

December 23, 2014

Bleed Valve PN 23073353 S/NFF27661
 TT: UNK TSO: 805.0

W/O R27478

A/C N373RL TT: 7284.7

On this day, Tuesday, December 23, 2014, 10:00 A.M., an analytical bench check and disassembly was performed on Bleed Valve S/N FF27661 TT: UNK TSO 805.0, which was included in an incident involving N373RL.

Bench check and subsequent total disassembly was performed on Bleed Valve S/N FF27661 in the Engine Shop Of RLC located at 430 N. Eola Rd Broussard LA 70518.

Present and performing the bench check and subsequent disassembly was Robert Chaumont, Engine Shop Supervisor. Present and observing was Barry Laviolette from HAAS, a qualified, unbiased, third party observer. Also present was Virginia Schaal, RLC Quality Inspector for the Component Overhaul and Engine Shops.

The Bleed Valve Bench check failed to meet serviceable limits as it was determined that it was closing too early.

Subsequent total disassembly included careful inspection of each part and revealed excessive corrosion. Corrosion debris was noted to be wedged in the exit orifice. In addition, unusual wear on the bellows face where the exit orifice mates was also discovered.

N373RL ECU Report

Below is a summary of the results from the check and test of EMC-35R ECU S/N JG8ALK0486 for Rotorcraft Leasing LLC:

Sales Order Number: 523710

Work Order Number: 809499

Part Number: 115220-2A5-24

Serial Number: JG8ALK0486

Started check and test on the morning of December 17, 2014 with the following steps:

- 1) Extracted fault history
- 2) Performed bonding check (PASSED)
- 3) Performed pressure test (FAILED)
 - a. Pressure measurements were consistently 0.5 psi below the input pressure (0.1 psi below the lower test limit)
- 4) Performed incoming Acceptance Test Procedure (ATP) (PASSED)
- 5) Performed 5 minute vibration test (PASSED)
- 6) Replaced seals in test equipment and performed pressure test again (FAILED)
 - a. Pressure measurements were consistently 0.5 psi below the input pressure (0.1 psi below the lower test limit)
- 7) Performed a check of the primary channel 5V power supply (FAILED)
 - a. Power supply voltage measurement was 4.93V (0.12V below the lower limit for the check)
- 8) Performed three cycle Environmental Stress Screen (ESS) (FAILED)
 - a. Test of an open circuit condition on the WFMV input failed during the high temperature portion of the ESS. The measured value was slightly out of tolerance.

Completed check and test on the afternoon of December 18, 2014.

Regarding the pressure test failure, this is a test of the ambient pressure sensor in the ECU. The 0.5 psi deviation from the nominal value equates to a delta altitude of approximately 1000 ft. So if the ECU 'thinks' that it is 1000 ft higher in altitude than it actually is, it will operate with a slightly lower acceleration schedule. So it will take slightly longer to go from one engine power setting to a higher setting. Also, the maximum fuel flow limit would be about 5% lower than it normally would be for that altitude. Since the ECU failed the pressure test, the sensor has been recalibrated. The pressure test was performed again after the sensor calibration and the ECU passed. The ESS also checks the pressure sensor measurements and there were no issues during the ESS related to the pressure measurements.

Regarding the 5V power supply check, power supplies that are below the lower limit are susceptible to intermittent resets of the primary channel. A reset of the primary channel would result in the reversionary channel taking control and a primary hard fault being declared.

Regarding the ESS failure, this is a test of an open circuit condition at the WFMV (metering valve fuel flow position) input to the ECU. This failure is attributable to moisture infiltration into the ECU flex circuit. Since the ECU is not a hermetically sealed box, the flex circuit material will absorb moisture over time resulting in small amounts of current leakage in the circuit and the failure observed during ESS. The normal production process is to bake the unit to remove the moisture. This bake out process has always resolved the particular ESS failure on previous units.

Since there were failures during the check and test process, I wanted to provide you with the summary and see if there were any additional steps that you required before we continue on in the process.



