

April 4, 2017 Evaluation of NTSB Fuel Pump

From Jerry L. Toms, EA FSDO 39

To Heidi Kemner, NTSB

Re: Evaluation of FUEL Pump sent by NTSB, with help of the manufacturer, Aero Accessories, Inc. at their facility on April 4, 2017.

1. The Shipping box was opened and the fuel pump carefully removed once at the manufacturer's facility..



2. . After initial visual assessment, the majority of oil was carefully removed for closer inspection and formal evaluation.



3. Once primary external cleaning and visual inspection was performed, inspection of the external fittings was made, then fittings carefully removed to be fitted for the test flow bench operational checks.

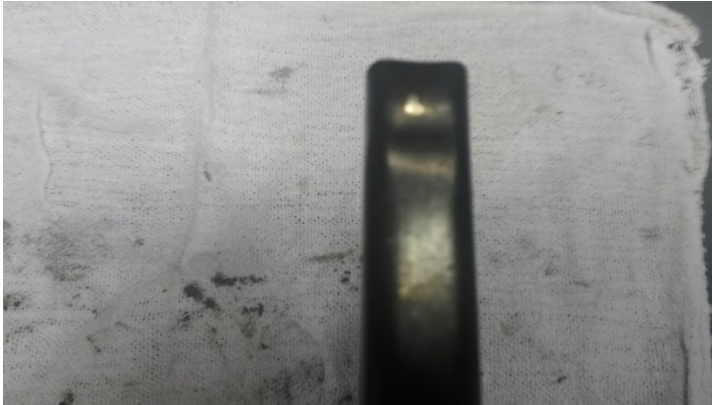


4. The internal threaded areas where fittings were removed were inspected for any contaminants or damage. Some physical damage appeared to exist at lower cover of pump.



5. Prior to installing the pump on the test bench a visual check was made of the actuator arm, at the point of contact where the pushrod in the engine accessory case area transfers mechanical action to the pump. The contact point indicates whether the

alignment is proper or if mechanical issues may exist in this area. In the photo below it appears to have been making proper contact within acceptable tolerances to transfer the mechanical loads to the fuel pump for proper operation.



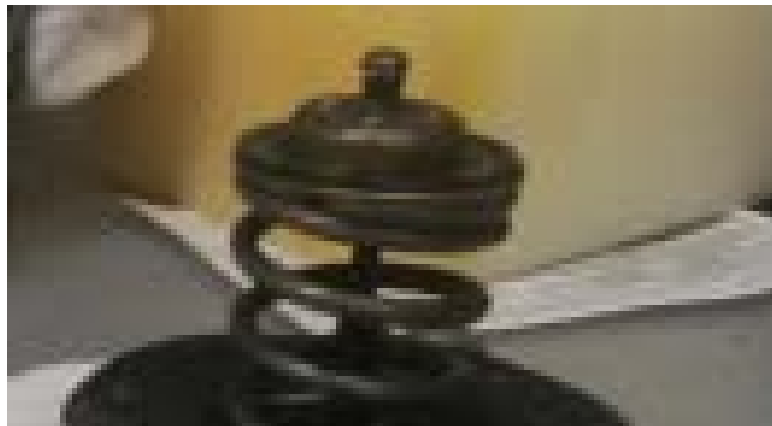
6. The attempt to operate it on the flow bench testing equipment; resulted in zero pressure and zero flow, indicating there was a mechanical type failure internally in the pump mechanism.



7. At this point I contacted Heidi by phone at the NTSB to ask if it were ok to disassemble the pump for further internal evaluation. Once permission was granted, the pump was disassembled for further detailed inspection.



8. By zooming in on the actuator arm and parts which connect the arm to the diaphragm pump actuator rod assembly; anomalies were identified as having failed to perform their proper pump functions.



9. The stamped ring is intended to be attached to the top of the diaphragm actuator rod of the fuel pump along with a washer and a fiber type spacer or washer. In this instance the stamped ring indicated physical damage of unknown origin and as a result of physical damage, the washer and fiber elements in this stackup were separated and the mechanical actuator linkages from the engine accessory section were unable to physically activate the pump.
10. Closer inspection of the stamped ring under a microscope did not reveal a specific source of the physical deformation or failure. As a result of this deformation where the actuator meets the diaphragm lift stem; the pump was unable to actuate the diaphragm elements: This resulted in the failure to produce flow, pressure or volume as designed.

While I could not determine the cause in the sequence which led to the part damage; the damage was to the stamped "lift cup" which rides on the lift stem and is supposed to be joined with a steel washer and a fabric washer with this group held in place on the stem by a controlled deformation of the stem by heat and pressure.

From my experience, this is very unusual.

After additional research of SDR's and further discussions with the manufacturer representatives; it was evident they had not seen this before. I do not know the hours on the pump nor the aircraft involved, but the pump was manufactured in early 2011... (just over six years ago).

As the steel washer and the fabric washer were missing, and no fragments noted in the pump; do you know if the crankcase was carefully cleaned? Could these be found in the crankcase? May provide better clues.

With the inability to locate any similar failures, no systemic problems were found. I am thinking about a possible Safety Recommendation which could produce an SAIB, but am reviewing the processes which would be required to detect, and identify if such an anomaly were present; from which to write a viable inspection process. If you have ideas on this concept, let me know.