient temperatures, slow flight with reduced cooling, and high lead content of fuel, owners and operators experiencing these conditions are encouraged to consider the following suggestions for operation and maintenance if they have experienced valve sticking. "

Lycoming SB 388 discusses the time of compliance for exhaust valve guide condition testing is 400 hours unless the guides have been replaced in accordance with SI 1485.

Lycoming SI 1485 states:

"Once guides made from the improved material are installed in all cylinders on the engine, it is no longer necessary to complete the mandatory 400 hour inspections specified in the latest revision of Service Bulletin No. 388. It is recommended that the inspection procedure from the latest revision of Service Bulletin No. 388 be completed at 1000 hours of operation or half way to the recommended TBO, whichever occurs first. (For recommended TBO, refer to the latest revision of Service Instruction No. 1009.)"

In discussion, the engine had experienced oil operating temperatures reaching about 245 degrees. That temperature is close to when oil begins to break down and coke, which introduces carbon deposits into the oil system. The

Lycoming Operators Manual states:

"Oil Temperature: The maximum permissible oil temperature is 245°F (118°C). For maximum engine life, desired oil temperature should be maintained between 165°F (73.8°C) and 200°F (93.3°C) in level flight cruise conditions."

The oil cooler bypass valve (vernatherm) was examined and exhibited a half-mooned shape witness mark on the valve face which is indicative of the valve not seating properly. If the bypass valve is not seating properly, some of the hot oil would bypass the cooler and continue into the oil system which would result in the oil temperature rising as the engine continues to run and heat up.

PHOTOS



Photo 1: View of the No. 1 exhaust valve stem.

