

On Ground Adjustable Propellers Guide

General information

On ground adjustable propellers make it much easier to find the ideal propeller for your platform and flight mission. By adjusting the pitch and flight testing, you can easily find the best propeller to reach your desired cruise speed while getting the best possible range for your platform.

Generally speaking, the higher the pitch setting, the faster the platform can fly. This can be best seen in the plot below (Figure 1) where the lower pitch setting will no longer produce any thrust at around 60 m/s, while a higher pitch setting will produce thrust up to around 130 m/s.

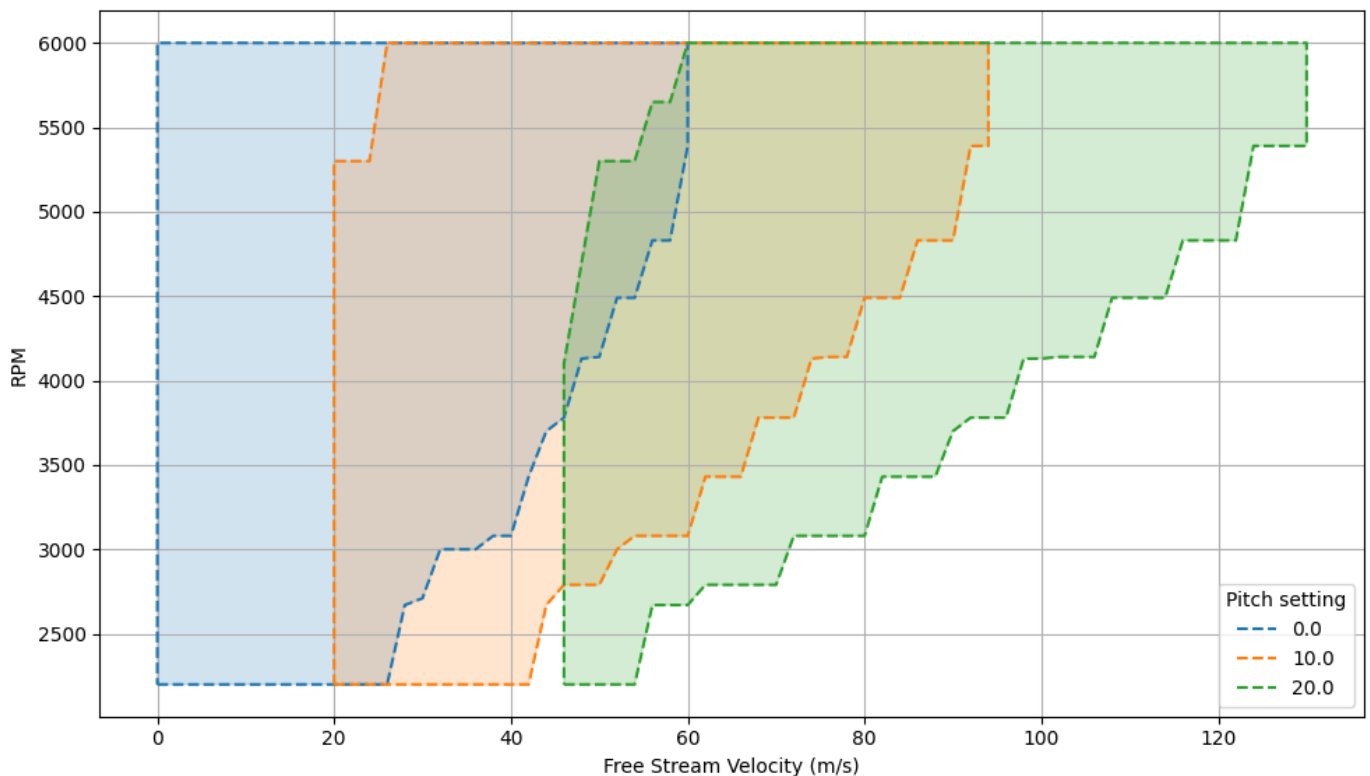


Figure 1: Operating range of a propeller based on its pitch setting.

With higher pitch also come some limitations. The main one being that at lower speeds, the propeller blade can stall. This leads to a rapid decrease in efficiency (Figure 2) (high power requirements while generating little thrust) and to additional vibrations. While this can be tolerated for very short periods of time, for taxiing or for some initial acceleration during takeoff, a stalled blade should be avoided during flight. Once again, this can be seen in the operating range of the propeller (Figure 1) where the pitch setting of 10° will be stalled when flying slower than 20 m/s.

