Kansas City Flight Standards District Office

Airworthiness Facts

Date FY19 1st Quarter (October, 2018)

Federal Aviation Administration

Airworthiness Section

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FAA Safety Team Airworthiness, Topic of the Quarter

The art of Torque:

So what is Torque? In aviation, Torque has several different meanings, with a turbine engine, torque is power, measured in percentage of torque, and another meaning of torque is the influence of engine torque on aircraft movement and control. This is exhibited as a left turning tendency in piston single engine propeller driven aircraft. The torque we are going to talk about is use in securing aircraft fasteners and measured with a wrench.

The following information is from an FAA Document titled:

Advisory Circular
43.13-1B, 7-40. TORQUES.
"The importance of correct torque application cannot be overemphasized. Under torque can result in unnecessary wear of nuts and bolts, as well as the parts they secure. Over torque can cause failure of a bolt or nut from overstressing the threaded areas. Uneven or additional loads that are applied to the assembly may result in wear or premature failure. The following are a few simple, but important procedures that should be followed to ensure that correct torque is applied.

NOTE: Be sure that the torque applied is for the size of the bolt shank not the wrench size.

a. Calibrate the torque wrench at least once a year, or immediately after it has been abused or dropped, to ensure continued accuracy.

b. Be sure the bolt and nut threads are clean and dry, unless otherwise specified by the manufacturer.

c. Run the nut down to near contact with the washer or bearing surface and check the friction drag torque required to turn the nut. Whenever possible, apply the torque to the nut and not the bolt. This will reduce rotation of the bolt in the hole and reduce wear.

d. Add the friction drag torque to the desired torque. This is referred to as "final torque," which should register on the indicator or setting for a snap-over type torque wrench.

e. Apply a smooth even pull when applying torque pressure. If chattering or a jerking motion occurs during final torque, back off the nut and re-torque.

NOTE: Many applications of bolts in aircraft/engines require stretch checks prior to reuse. This requirement is due primarily to bolt stretching caused by over-torqueing.

f. When installing a castle nut, start alignment with the cotter pin hole at the minimum recommended torque plus friction drag torque.

NOTE: Do not exceed the maximum torque plus the friction drag. If the hole and nut castellation do not align, change washer or nut and try again. Exceeding the maximum recommended torque is not recommended.

g. When torque is applied to bolt heads or cap screws, apply the recommended torque plus friction drag torque."

I can say there is vast amount of information published on the subject of Torque. With all information available I had to limit the content of this document because of size, some additional references are:

The Navy Document NRTC 14008A

FAA Documents; there are several Advisory Circulars available.

NTSB Safety Alert Document SA-056

The Torque Wrench is one of the most important tools in your tool box, and when it comes to your tools, you get what you pay for.

Mechanics: Prevent Carbon Monoxide Poisoning,

This information came from the NTSB Safety Alert 070

"**Carbon monoxide (CO)** is a colorless, odorless, tasteless gas by-product of internal combustion engines found in exhaust gases. Sufficiently high levels of CO in the bloodstream will lead to oxygen starvation and the onset of symptoms (such as headaches, drowsiness, nausea, or shortness of breath).

Many internal combustion engine airplanes are heated by air that has been warmed by circulating air around the exhaust system using a heater shroud. **A defect or leak in the exhaust pipes or muffler can introduce CO into the cockpit.**
Cracks in exhaust/heater mufflers and tubes and unplugged holes in the firewall can go unnoticed during inspections and lead to CO entering an airplane's cabin during flight. Degraded door and window seals or leaks in the air ducting can also allow CO into the cabin.

The National Transportation Safety Board (NTSB) has investigated several accidents (some fatal) in which pilots were incapacitated following CO exposure, such as the following:

A Mooney M20C airplane crashed in a field following the pilot's incapacitation; the pilot was seriously injured. Shortly after departure, the pilot lost consciousness and air traffic control was unable to contact the pilot. The airplane continued to fly for about 1.5 hours until the fuel in the selected tank was exhausted. The pilot's CO level was at least 28% (and likely higher) at the time of the accident. CO levels between 10% and

