



Practice drilling holes in scrap pieces until you are familiar and confident with the process. It is important to remember that heat from the machining and drilling processes *may* change the acrylic characteristics some to allow some of the approved products to affect the material. This is an important reason to cut slowly and avoid overheating the acrylic material.

Use of a step-drill (Unibit) or reamer is recommended for hole enlargement.

**CAUTION:** Do not use a regular twist drill as they have tips that tend to fracture the acrylic. Using a regular twist or plexi drill to enlarge a pre-drilled hole is not recommended and will almost guarantee to crack a canopy.

**Fiberglass Bonding, Cracks, Etc.**

Be certain to use ONLY epoxy resins. Do *not* use the more common polyester or vinyl ester resins. They are not compatible with Plexiglas and cause crazing that will ruin the canopy. We have had excellent luck with West Systems Epoxy products, available from boat yards and mail order houses.

Cracks... Seriously avoid jeopardizing or cracking the canopy at all costs. If the worst does occur and you develop a crack, they may sometimes be fixed using a solvent adhesive such as Plasti-Fix or Weld-On 3. Stop-drilling the crack is typically required to keep it from running.

**CAUTION:** Do not use Polyester resin of any type, as it will cause crazing.

**Cleaning And Use Of Liquids**

For general cleaning use dishwashing liquid and water followed by a clear water rinse. To prevent water spots, blow dry with compressed air or wipe dry with soft cotton flannel. Plexus, Sprayaway #848 Industrial Plastic Cleaner, or All Clear can also be used for day to day cleaning. Grease, oil, tape residue, etc. may best be removed with mineral spirits, refined kerosene, white gasoline, naphtha, or isopropyl alcohol. Wash approved solvents off of canopy with dishwashing liquid and water. It is best to avoid using products that are not specifically formulated for acrylics on your canopy such as Rain-X or furniture polish.

**CAUTION:** Do not use Loctite, aromatic solvents, acetone, benzene, ethyl acetate, carbon tetrachloride, lighter fluid, lacquer thinners, gasoline, toluene, window sprays, concentrated alcohols, keytones, scouring compounds, or ammonia products on or around acrylic or Lexan canopy materials.

**CAUTION:** Do not allow electrical tape or auto fuel to come into contact with Lexan as it will also cause crazing. This is a particular issue to beware of when refueling the RV-12.

**Scratch Removal**

Small scratches can be buffed out with Meguiar's Mirror Glaze #17. For deep scratch removal, use Scratch Off, Micro Mesh, or 3M Window Repair kits. Avoid removing scratches in critical

areas where clear visibility is important, as the process will usually result in some degree of optical distortion.

**Canopy Protection and Ventilation**

If the aircraft is tied down outdoors and subject to weather elements for any length of time, then the use of an aircraft canopy cover is highly recommended. The cover will protect canopies and windows from abrasive dust, dirt, and sand kicked up by wind or prop wash. Before purchasing, verify that the canopy cover is NOT waterproof as the trapped moisture and heat from the sun can be deleterious. Acrylic subjected to this treatment over a period of time may turn slightly milky and eventually crazes.

Keep your canopy ventilated or covered when your aircraft is parked in the hot sun. Cabin temperatures can easily reach 150-200 degrees F even on a mild day. The acrylic can generally take these temperature conditions multiple times without any apparent adverse effect. It is the cumulative affect that will cause shortened service life of your canopy. The use of a Van's Aircraft Canopy Cover will significantly reduce the internal temperatures inside your aircraft to just a few degrees above outside ambient temperatures. Additionally it will also protect your expensive avionics from heat and your upholstery/seat belt harnesses from harmful UV rays.

In winter conditions, ensure that the cabin and canopy is warmed adequately prior to flight if possible. A heat lamp or small, low output ceramic space heater can raise the cabin temperature to warm the acrylic, keeping it free from ice or snow. It will also be less prone to cracking.

**5V NUT AND BOLT 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 over - stressing 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.

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

Use the standard torque table provided as a guide for tightening nuts, bolts and screws whenever specific torque values are not provided in the builders manual. These values are for clean and dry threads. Note that on the smaller bolts the torque is quite low and is in inch pounds. Do not try and use a foot pound torque wrench on these bolts. Use a torque wrench calibrated in inch pounds. The propeller manufacturer and the engine manufacturer have specific torque requirements for their equipment. Consult the appropriate manual for that information. Apply a smooth even pull when applying torque pressure. When using the 1/4 in. drive snap-over type torque wrench we recommend practicing with it off the aircraft first until you get the feel of the snap-over since it can be rather light depending on the size of the fastener.

Apply the torque to the nut and not the bolt whenever possible. This will reduce rotation of the bolt in the hole and reduce wear.

When the bolt is rotated for final torque the chart values must be modified. When applying torque to a bolt be sure to have a washer under the bolt head and lubricate the bolt shank. Add to the overall torque value the torque required to overcome the friction associated with turning the shank of the bolt within the assembly.

When tightening fasteners with self-locking nuts the chart values must be modified. Due to the friction of the locking device noticeable torque is required just to turn the nut onto the threads and does nothing to actually tighten the parts together and stretch the bolt (clamp load). This is called friction drag (or prevailing) torque. The friction drag torque must be determined and then added to the standard torque from the table. Run the nut down to where it nearly contacts the washer or bearing surface and check the friction drag torque required to turn the nut. (At least one thread should protrude from the nut). Add the friction drag torque to the standard torque. This sum is referred to as the final (or total) torque, which should register on the indicator or setting for a snap-over type torque wrench.

As an example illustrating the importance of determining the friction drag torque consider new AN3 bolts and MS21042-3 all metal lock nuts. Testing showed the friction drag torque at 14 in-lbs. The standard torque for this nut/bolt combination is 20-25 in-lbs. Let's say we choose 20 in-lbs. This results in a final torque setting on our wrench of 14 plus 20 or 34 in-lbs. Though we exceeded the 25 in-lb value listed in the table by using a final torque of 34 in-lbs we are still well within the capability of the nut. (Incidentally this nut must meet a maximum torque test value of 60 in-lbs per the military standard spec sheet.) Now what if we completely ignore the friction drag torque and set our wrench to just 20 in-lbs? Recall that it requires about 14 in-lbs (friction drag torque) just to turn the nut. We subtract 14 from 20 and arrive at only 6 in-lbs of torque (torque being the measurement of friction, not tension) applied to induce preload (clamp load) in the bolt. Not a satisfactory result.

(Portions of this information has been adapted from AC 43.13-1B Section 7-40.)

AN Bolt Size	Bolt Size- Threads Per Inch	Standard Nuts AN310, AN315, AN365	
		INCH POUNDS	FOOT POUNDS
AN3	#10-32	20-25	1.6-2.0
AN4	1/4-28	50-70	4.2-5.8
AN5	5/16-24	100-140	8.3-11.6
AN6	3/8-24	160-190	13.3-15.8
AN7	7/16-20	450-500	37.5-41.7
AN8	1/2-20	480-690	40.0-57.5
AN9	9/16-18	800-1000	66.6-83.3
AN10	5/8-18	1100-1500	91.6-125.0