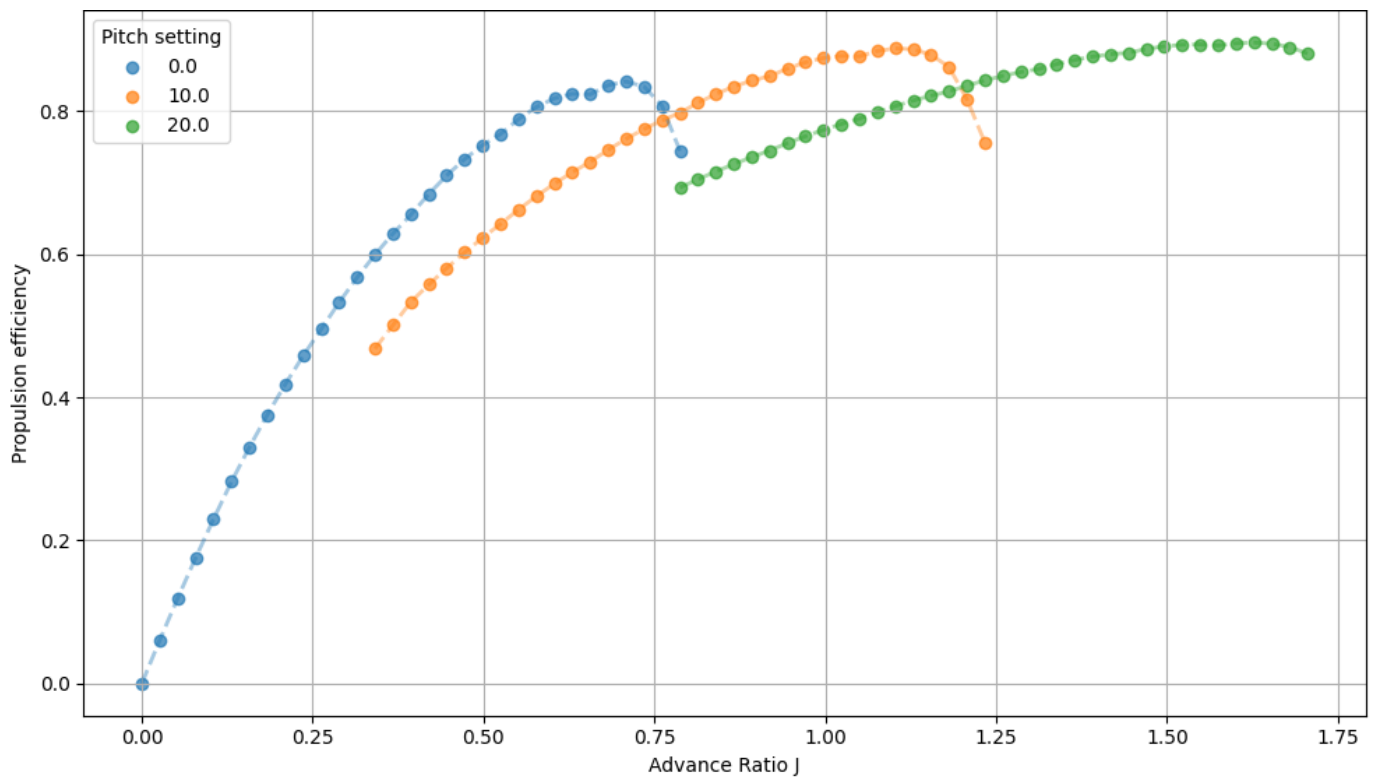


Figure 2 Propulsion efficiency of a propeller based on its pitch setting.

How to set the pitch

1. Loosen (do not remove completely) the 4 bolts holding the hub together (if the propeller is mounted on an engine, loosen the 6 bolts to the engine as well). The blades must be free to rotate in the hub.