20% can result in confusion, impaired judgment, and difficulty concentrating. Post accident examination of the airplane found a fracture in the exhaust/heater muffler (see left photograph in figure 1) and exhaust deposits inside the muffler shroud (right photograph in figure 1). This allowed the exhaust gas to enter the cabin, exposing the pilot to CO. (CEN17LA101)

Witnesses observed an experimental amateur-built, Hefty Polar Cub airplane flying erratically at a low altitude before impacting terrain. A post-crash fire ensued, and the pilot was fatally injured. Toxicology testing revealed that the pilot's CO level was 48%; no soot was found in his airways, indicating the CO was not a result of the fire; thus, the NTSB determined that the pilot's severe CO impairment likely caused the pilot's loss of airplane control. Examination of the airplane's exhaust system revealed that the exhaust/heater muffler was fractured, allowing CO to enter the cockpit. (ANC16FA065)

About 3 hours into a 3.5-hour post maintenance flight, a Cessna 207 airplane impacted trees and a river. The pilot was fatally injured. Toxicology tests identified a CO level of 21% in the pilot's blood, which likely adversely affected his performance. The airplane's original cabin heat system had been modified with a "winter heat kit"

that, according to maintenance records, had not been installed in accordance with Federal Aviation Administration (FAA) field approval procedures. The full heat system was not recovered, and it was not possible to determine the exact source of the CO. (ANC15FA032)

A Bellanca 14-19-2A descended from cruise flight at a rate of 2,900 ft. per minute and collided with power lines and trees. The pilot was fatally injured. The wreckage examination revealed cracks and holes in the muffler wall and exhaust gas penetration into the interior of the shroud. Toxicology tests identified a CO level of 37% in the pilot's blood. Most of the CO detected in the pilot's blood was likely from inhalation during the flight; the CO levels would have impaired his ability to safely fly the airplane. (CEN14FA024)

What can you do?

- Inspect exhaust systems, air ducting, firewalls, and door/window seals thoroughly at every 100-hour or annual inspection to reduce the chance of CO being introduced into the cockpit.

- Inspect heater air inlet cockpit vents for evidence of sooting, consistent with the presence of CO.

- Talk to pilots about installing electrochemical CO detectors with aural and visual alerts in the cockpit.

- Be informed and review and comply with any airworthiness directives and service bulletins regarding the exhaust system. Speak with the owner about regular inspections and the replacement schedule of parts."

For the full article, see the NTSB SAFETY ALERT 070.

https://www.ntsb.gov/safety/safety-alerts/Documents/SA-070.pdf

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Notice of Proposed Rules Airworthiness Directives:

Notice of Proposed Rule Making is your chance to make a difference; yes, if you go through the process, you can make a difference.

This link is for Proposed Rules Airworthiness Directives; http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgADNPRM.nsf/MainFrame?OpenFrameSet

New Airworthiness Directives:

This link is for Airworthiness Directives, for all aircraft.

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgAD.nsf/MainFrame?OpenFrameSet

Service Difficulty Program:

When a system, component or part of an aircraft (Powerplants, Propellers, or Appliances) functions badly or fails to operate in the normal or usual manner, it has malfunctioned and should be reported. Also, if a system, component, or part has a flaw or imperfection which impairs function or which may impair future function, it is defective and should be reported. While at first sight it appears this will generate numerous insignificant reports, the Service Difficulty Program is designed to detect trends. Any report can be very constructive in evaluating design or maintenance reliability.

The reports can be filed electronically or by paper, for electronic go to https://www.faa.gov/forms/index.cfm/go/document.list?omni=Forms&parentTopicID=0&display=current&subjectClassPrefix=&documentNumber=FAA+8070-1&q=FAA+8070-1.

Service Airworthiness Information Bulletins:

http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSAIB.nsf/Frameset?OpenPage

Kansas City Flight Standards Office Information

To include Designees, Airworthiness Representatives, Designated Mechanic Examiners, and Designated Parachute Rigger Examiners information.
Current Link:

https://www.faa.gov/about/office_org/field_offices/fsdo/mci/

Closing Question?

When was the last time you had the Calibration Check on your torque wrenches?

Next Quarter:

Mechanics: Manage Risks to Ensure Safety.

Airworthiness Facts are published on a quarterly basics and available via email only. If you would like to receive Airworthiness Facts or be removed from the mailing list, contact the Kansas City FSDO FAASTeam

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