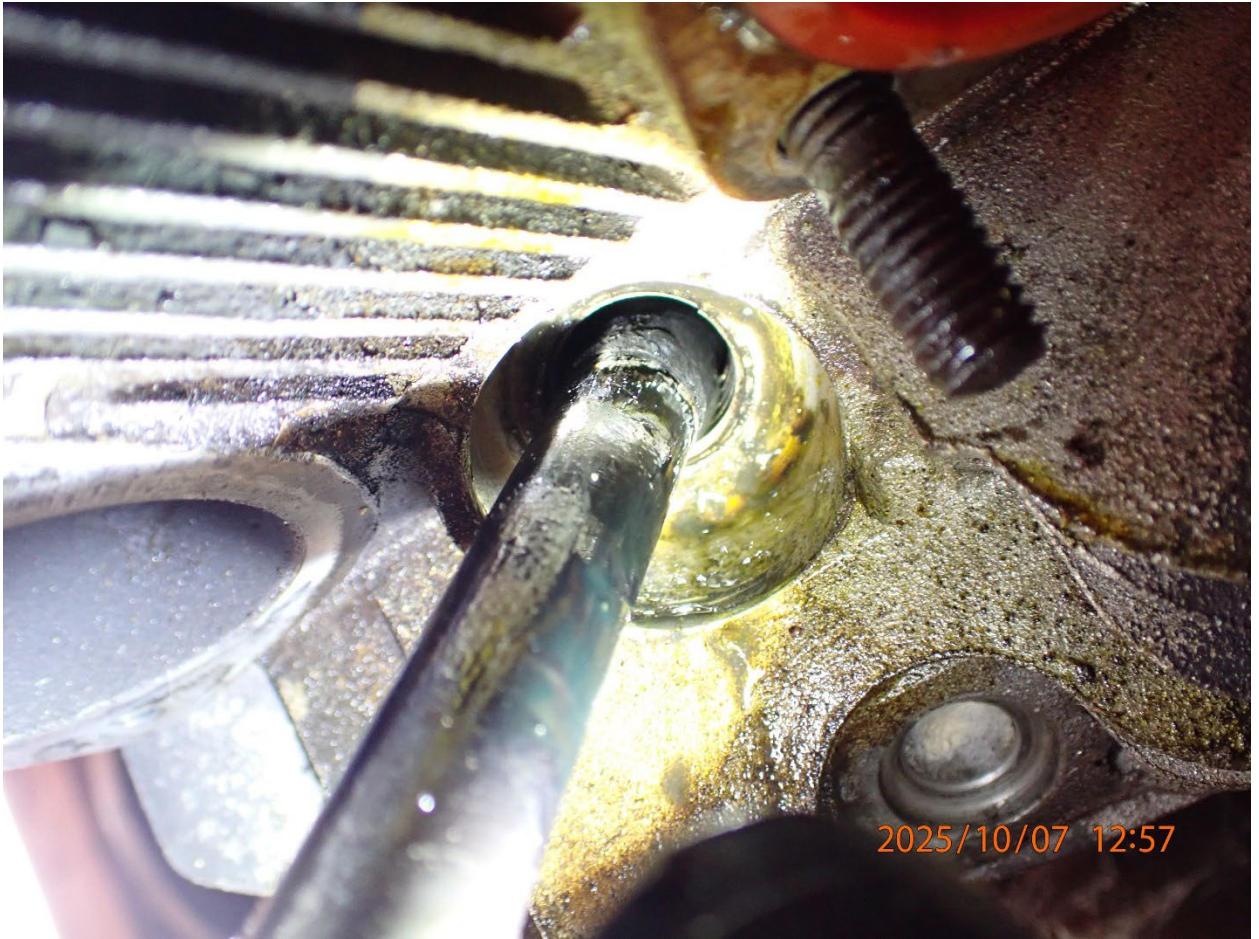


Photo 2: View of the No. 2 exhaust valve stem.



Photo 3: View of the No. 2 exhaust valve stem.

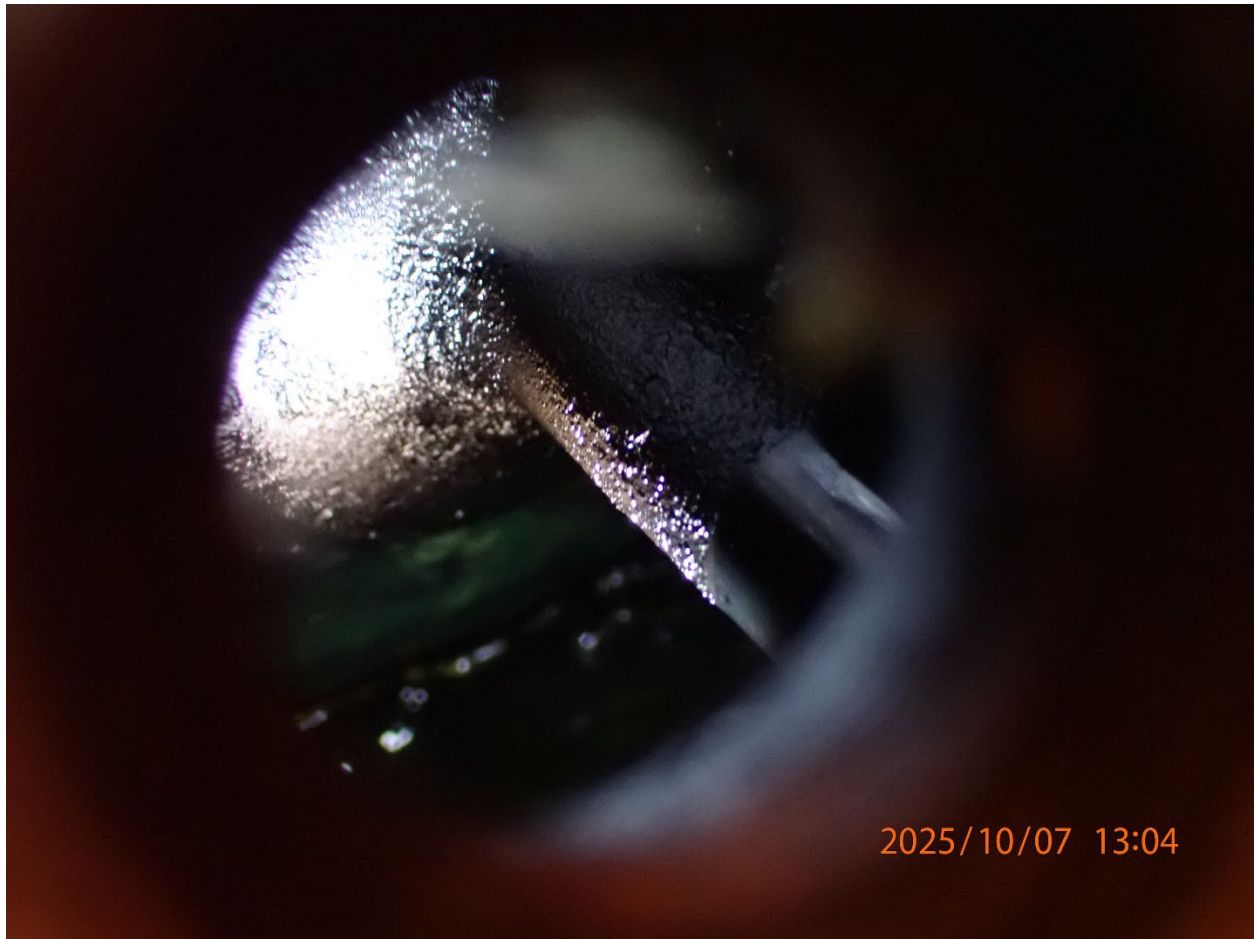


Photo 4: View of the No. 3 exhaust valve stem.