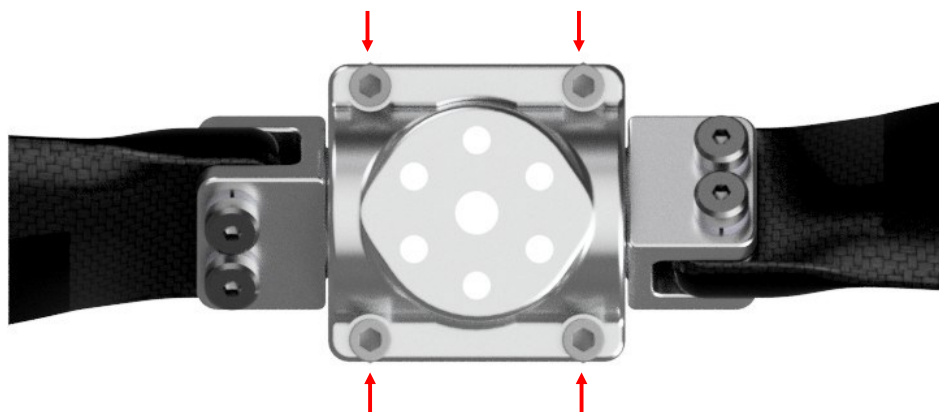


Figure 3 Securing bolts (4x).

2. Take the pitch setting tool. It is designed so as the holes with the correlating letter will align perfectly when placed on the propeller hub.

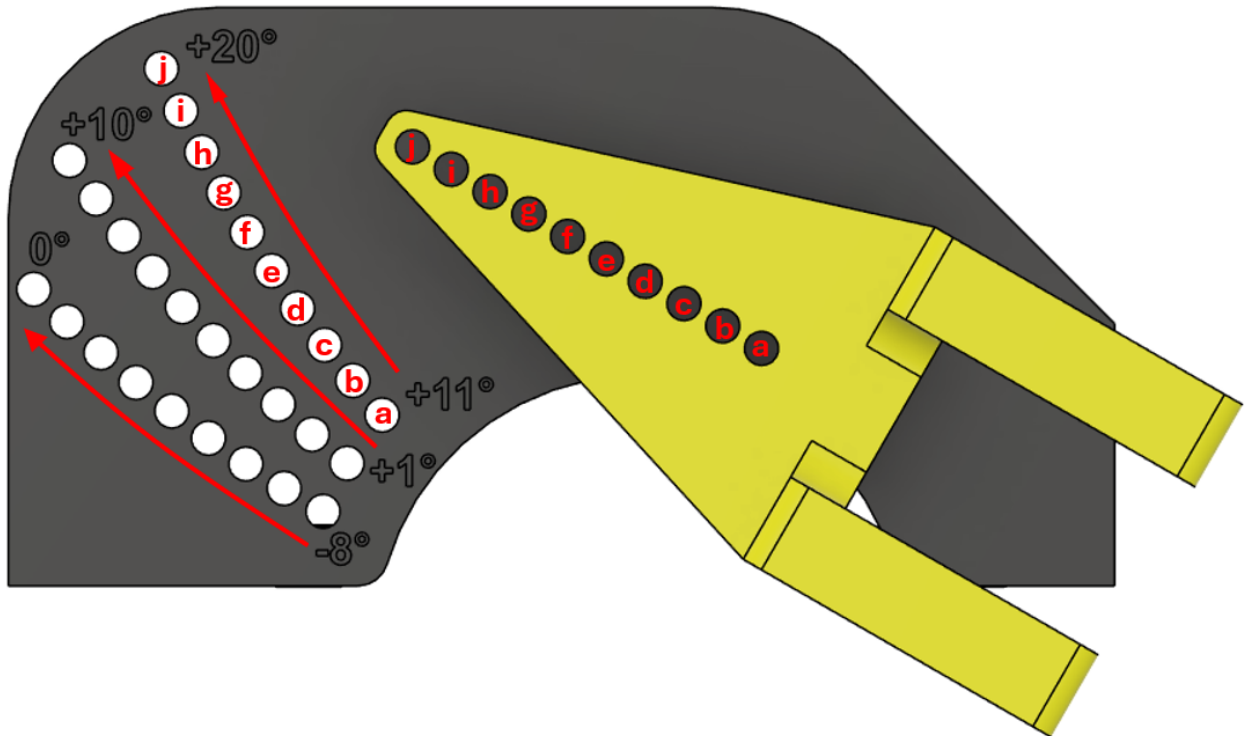


Figure 4 Pitch setting tool.

