POWERFIN Propellers
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Propeller & Light Sport Aviation Manufacturing

POWERFIN BLADE MAINTENANCE

Please recognize that any modification of a POWERFIN Propeller could void your warranty offered by either the manufacturer or any dealer representing the manufacturer. Please note also that in order to maintain your warranty, ONLY the POWERFIN factory is authorized to make repairs.

< * Apply the following procedure at your own risk * >

POWERFIN Propellers are formed with a foam core surrounded by a "shell" of carbon fiber and glass fabric. When a blade is cut to a shorter length by the customer, the foam core is exposed at the tip and needs to be properly sealed to safely operate the propeller and provide the durability of a blade produced at the factory. The failure to properly seal the tip after trimming will result in premature wear and the possibility of delaminating and catastrophic failure of the blade.

For this reason POWERFIN strongly recommends that the factory performs these operations. It is expected, however (knowing what we know about the human nature on this planet, the planet they call "Earth"), that some individuals will attempt field repairs despite the recommendations of the manufacturer. So, in the interest of safety, a guide for this procedure follows…

Premise #1: It is essential to understand how to balance a propeller before beginning the procedure of trimming and sealing the blades. Yes, chances are fair, that if these directions are followed closely, the propeller will remain in balance; this result cannot, however, be guaranteed!

Hence, apply the following procedure at your own risk!

Trimming the Blade to the desired length

The root of the blade has a molded shoulder, or flange which retains it in optimal position in the hub, against the load of centrifugal force. Therefore the blades must be jigged and trimmed in such a way as to ensure that the distance between this molded shoulder/flange and the tip is exactly the same on every blade.

The blades can be trimmed with a chop saw using a composite blade or any other blade designed for cutting metal, or by using a standard band saw with a metal cutting blade. A milling machine can also be used that has a fairly high spindle RPM (3000 or higher). A small diameter, two flute, carbide end mill should be used (3/16" or smaller).

With any method of cutting an attempt should be made to minimize heat buildup. No coolant or lubricant of any kind may be used with any cutting process. Also, when trimming the blades, remember to keep the cuttings. These scrapes will be useful to practice on in the next operation.

Recessing the Foam in the Tips

Cutting the blade will expose the foam core. This foam MUST be sealed.
Before epoxy is used to seal the tip the foam must be recessed no less than 1/8" in order to provide the epoxy a solid foundation with which to adhere. Using a Dremel tool or other high speed rotary tool, rout out the foam until it is recessed into the tip 1/8". A simple cutting bit for the Dremel can be fabricated with a wire brad or nail, bending it over 90 degrees, and clipping it to 1/8". The result is an "L" shaped piece of wire with the long leg chucked up in the Dremel and the 1/8" leg rotating, doing the cutting. With the Dremel angled at 90 degrees relative to the tip, a very consistent depth of 1/8" can be achieved with a little practice. Safety glasses are prudent with the use of any high speed tool, especially one with a self-fabricated cutting bit.

The goal with this operation is to clear the foam away from the inside of the carbon fiber shell, making the walls of the recess as clean as possible, creating a consistently wide 1/8" edge, and providing a freshly scuffed, clean surface for bonding. The reason you saved the tip cuttings from the previous step is so you can practice recessing the foam with the Dremel tool, perfecting your technique before you risk the attempt on the blade itself.

The blades must be vertically stabilized to the edge of a table top somehow before filling the tips with resin.
A good quality, room temperature curing, two-part, unfilled epoxy must be used.
(Note: We have not seen any issues with any of the brands of two-part epoxy.)

The epoxy must have low viscosity and be able to easily pour. Fill the cavity in each tip until level or slightly rounded. It is best to avoid the use of 5-minute epoxies for this one particular reason: As you fill the cavity, the foam may allow a bit of the epoxy to seep into it. This can take more than 5-minutes, precluding the full curing process from occurring before the epoxy hardens, resulting in a less than optimal bond.

On a separate point, if there is enough seepage of the epoxy into the foam, the level of epoxy will drop, causing a bit of a depression. You should be ready to fill the tip with more material if this occurs. Follow the curing instructions provided by the manufacturer very carefully.

When the epoxy is hard enough to sand, a small, palm sized sanding block with 240-grit sandpaper can be used to dress the tips. The only objective in this operation is to sand away rough edges - without over sanding.

In this section it must be stated what NOT to do:

- ***Do NOT sand the epoxy at the tip to less than 1/8"***
- ***Do NOT attempt to create an exaggerated bevel, chamfer or radius around the edge.***
- ***Do NOT attempt to radius the corners of the tip to any significant degree.***

Once the basic work is done, switch to 400-grit, then 600-grit sandpaper. Remember, smoother is better from both a structural and aerodynamic standpoint.

Lastly, make sure to * be patience * and wait for the entire recommended cure cycle to be completed before attempting to use the propeller. As an example, a 1-oz. weight on the end of a 36" string spun at 2500 rpm will multiply that weight by a factor OVER 8000, creating a centrifugal load of more than 500-lbs. The small epoxy patch at the tip of the blade weighs only a few grams, but this example hopefully illustrates how easily the repair is ruined if the propeller is run prematurely.