



POWERFIN Propellers
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Propeller & Light Sport Aviation Manufacturing

POWERFIN Assembly Instructions

THANK YOU for your purchase from POWERFIN; your support of Powerfin's blade design with its light weight, carbon-fiber composite structure is greatly appreciated.

Please note, that you are responsible to read and apply the information contained in this document in order to safely mount and operate your POWERFIN propeller configuration. Please take the time to read through all the instructions BEFORE YOU ATTEMPT TO USE OUR PRODUCTS. **Failure to understand and apply this information could put you at risk of bodily injury and even death.** Having said that, we are sure that by following our assembly directions carefully, you will quickly, easily and safely mount your propeller and then be able to set the pitch accurately.

We have made every effort to insure that you have received a product that will meet your expectations for years to come. We offer a solid warranty on our propellers. POWERFIN propellers are warranted against any factory process or material defect. This warranty however, does NOT cover customer abuses - such as operation in abusive environments, prop strikes, foreign object strikes, improper assembly, or operations on non-approved applications. And in an effort to be certain that no POWERFIN customer ever has to settle for something less than satisfaction, we also have a 60-day, no questions asked return policy. If you are not happy with what you received from POWERFIN, PLEASE return it in the same condition as it was received, directly to POWERFIN for a refund.

Packing List

Included in a complete **propeller system** order, you will find the following items:

1. Individually wrapped propeller blades, with the number of blades matching your hub.
2. One propeller hub (this may or may not be in separate package)
3. And a packet of instructions, along with your Work Order.

For "B", "C", and "F" model propellers: Note that the torque specification is **175**-in/lb on all bolts

4. Six 80-mm x 8-mm socket head bolts for the mounting plate
5. Two (times the # of Blades) 40-mm x 8-mm socket head bolts.
(So if you have received a FOUR blade configuration, you should have 8 (2 x 4-Blades) socket head bolts)
6. Six 8-mm flat washers (these are for the center hub/mounting plate bolts ONLY)
And for or some application, Six 8-mm nylox locknuts.

For all "E" model propellers: Note that the torque specification is **125**-in/lb for the mounting plate (inboard) bolts, and **125**-in/lb for blade root (outboard) bolts

4. Six 70-mm x 8-mm socket head bolts for the mounting plate
5. Two (times the # of Blades) 30-mm x 6-mm socket head bolts.
(So if you have received a THREE blade configuration, you should have 6 (2 x 3-Blades) socket head bolts)
6. Six 8-mm flat washers (these are for the center hub/mounting plate bolts ONLY)

Packing List (continued)

7. And then – regardless of the model of blade - ONE of the following...to set your pitch...
 - a. One 1/4" x 2.5" steel dowel pin
 - b. Each blade having a 3/16" embedded steel dowel pin
 - c. Our NEW Digital Propeller Protractor to complete your blade pitching adjustment

If you have not received any of these items, please contact POWERFIN immediately.

Assembly Instructions

You will need a few specific tools to mount your new propeller.

- A good quality torque wrench; one capable of accurately applying **125-in/lbs to 175-in/lbs** of torque. And yes, that is **INCH** pounds!
- A **6-mm** socket (Allen) wrench that is compatible with your torque wrench.
Most local hardware and auto parts stores carry these items.
- If using either the 1/4" dowel pin or the embedded 3/16 pins to set your pitch through the Speed Set Apex hub window, you will also need a standard set of feeler gauges OR our new Powerfin Digital Blade Protractor

With these instructions, we have provided images to help clarify the assembly steps. And again, please completely read these instructions **FIRST**, before performing any step, and then **FOLLOW THESE INSTRUCTIONS CAREFULLY**. Whenever you do any work near your craft be **ABSOLUTELY SURE** that your ignition switch and Magnetos are **OFF**. An engine with a hot ignition can kick when you turn the propeller by hand, causing *(as I am sure you are currently imaging)* serious injury!

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1. The propeller hub has two distinct halves. One half – the bottom or closest to the engine half - has the outside (blade root) retaining bolt holes threaded and **NO** cut window holes in the blade cavities. Additionally, this half does **NOT** have the POWERFIN logo or website (www.Powerfin.com) inscribed on it. Place this half on a large flat table. This is the half that will mate with the prop mounting plate, once installed.



*Set the bottom half (the half with **NO** window in the blade root sections) of the hub on a table with the cavities facing up.*

2. POWERFIN blades that can use a dowel pin for pitching, have either a 1/4" hole drilled into the root of the blade, or an embedded 3/16" pin. This hole (or pin) will be located on the same side of the blade that will be facing you when installing the hub on the mounting plate. If this is not the case please contact us for specific instructions. Place a blade into each blade cavity in the hub such that the hole (or the dowel pin) faces up.