3. Place the pin in the hole that corresponds to the pitch you want to set the propeller to.

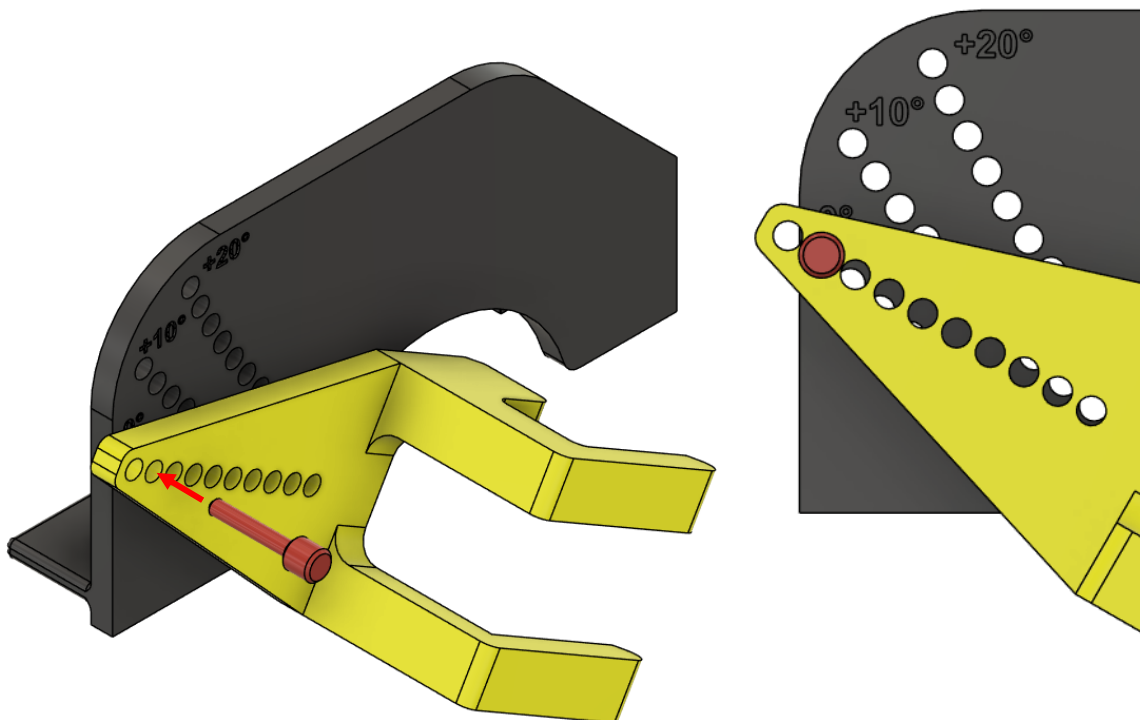


Figure 5 Choosing a pitch.

4. Place the pitch setting tool (with the selected pitch) on the propeller hub. When placed on the hub, apply pressure on the three highlighted surfaces, so the pitch is correctly set.