N373RL INVESTIGATIVE SUMMARY

On 11 November 2014 at 01:30 p.m. Central Time, N373RL, a Bell 407 departed VX-989 with three passengers on board (plus the pilot. Shortly after departure (~30 seconds and 400') experienced compressor stalls on climb out from VK-989 enroute to Main Pass 301. The commercial rated Pilot reported that a series of compressor stalls and engine surges began. The Pilot adjusted the collective pitch stick and began a slow decent. After lowering the engine power, the surges and stalls ceased and the Pilot's plan, at this point, was to try to attempt to fly the aircraft back to the Pompano (Viosca Knoll 989). At approximately 250' - 300' the Pilot began increasing the collective to regain some power, but the surges and stalls reoccurred. The Pilot reported hearing the low RPM horn and when he observed the NR gauge, the NR was about 90% and N2 was running high; at or near redline. At this point the Pilot made the decision to land the aircraft in the water. He fully lowered the collective to salvage the RPM, but the engine was still surging at flat pitch so he rolled the throttle to idle and entered an autorotation. The Pilot told the passengers to secure themselves, called mayday to RLC Flight Following. He then activated the float inflation handle (APICAL), pressed the aircraft quick position button, flared the aircraft and landed in the water. The Pilot estimated from the time of the initial compressor stall to water contact was approximately 15 to 30 seconds.

The Pilot asked the passengers if everyone was OK, got a verbal response from all the passengers that they were good and deployed the life rafts. The Pilot called RLC Operations on the sat phone to let them know his position and that all POB were OK. The Pilot observed a fishing boat was making its way to his location from the Pompano about 1.5 miles away. As the boat arrived the Pilot asked the left front passenger (Dan Johnson) to tell the boat to keep their distance for the moment so they don't make contact with any of the aircraft's floatation equipment, the Pilot continued to talk to the RLC operations department. The Pilot also directed the passengers in the back to collect the tool bag and first aid kit in case they needed it. He then instructed the passengers to get into the life raft on the left hand side of the aircraft.

No injuries were reported incurred to the Pilot or passengers during this incident. No visible aircraft damage was apparent.

INVESTIGATION INFORMATION

- 13 NOV 14 - N373RL (Eng. S/N CAE847835) test cell run through full operational parameters at Rolls Royce in Indianapolis, IN (FAA and NTSB representatives in attendance)
- 17 DEC 14 – N373RL (ECU S/N JG8ALK0486) bench tested at Triumph Engine Controls in West Hartford, Connecticut
- 23 DEC 14 – N373RL (Bleed Valve S/N FF27661) bench tested at RLC Engine Overhaul Shop in Broussard, LA
- 26 JAN 15 – N373RL (HMU S/N JGALM078) bench tested at Rolls Royce in Indianapolis, IN

CONCLUSIONS

Based upon the additional component testing information obtained from the reports found above, the primary causal factor was a malfunctioning bleed valve. Test results determined that it was closing too early. Upon total disassembly, excessive corrosion was found in the bleed valve. In addition it was noted that corrosion flakes were wedged in the bleed valve exit orifice. Also, unusual wear was found on the bleed valve bellows face where the exit orifice mates.

MANAGEMENT MITIGATION ACTION

Based upon the primary causal factor regarding this incident, RLC Management has made the decision to revise the OEM's bleed valve overhaul schedule from 1500 hours to 750 hours to mitigate recurrence of a similar incident. RLC IEP group and other managers will increase surveillance on engine water wash and chemical wash procedures to insure proper techniques are used when performing these tasks.

250 C30/47 BLEED VALVE SERVICE LIMITS/750 HR INSP

250-30 MANUAL 14w3 2ND Edition 20th Revision Dated 1 Apr 14

250-C47 MANUAL CSP22001 Edition 2 Revision 15 Dated 15 Sept 2014

Date removed 12-15-14 Discrepancy STALLS W/O R 27478

P/N 23073353 SIN FF2766L TT unk TSO/TSI 8050

A/C removed from N373RL A/C TT @ Removal 7284.7

Vendor (if repaired) CADORATH

CALIBRATION LIMITS (PSI)

P AMB	P F	TEST CONDITIONS	PC min	PC max	PC	TE	Insp
14.7	31.0	.150 valve position	52.0	63.5	26.9		
14.7	76.4	.010 valve position	72.0	78.0	37.5		
6.75	20.0	.150 valve position	22.0	30.0	18.5		
6.75	20.0	.010 valve position	33.0	40.0	23.0		

CALIBRATION LIMITS (KPA) GAUGE READINGS

P AMB	P F	TEST CONDITIONS	PC min	PC max	P C	Tech	Insp
14.7	112.5	.150 valve position	257.5	336.8	85		
14.7	425.3	.010 valve position	395.4	436.8	160		
6.75	36.7	.150 valve position	50.7	105.8	30		
6.75	36.7	.010 valve position	126.5	174.8	60		

Passed Adjusted Serviceable Rejected

Remarks(findings): Corrosion debris wedged in exit orifice, causing bleed valve to close early. Unusual wear on bellows face where exit orifice mates

Tech [redacted] Insp. [redacted] Date 12-23-14