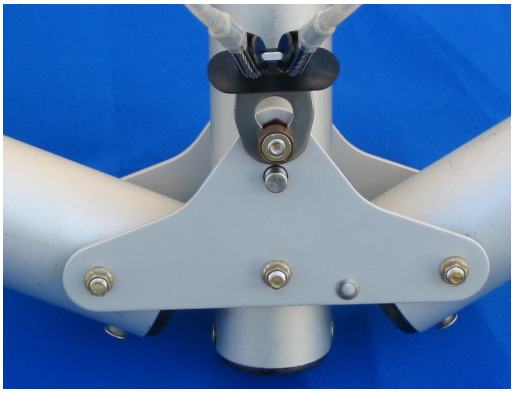
Supercedes: TB980716 Inspection and Pre-flight of Locknut Assemblies

### Service Recommendation

We are henceforth recommending the use of of Loctite 271 Threadlocker in the assembly / installation of the following locknut fasteners:

1. The keyhole collar which retains the bottom nose wire (bottom of the noseplate).
2. The keyhole collar which retains the sweep wire and (if applicable) top rear wire (rear of keel).
3. The redcap locknut used to retain the inner sprog wire and bottom side wire on the crossbar of the T2.
4. The redcap locknut used to secure the crossbar and inner sprog of the T2 to the T2 leading edge bracket.



5. Any other critical locknut fastener or assembly used in an application where the possibility of rotation of components may loosen the nut, or where inspection of the degree of engagement of the bolt threads into the nut locking mechanism is difficult or impractical.

Loctite 271 is available from Wills Wing in three sizes (prices shown subject to change):

| ID | Description | Specification | Retail Price |
|---|---|---|---|
| 70L-1741 | LOCTITE 271 - 0.5 ML CAPSULE | APPROX 10 APPLICATIONS | $2.50 |
| 70L-1742 | LOCTITE 271 - 10 ML BOTTLE | APPROX 200 APPLICATIONS | $20.00 |
| 70L-1743 | LOCTITE 271 - 50 ML BOTTLE | APPROX 1000 APPLICATIONS | $50.00 |

### Background

Over the years a number of incidents have occurred in which locknuts have fallen off of critical glider assemblies, allowing these assemblies to come apart. In any such incident there exists the potential for an extremely serious and dangerous accident.

Wills Wing has used a number of different types of locking nuts. They vary, both between types and among nuts of the same type, in initial torque required to install and remove (on first installation), and in residual torque required to install and remove after repeated use. The torque required to loosen a locknut after one installation can vary from 12 inch pound (three lbs of force at the end of a four inch wrench) to as little as 4 inch lbs. The torque required to loosen a locknut after repeated use can drop to less than 1 inch lb.

The application of a drop of Loctite 271 Threadlocker has, in our tests, increased the torque required to loosen the nut to a range between 20 and 50 inch lbs. Even at the highest level, this still allows for disassembly requiring only modest forces (12 lbs applied on a 4 inch long wrench), but it increases the security of the assembly against inadvertent loosening by a substantial margin.

In "normal" use, (normal set-up and breakdown, and flight), there are few situations in which any significant forces will act on a nut in such a way as to tend to cause it to loosen up. However we have identified a few common practices, such as tethering a glider from the nose wires, either for transport, or when parked in the wind, that can apply sufficient torque to a locking fastener to cause it to loosen up. We specifically recommend that you do not ever use the nose wires to tether the glider for any reason – if you need to tether the nose, the tether should be attached to the keel tube.

### Additional Recommendations

We make the following additional procedural recommendations regarding the use, installation and maintenance of locknuts on our gliders:

1. Pre-flight inspection:

   It is NECESSARY, for safety, that EACH and EVERY fastener on the glider be inspected prior to EACH and EVERY flight. This is the only way to insure the security of the assemblies and components that are held together by these fasteners. For gliders used in multiple flights per day, as in a training situation, it is NOT adequate to perform one inspection at the beginning of the flying day. Inspection of all nuts should confirm that the nut is properly installed, that it is adequately engaged on the threads of the bolt for proper locking, that it cannot be loosened by any force that can applied by hand, and that any applicable safety ring or other safety device is properly installed.

2. Adequate engagement of the locknut on the threads of the bolt:

   The locking portion of a locknut is typically the last part of the nut through which the bolt passes when the nut is installed. (The exception to this is the specific application in which the clinch nut is pressed into the keyhole collar – this nut is reversed, so the locking portion is the first part of the nut that the bolt passes through.) When the nut is properly installed, the end of the bolt should extend beyond the locking area of the nut by at least one full thread (.036 inches for a typical ¼ - 28 AN bolt) on the non-tapered portion of the bolt. (This criteria is satisfied on the keyhole collar that uses the pressed in nut when the bolt head is flush with the bottom of the nut / top of the collar.)