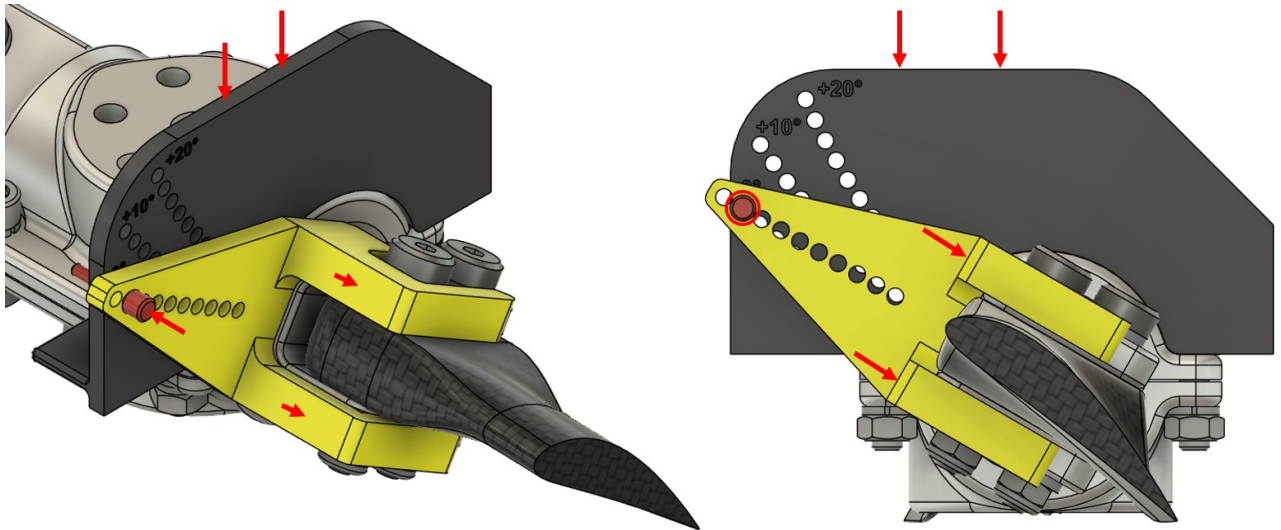


Figure 6 Surfaces to apply pressure to.

5. Tighten the corresponding 2 securing bolts just enough, so that the propeller blade cannot be easily rotated by hand. The second blade should still be able to rotate.

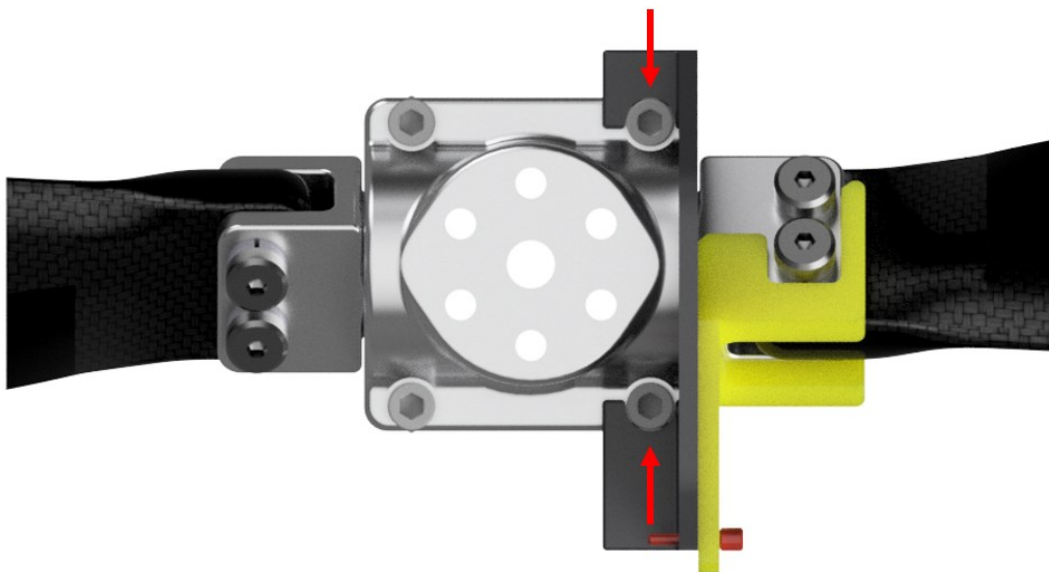


Figure 7 Securing bolts on the side with pitch correctly set.

6. Repeat steps 2.-6. for the second blade.
7. Verify again that the pitch is correctly set on both blades.
8. Tighten the 4 securing bolts to 10-14 Nm.
9. Tighten the bolts to the engine to 10-14 Nm.



How to find the ideal pitch (with flight tests)

There are several viable approaches to propeller pitch optimization. In this document, a single approach is presented as a representative example.

First, select an appropriate range of pitch settings to be evaluated. This range can be estimated using the propeller's recommended operating limits (as specified in the propeller datasheet) together with the aircraft's expected cruise and maximum level-flight speeds. For an initial assessment, pitch increments of approximately 2–4° are generally sufficient. For example, if the target cruise speed is 40 m/s and the maximum level-flight speed is 50 m/s, a suitable pitch range for the propeller shown in Figure 8 would be approximately 2° to 12°.

For each pitch setting, perform a short flight test. Key performance parameters to assess include overall aircraft performance (e.g. achievable speed range, climb performance) and, where applicable, fuel flow. Fuel consumption data can then be compared across individual pitch settings to identify trends.