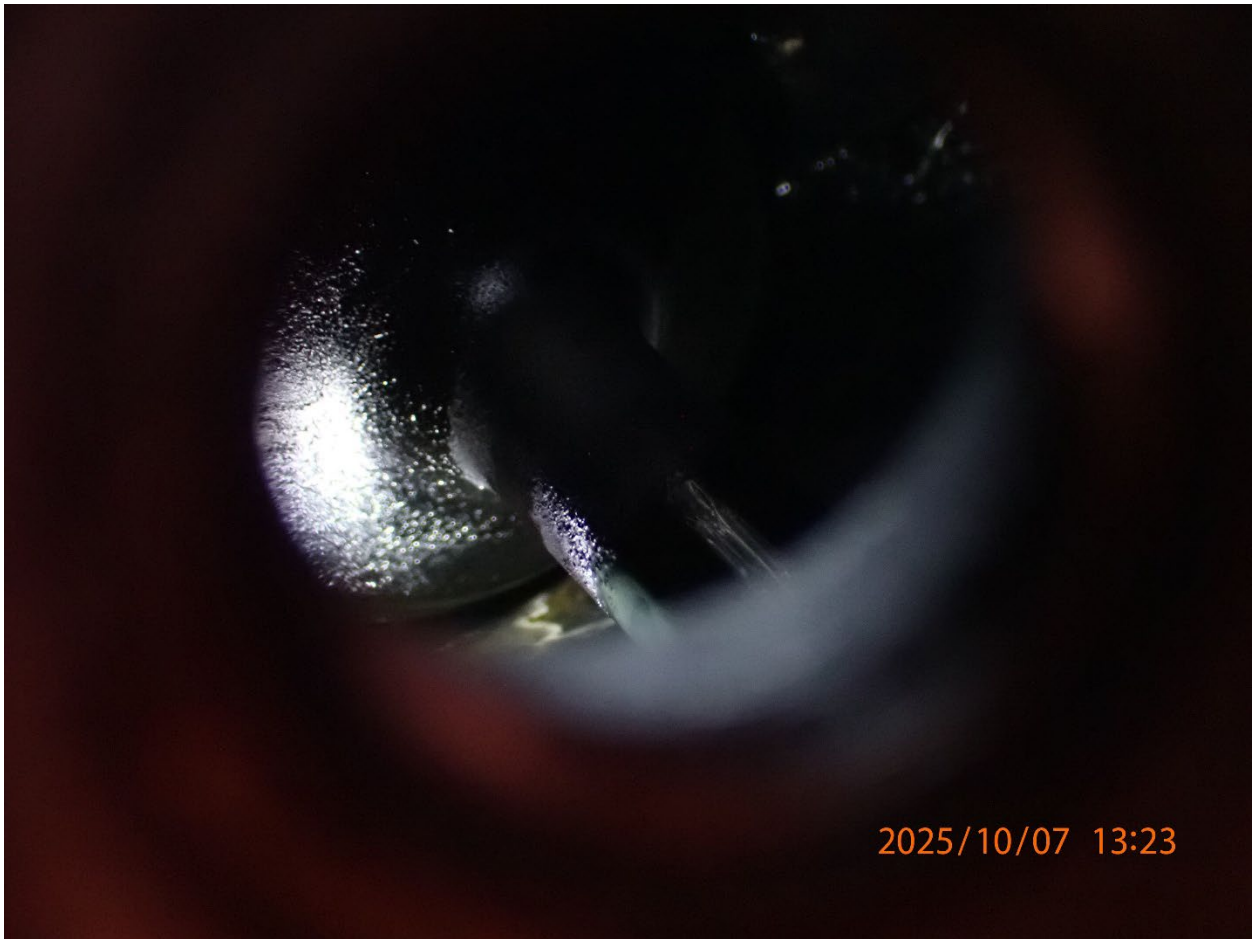


Photo 5: View of the No. 4 exhaust valve stem.



Photo 6: View of the No. 5 exhaust valve stem.



Photo 7: View of the No. 5 exhaust valve stem.



Photo 8: View of the No. 6 exhaust valve stem.



Photo 9: View of the No. 6 exhaust valve stem.



Photo 10: View of the exhaust valve springs.