   The resistance to turning provided by the locking feature of the nut during installation equates to about 5 lbs of force or less at the end of a four inch long wrench. Elastic compression of the parts which the

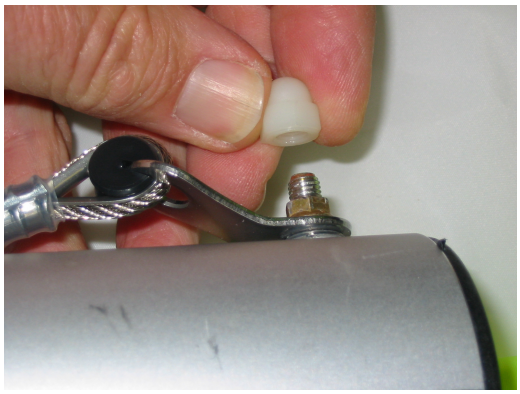
bolt and nut are securing may as much as double this force as the nut reaches full tightness. If you need to exert more torque than this, (more than ten lbs on a 4 inch long wrench) you are over-tightening the nut. If you cannot a achieve the minimum one full thread and .036" of engagement as indicated without over-tightening the nut, you must do one of the following:

a. Remove washers, or substitute thin washers for thick washers.
b. Use a flat file to reduce the height of the heads of aluminum bushings to 1/16" (.063") above the tube.
c. Replace the bolt with a longer bolt.

The "one full thread / .036 inches" criterion is to be used to inspect existing bolt installations. When re-assembling a lock nut onto a bolt, there is an additional criterion which must also be met, in addition to the one full thread requirement – you must have a minimum of one full turn of the nut after the locking feature of the nut engages (after the installation torque reaches at least 6 inch lbs.) If either of these criteria is not met, you must replace the nut and / or the bolt, or alter the assembly configuration until you can achieve both.

3. Use of Nylon Threaded Nutcap as Both Safety and Visual Indicator of Adequate Engagement.

We have introduced a new bolt, nut and nut cap assembly configuration for the crossbar – leading edge junction on Falcon 3's, Sport 2's and U2's, and for the separate crossbar -side wire junction on Sport 2's and U2's. The photos below show an example of the new assembly as installed on the Falcon 3 Tandem. In each assembly, a ¼ inch clinch nut (10N-1740) is used in combination with a long enough bolt to provide several threads exposed beyond the nut, and then the nylon nut cap is threaded onto the end of the bolt.



*Installation of clinch nut*

*Nylon nut cap installed above clinch nut*

The nylon nut cap pictured is item 15A-2010 NYLON THREADED NUT CAP 1/4 28

The nylon nut cap serves as a wear protector, and also, in effect, provides a visual check that the nut is adequately engaged on the bolt, because the nut cap can only engage if there are threads on the bolt extending beyond the nut.

*Note: Although the nylon nut cap has the appearance of an acorn nut, it is not a structural part, and must not be used as a fastener in any application.*

The original assembly configuration for all of these assemblies included a bolt, castle nut, and small safety ring. A later, interim configuration used a clinch nut and safety ring. The change to the clinch nut and nylon nut cap is

intended to address a number of problems with each of these configurations, including wear issues and problems with the safety ring becoming dislodged.

When installing the clinch nut on the bolt, it should be tightened down until all slack is taken up, and then backed off just enough to allow the secured parts to swivel under light to moderate pressure. The nylon nut cap is then installed onto the bolt as far as it will go – do not over tighten or you will strip the nylon threads.

The following bolt changes are required to provide sufficient threads to engage the nut cap:

| | |
|---|---|
| Falcon 3 145, 170, 195 | No changes required – may change to A type (no hole) |
| Falcon 3 Tandem | AN4-32 changed to AN4-33 (or 33A) |
| Sport 2 62mm Xbar/side wire | AN4-32 changed to AN4-33 (or 33A) |
| Sport 2 175 66mm xbar – Xbar/side wire | AN4-33 changed to AN4-34 (or 34A) |
| U2 Xbar/side wire | AN4-30 changed to AN4-31 (or 31A) |
| Sport 2 Xbar/Leading Edge | AN24-46 changed to AN4-27 (or 27A) |
| U2 Xbar/Leading Edge | No changes required – may change to A type (no hole) |