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Safetying Nuts and Bolts

BY JOE NORRIS

A BOLT IS NO good without a nut, and in aviation the nut will probably be either castellated or self-locking. Self-locking nuts are, well, self-locking, but if you're using a castellated nut, you'll need to secure it in some fashion.

There are several styles of self-locking nuts, all in one of two major groupings depending on their construction: all metal or nylon. The nylon style uses a nylon insert (sometimes called fiber lock) to apply locking pressure on the bolt threads. The all-metal style eliminates the nylon insert and is heat-resistant. All-metal lock nuts can be used anywhere on the aircraft, but the nylon style should not be used in the engine compartment.

The most common self-locking nut is the nylon style designated AN365 or the new designation MS20365. There is a thin (half-height) version designated AN364 or MS21083 that can be used if the fastener is only loaded in shear. For applications in the engine compartment, you'll want to use the all-metal AN363 (MS21045) self-locking nut.

Self-locking nuts can be used on fasteners that are not subject to rotational forces. But where the fastener *is* subject to rotation, you'll need to use a drilled fastener and a castellated nut. You will then secure the nut with either a cotter pin or safety wire. A cotter pin is the most common safetying device, but if your nut goes on a stud that is in turn threaded into a component of your aircraft, use safety wire to secure the nut. This also keeps the stud from loosening.

COTTER PIN INSTALLATION

The primary method for installing a cotter pin is to put the pin in so that the eye is lined up with the shank of the fastener. The eye of the pin will then nestle down into one of the castellations on the nut. This will prolong the life of the pin by keeping it from turning in the nut. When installing the pin in this fashion, one leg of the pin will be bent down toward the washer and the other end will be bent up and over the end of the fastener. Trim the end that goes down toward the washer short enough so that it does not reach the base material being fastened. If the end of the pin is allowed to mar the base material, it will cause a stress riser that may propagate a crack. Trim the pin off short enough to avoid this. The end of the pin that goes up over the end of the fastener should be trimmed off so that it does not extend beyond the edge of the fastener. This will not only avoid having the sharp end of the pin in a position to cut you later on, but also will guard against the possibility of something

SAFTEY WIRING OVERVIEW

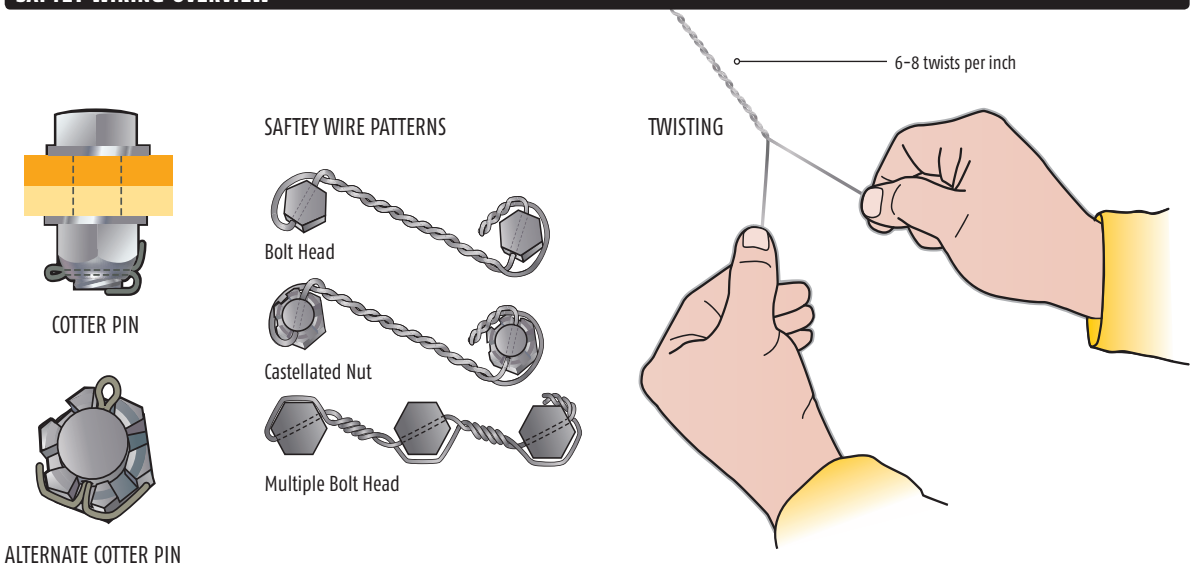

ILLUSTRATION BY GARY COX

catching the pin, which may lead to the pin breaking off and falling out.

In the secondary method, the pin is inserted with the eye perpendicular to the shank of the fastener and parallel to the washer under the nut. The two ends of the pin are bent around the outside of the nut to the left and right of the pin. The ends should be trimmed off approximately one-third of the way around the nut to keep them fairly short so they don't get caught on something later on.

SAFETY WIRE

Safety wire is also used to safety bolt and screw heads along with plugs, caps, and anything else that you want to lock in place. The wire is passed through a hole in the fastener and then twisted around itself before being locked to a fixed location. This can be another bolt or screw head, or it can be some handy part of the structure nearby. The trick is to avoid twisting the wire too tightly and to make sure it's installed in the tightening direction (called positive safety). The safety wire should appear to be pulling the fastener toward the tightening direction. Our illustrations show positive safety on a standard right-hand thread fastener. For safetying left-hand threads, your finished safety wire would be a mirror image.

Safety wire can be twisted by hand, but most people use a tool to accomplish this task. Manual and spring-loaded safety wire pliers are the tool of choice, but the ease of using this tool often leads the builder to twist the safety wire too tightly, which will cause the safety wire to break and defeat your purpose. You want only 6 to 8 twists per inch in your safety wire. Any more will put undue stress on your wire and cause it to fail.

Note that one strand of safety wire goes through the fastener and the other strand loops around the outside. Always twist your safety wife so as to force the outside loop down around the head of the fastener. If you've twisted it the wrong way the outside loop will pop up off the head of the fastener and won't stay put. If this happens, start over and twist the wire the other way. Our illustrations show how to twist the wire so as to keep these exposed loops in place.