Figure 2: Place the blades in the Hub, and if using a dowel pin for pitching, then the drilled holes face UP.

Note that some clients have requested to use our new Digital Propeller Protractor.

A protractor is the ideal way – although just a slightly more involved procedure – to set the blade's pitch. To set the pitch of a blade, when using a Propeller Protractor, no hole or pin is required in the blade's root – and you are absolutely assured of the blade tip's pitch angle!

3. Place the other half of the hub over the assembly. If using a dowel pin (whether imbedded 3/16" pins or a separate 1/4" dowel pin), the 1/4" hole or the pins should be viewable through the small square windows cut into the hub's front half. If this is the case, insert all of the outside retaining bolts – withOUT washers. Tighten them just to the point where you can pick up the assembly and it isn't so loose that the blades flop around.



Figure 3: Place the top half of the hub on and insert the bolts.

4. Tighten the outside (blade root) bolts down with a wrench, monitoring the gap between the hub halves to make sure the bolts go down **EVENLY**. This is especially critical on the two bladed propeller hubs. If one side is overly tightened down prematurely, the hub halves will not be parallel and the accuracy of the pitch setting will suffer. Generally, if you cannot see a clear difference between the gaps of the hub halves on each side of a blade, you will be accurate enough. The objective of this step is to make sure that the outside retaining bolts are down almost snug, and yet still allow for a turning movement of each blade without a lot of force.



Figure 4: Insert the bolts evenly, but do NOT torque.



Figure 5: PULL & twist the blade with outward force to seat the blade's root against the shoulder of the hub.

5. Pick up the entire assembly and place one hand near the root of a blade and one hand on the hub. Pull and twist the blade with outward force so that the blade seats in the hub cavity all the way out as far as it can. Also make sure that the 1/4" hole (or the pin) ends up in the middle of the square window of the hub. Do this on every blade. At this point your propeller is ready to mount on your craft.



*Figure 6: Lightly snug the center bolts (mounting plate bolts)
But make sure the blades can still turn in the hub.*

flat washer – no more. Make sure the blades still turn in the hub by hand, without too much effort. Loosen each bolt evenly in very small increments, if this is needed to turn a blade in the hub.

6. Place a flat washer on each (inboard) mounting bolt and insert them into the 6-center holes. Place the propeller hub onto the mounting plate making sure that there is a CLEAN surface between the propeller hub and the plate. Please verify that it goes down flat, without extra force to allow the propeller hub to fit flush to the plate. Failure of any propeller hub to lay flat against the mounting plate is indicative of a serious problem. **Call us immediately if this is an issue! Do NOT continue if effort is required seating the hub flat on the mounting plate!**

Tighten the 6-mounting bolts (inboard bolts) so that they just start to snug the

7. It is a good idea to do things methodically when setting the pitch on your propeller. Making sure the ignition switch is **OFF** (both magneto switches **OFF**), only then should you turn the propeller so that one blade is in a horizontal, comfortable working position.

And when you're ready for the next blade, turn the propeller so that the next blade is again in this same position. In other words, bring the blades to you; you do NOT want to adjust your position for each blade.



*Figure 7:
Work from the same position - relative to the craft and your hub, with every blade.*

8. ***If using our new Powerfin Digital Pitch Protractor – please now refer to those separate instructions...***

If using the dowel pins to set the pitch and the blades do not have the embedded 3/16" pin installed, then place the 1/4" x 2.5" steel dowel pin into the hole in the root of the blade. (This hole should be visible in the "blade window" on the hub.) Make sure it goes in at least 1/2". It doesn't matter how far you push it in past 1/2" as long as you don't push it in so far that you can't get it out with your fingers again.



Figure 8: If the blades do not have the embedded 3/16" pin installed, then insert the 1/4" dowel pin, through the hub's "window" and in the hole of the blade's root.

**Note that you may also use a Protractor to set the pitch of your blades. (Digital Pitch Protractors can be purchased via POWERFIN.) Blades without an Apex Hub or without a Pitching Pin (either a 1/4" hole or an embedded 3/16" pin) must use a Protractor at the Blade Tips to set the Pitch of each blade.*

[*<Instructions for using a Propeller Protractor – if not included with your kit – can be downloaded from our website>*](#)

9. The Speed Set feature on POWERFIN Apex hubs allows our blades to be pitched *easier and faster. (****But using a Propeller Protractor is the most accurate procedure for adjusting pitch. We do have Propeller Protractors available if you prefer, and you can also [download our instructions for setting pitch via our propeller protractor.](#)***)

When using the dowel pin to set the blade's pitch (with either the 1/4" dowel pin or the embedded 3/16" pin), combine the thickness of the feeler gauges to duplicate your previous setting for the current density altitude – or if you have no starting point, start with a feeler gauge amount of about 0.095". This thickness is an average to provide you with a pitch setting that is generally conducive to most applications. There will, of course, be exceptions to this setting. Without a history of feeling gauge setting for your application in your current density altitude, 0.095" will index the pitch of the blade ("in-the-ballpark") such that it comes close to proper RPM during a static run-up. The only way to be absolutely sure of the amount of pitch is to use a Propeller Protractor (and again, we can provide you with this pitching tool). A Propeller Protractor will let you know what tip pitch-angle you have for any Make or Model of Propeller blade. You can use this information when discussing pitch issues with POWERFIN or your craft manufacturer.



