



Ann-Charlott Söderquist
Administrator
Swedish Accident Investigation Authority
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Sweden

Dear Söderquist,

This is the Federal Aviation Administration's (FAA) final response to Safety Recommendation 18.157 received on December 10, 2018. The Swedish Accident Investigation Authority (SHK) issued this recommendation as a result of a helicopter accident (MDHI 369D), registration #SE-JVI, equipped with a Rolls-Royce Corporation (RRC) RR 250-C20 engine, that occurred on September 26, 2017. The helicopter lost altitude and speed shortly after takeoff from Älvsbyn/Högheden Airport (ESUV). The helicopter collided with the ground at the side of a grass field behind a building and near the edge of a forest as a result of loss of power supply. The engine did not supply enough power to actuate the rotor system. One crew member was killed and another was seriously injured. The helicopter sustained substantial damage.

18.157. Evaluate whether the construction of the Rolls-Royce engine RR 250-C20 and other models using the same type of B-nut, without any other safety measures than the tightening torque and the prescribed nut checks, provides sufficiently secure protection against engine failure in single-engine configurations. [RL 2018:08 R1]

FAA Comment.

The FAA, with support from RRC, evaluated the safety of B-nuts for fitting connections on the RRC Model 250 engine. Over the years, RRC has taken several actions to ensure that the ongoing risk of an incorrectly installed B-nut is as low as reasonably practicable. These actions have yielded a design that has an event rate that the FAA considers safe without the need for additional safety measures.

The FAA investigated the service history of B-nuts and the actions taken by RRC to determine the root cause of this event. In this specific accident, the loose B-nut resulted in the loss of engine power. However, the root cause of the loose B-nut could not be conclusively determined. Torque tests performed after the accident were inconclusive regarding how the non-original equipment manufacturer hardware on the fuel control unit played a role (if any) in the accident. Our review suggests that the likely root cause is the failure of maintenance technicians to follow the RRC maintenance procedures for the tube assembly installation during the change to the gas generator governor, which was completed 129 hours before the event.

Our review also suggests the torque paint installation and inspection procedures do not seem to have been followed for the B-nut prior to the event flight.

In 1988, RRC conducted a series of B-nut tests with varying torque values. Those tests confirmed that a properly installed B-nut with approved fittings does not loosen with time during engine operation. The FAA reviewed the tests and found them to be valid and applicable. Subsequent to the B-nut tests, RRC conducted a study of alternative methods to secure tubing connections. RRC evaluated the current B-nut design, the current B-nut design with an anaerobic thread-locking adhesive, the use of safety wire, and two self-locking designs. The study concluded that none of the other connector designs offered a superior indication to the maintenance technician that the required torque has been achieved compared to the current B-nut design.

We reviewed the existing RRC Model 250-C20 engine service information, including Commercial Service Letters and Operation and Maintenance Manuals (OMMs) for the completeness of instructions regarding B-nut servicing. We found the OMMs clearly require the use of torque striping lines after proper alignment and tightening in the appropriate sections of the manuals. There are also instructions to remove old torque paint before applying new torque paint and a requirement to check the torque paint marks before flight.

As noted in the SHK report, Final report RL 2018:08e, dated August 20, 2018, the hardware on the engine was not representative of RRC's type design hardware. Also noted in the report, the fitting on the fuel control unit that mated to the loose B-nut differed from the RRC engineering drawing. The thread count was less than the drawing requirement, and the thread profile was shorter and rounded compared to the RRC drawing. Because of this component, it is difficult to conclude that B-nut connections are deficient using this example since the mating component did not meet the original design intent.

In summary, we evaluated the service history of B-nuts used by RRC on their Model 250-C20 engines, including the Model 250-C20B. We specifically evaluated the integrity of the connection without any other safety measures other than the tightening torque and the prescribed nut checks. We have determined that properly maintained tubes and fittings, which are torqued, marked, and inspected per the service information, provide sufficiently safe protection against engine failure in all installations.

The FAA would like to thank the SHK for submitting FAA Safety Recommendation 18.157 [RL 2018:08 R1] and its continued interest in aviation safety. If you have any questions, or need additional information regarding this safety recommendation, please contact the FAA Safety Recommendations program staff at 9-AVP-FAA-SafetyRecs@faa.gov. Alternatively, you may contact Ms. Naleé D. Romero, AVP-420, at (202) 267-7402.

Sincerely,

Steven J. Gottlieb
Aviation Safety
Executive Director
Office of Accident Investigation and Prevention