

Fastener Failures

The number of amateur-built aircraft is increasing and unfortunately so is the incidence of reported fastener failures. An FAA Designated Engineering Representative (DER) from Oregon investigated the reports and found a common link. The following was paraphrased from the report.

His research "strongly suggests that **fasteners are under torqued far more often than they are over torqued.**"

It seems a fastener is far more apt to fail if it is assembled with insufficient preload. This preload is commonly referred to as torque. Unfortunately the preload can be wrong even if the apparent torque input is correct.

The commonly accepted "torque" procedure is just a way to attempt to control preload. It appears to be very precise as some mechanics have a fit if you are 1/2 pound off on torque setting. It, however, has been demonstrated that this pre load procedure is very poor and unpredictable. It is subject to many variables including assembly technique and friction. Any friction will obviously reduce the pre load applied to the bolt.

To reduce this error all fasteners should be at least like new with clean, smooth, properly plated, and **properly lubricated**. Proper torque sequence must also be followed to prevent uneven preload on the fasteners.

The DER pointed out that "any fastener which is loaded in tension must have a preload which is higher than any load which will be imposed in service. So long as preload exceeds service load, the fastener will not experience any cyclic stresses and will ordinarily have an infinite fatigue life." If the service load exceeds the preload then the fastener will be cyclically stressed resulting in further loosening and preload loss. The fastener will then fail depending upon the number of cycles and the load imposed.

I have seen some builders who believe that a bolt is a bolt and local Handy Andy hardware bolt is just as good as a Lycoming bolt for holding things together. This is not true. AN bolts are not an automatic solution to all fastener problems. There are many special case situations where the fastener material must be able to hold a higher than normal preload and therefore require a special bolt. Engine case bolts, connecting rod bolts, case studs, etc have a much higher than normal strength and require torque values that would destroy AN or hardware store fasteners. Do not substitute AN hardware for special OEM hardware!

In summary, the DER made the following recommendations we should follow." At the very least, use only a high quality calibrated and certified torque wrench. Assemble everything according to approved instructions and follow them to the letter. Then go back and double check everything twice. Never re-tighten a critical fastener such as a propeller bolt if found loose in service. Replace it!

But, before doing anything else, investigate the cause of the loose fastener and look for other damage. **Treat the cause, not the symptom!**"

Engine Failure Caused by Switch

An off airport landing was made following total engine failure caused when both ignition sources failed to develop enough power to fire the spark plugs. It seems the builder had connected both coil negative terminals together at a switch. The switch controlled an electronic tachometer and had an internal ground fault. The coils overheated and failed to produce enough energy to fire the plugs.

Though not typical in our engine installations, I thought it wise to point out this problem for those trying to tie the Equus electronic tach to both a mag and an electronic ignition.

Alexander SportAir Center Builder's Workshop Schedule

The following is a listing of Alexander Sportair composite workshops. The two day **Composite I** Workshop will be of interest to those starting **scratch built** moldless construction similar to what is used in building EZs, Cozys, Defiants, E-Racer, etc. Students will build a portion of a canard.

Please check with your aircraft's designer to see if the presented methods and materials are acceptable for your aircraft project.

The two day **Composite II** Workshop is appropriate to those who are considering construction of **kit built** airplanes like the Berkut, Glasair, Lancair, etc. Vacuum bagging, bonding, glassing panels and general laminating will be experienced.

Cost of each course including materials and comprehensive workbook is \$199. Phone 800-WORKSHOP or write:

Alexander SportAir Workshops
219A Barry Whatley Way
Griffin, GA 30223.

July 13-14 Arlington, WA
August 24-25 North Hampton, NH
September 21-22 Frederick, MD
October 12-13 Mesa, AZ
November 2-3 Lakeland, FL
November 16-17 Griffin, GA

Vari-Eze Project

Major glass work done on fuselage, wings and canard. Ailerons and elevator fabricated but not attached. Nose gear and main gear not attached, material available for winglets and rudders. Plans, early Canard Pushers, full set of instruments, cowlings, Jiran pre-fab tanks, Cleveland wheels brakes and tires are included. I have over 800 hours and \$3,000 - \$4,000 invested. Sale price: \$2,000 FOB Harvest, AL.

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