*Figure 9:
IF not using our Digital Protractor, combine the proper feeler gauges to make your previous setting (or about 0.095" if this is your first time).*

10. There are two places where you can put the feelers - on the leading edge side of the pin or on the trailing edge side in the Apex window. Usually on PUSHER applications you'll use the side that corresponds to the leading edge (the edge with the tape). On TRACTOR applications, you'll normally use the side of the pin that corresponds to the trailing edge of the blade. But again, as long as you are consistent, you can use either side.

Place the feelers into the gap between the pin and the edge of the window. Make sure they are centered from side to side in the gap and that they are also parallel to the pin and perpendicular to the blade. Next, turn the blade so as to squeeze the feelers between the edge of the window and the pin.



Figure 10: To use our Speed Set window & pin, place the feeler gauges in the gap between the pin and the window's edge. As long as you are consistent, you can use either side of the pin to set the feelers. Turn the blade firmly, consistently to adjust the pitch to the feelers.

11. Holding enough turning pressure on the blade to keep the feelers from falling out, begin to EVENLY apply torque to the outside retaining bolts until the blade is secure and no longer turns in the hub. Once complete, gently walk the feelers back and forth to remove them from the window. Pull out the pin (where applicable) and proceed to the next blade.

Repeat steps 10 and 11 for each blade and then proceed to step 12.



Figure 11: Holding the blade's 'turning' pressure against the feeler gauges, tighten the two outside bolts by going back and forth in small turns until the blade is snug, i.e, it does NOT turn easily.

12. Once all the outside (blade) retaining bolts are down tight enough to keep the blade from turning, you'll find that the inside mounting bolts need a little tightening to bring the hub back flush to the propeller mounting plate. This time bring all the inside bolts down until the washers are snug but go no further. Next, increase the bolt pressure **EVENLY** by going only a quarter turn on each bolt and switching to the opposite bolt in a torque pattern - much like you would crisscross tightening bolts when changing a tire on a car. Bring the bolts down fairly tight so that you are near final torque.



Figure 11: Evenly tighten the inside bolts fairly snug, using a torque pattern.



Figure 13:

Apply torque evenly to all bolts by going no more than a 1/4 turn on each bolt -once you feel resistance- until you reach the required torque on each bolt for your application.

13. Select the torque setting for your application (**175-INCH pounds on B, C & F models**) and (**125-INCH pounds on E models**) on your torque wrench. (*Yeap, that's right, **INCH** pounds!*) Bring the torque down **EVENLY** in small 1/4 turn increments switching back and forth between the two bolts on the blade until final torque is reached. When torquing the inside mounting bolts, be sure to alternate in a criss-cross pattern as you tighten the bolts. You may have to go around several times to achieve proper torque due to the incremental compression of the hub. When each bolt holds the required torque you are ready to do a static run-up of your engine.

14. With your craft secured, and after performing a thorough PREFLIGHT, start your engine and allow it to warm up to proper running temperatures according to the engine manufacturer. Once operating temperatures are reached, you can advance the throttle to see how the propeller loads the engine. Don't throw the throttle all the way to maximum right away. Bring it up slowly to be sure that there is no adverse vibration or temperature issues -



Figure 14: Time to do a run-up and see how you did.

***** ESPECIALLY WATCH YOUR EGT's on 2-cycle engines! *****

Also, you want to make sure that your engine doesn't exceed red line RPM at any throttle setting.

If full throttle results in an RPM that is optimal for your engine (and well below red line RPM) you are ready to fly.

maximum power RPM when the aircraft is climbing out. See the next page for pitch changing tips if this is not the case.

If your blade pitch needs adjusting to acquire the proper RPM, please **repeat steps 10 and 11 for each blade and then proceed to step 12.**

See the next page for pitch changing tips if this is not the case.

Pitch Change Instructions

Once you have completed an engine run-up and have determined that further adjustments are necessary, you must go through a structured process to make a pitch change. If your engine went past the desirable RPM, then you must **INCREASE** the pitch of your propeller blades (i.e., "take a bigger bite" out of the air) – for it is the propeller pitch that governs the maximum engine's RPM.

Conversely, if your engine did not achieve the desired RPM at full throttle, you need to reduce the pitch – reduce the resistance - by taking a smaller bite of air. To do this you must adjust - more or less – the feeler gauges, depending on which way you have to turn the blades.

The next question is how much to add or subtract. The answer is not to make changes in very large amounts. One degree of pitch change is about 0.020" on the feeler gauge. If you have a normal application your engine should have come fairly close to the RPM you need during a static run-up. If it was within 500-RPM, don't make changes with any increment larger than 0.020"

One important thing to understand when changing the pitch is to never use a combination of feelers in excess of 0.125". When you reach the point where you need to add more than 0.125" of feelers, simply calculate the difference between what you want and 0.125", subtract that difference from 0.125", and use the other side of the pin and hub window and force the blade into the feelers on opposite side from then on.

For instance; if you were reducing pitch on a pusher and were using the slot which corresponds to the leading edge of the blade, you would be adding thickness to stop the blade at a lesser angle. If you got to the point that a 0.120" thickness was not quite enough and 0.135" might be perfect, simply find the difference between 0.125" and 0.135" (*when using the 1/4" dowel pin*). Subtract 0.010" (the difference) from 0.125" and you'll get .115". Select 0.115" feelers only this time put them on the other side of the pin and twist the blade in the opposite direction to snug them against the other side of the window. From then on, instead of **ADDING** feelers to decrease pitch, you'll have to **SUBTRACT** feelers to decrease pitch. If you find yourself subtracting so many feelers that you have no more, you can set the pitch with our digital propeller protractor, a digital level, or other angle finder. [You can download instructions from our website for using our Digital Propeller Protractor.](#)

When you are ready to make the pitch change, loosen each bolt about 1/2 of a turn. Check to see if the blades will turn in the hub. If not, continue to loosen all the bolts by exactly the same amount until the blades all turn in the hub without too much effort. Repeat steps above to finish making the pitch change. This process should only take a few minutes to do. You may wish to experiment to find the perfect pitch settings for both cruise and climb performance. By recording a history of settings for each application and the density altitude at the time, you will be able to quickly set your propeller for the type of flying you wish to do that season, or even that day.

Once you have your propeller set and you have flown it once, check the torque on all the bolts. Do this a few times each hour in the first ten-hours of operation to be sure there is no loosening of the bolts. Typically, you will see a little movement during the first few checks. After that everything should settle down and stay tight. There are several things you can do to stop this if it keeps reoccurring. You can use blue Loctite if you so desire. Another thing you can do is to drill out the heads of the mounting bolts to safety wire them. We can also provide locknuts to use on the back of your propeller mounting plate if there is room to install them. Those engines which do not have flat areas to mount the nuts will have to use one of the other methods or just get used to checking the bolts every 10-hours. If there

is room to mount the nuts, just use moderate wrench torque to tighten them down. Do NOT use any washer under the nut. Check torque often on the outside retaining bolts. Once every 10-hours should be sufficient.

Maintenance Instructions and Tips

POWERFIN Propellers should be fairly maintenance free aside from the occasional torque check and cleaning. This section is more geared for providing tips on how to keep your propeller looking new and presentable.

The main cause for surface deterioration of POWERFIN propellers is UV light - sunlight. Although there are special chemicals mixed into our finish to help ward off the effects of sunlight, the effect of long term exposure to sunlight will be to dull the shiny finish. There is no structural issue to concern you. Your POWERFIN carbon-fiber composite propellers are cured at very high temperatures. Direct, long term exposure to the hot sun does not – under normal use - affect the structural integrity of POWERFIN blades. The only concern is with the glossy, cosmetic finish. To address this issue, it is recommended that you always keep the propeller clean and apply a wax of some sort to the blades. Most paste type car waxes add another coat which protects against UV. Avoid liquid waxes. They frequently contain solvents which could be harmful to the finish of your propeller. Acetone will not hurt the finish of your prop and can be used to clean stubborn residue. Generally, soapy water will clean most anything that can accumulate on your propeller.

Bugs are another cause of superficial damage. Bug guts are highly acidic and, if left on the propeller for too long, will eat small little pits in the finish below them. Get them off with soapy water as soon as possible to avoid this kind of damage. Once this kind of damage occurs, that beautiful finish is gone forever.

Lastly, you can change the polyurethane leading edge tape at your discretion. It should be replaced if it gets chewed up. The leading edge tape can greatly lengthen the life of your propeller blades. If you continue to run your blades in abrasive environments with rips and tears in the tape, the composite structure below will not take long to deteriorate. Urethane replacement tapes are available through the POWERFIN factory or a stocking Powerfin Dealer.

We hope these instructions are clear and concise. If you have any difficulty assembling or setting the pitch on your propeller, please feel free contact us.

Incorporating ole-fashion consideration, along with handcrafted integrity into carbon-fiber composite blade technologies!

www.POWERFIN.com