It is recommended to begin testing at the lower end of the selected pitch range (ideally at or below 0°). This ensures maximum static thrust during the initial takeoff. Pitch settings above 0° are stalled at zero airspeed, which results in increased power demand and typically reduced thrust during takeoff.

After completing the full pitch range evaluation, select the setting that delivers the desired cruise performance at a moderate throttle position while maintaining the lowest steady-state fuel flow. For finer optimization, the testing procedure may be repeated around the optimal setting using smaller pitch increments.

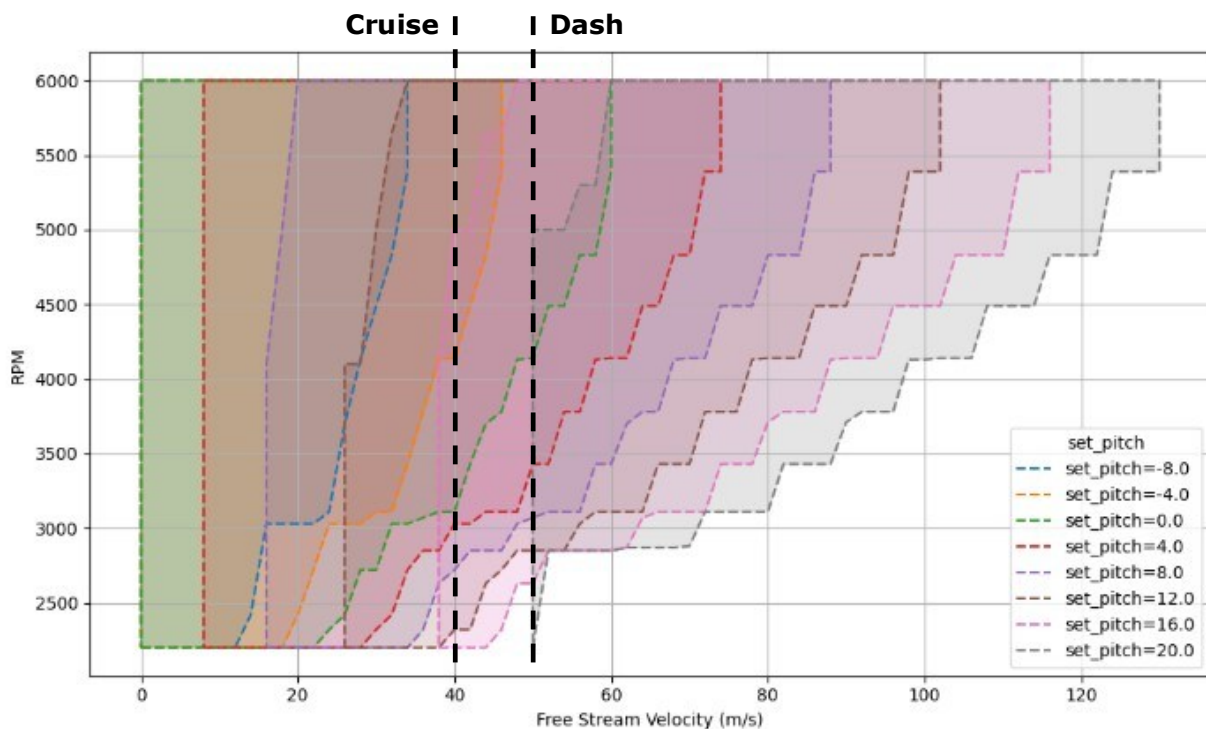


Figure 8 Example propeller operating range.



Help with pitch evaluation:

- The pitch is too low if the engine is already at maximum RPM, the engine power is not maxed out, and you can't reach your desired cruise speed.
- By increasing the pitch, the propeller will demand more power at the same RPM and speed and produce more thrust. This will lead to higher achievable speeds and better engine power utilization.
- The pitch is too high if the engine cannot reach its maximum RPM, and you can't reach your desired cruise speed. However, if you decrease the pitch and your cruise speed doesn't increase, this can mean that the engine is not powerful enough to produce the thrust required.

What to do once you have the ideal pitch

Once you have tested the different pitch settings and found the one that suits your platform the most, we can quickly create a fixed version with the same characteristics. All you need to do is contact us at sales@mejzlik.eu.

Advantages of the fixed propellers are lower weight (due to not having an aluminum hub), higher reliability, and higher possible order quantities. Additional modification requirements can also be implemented.

The only information we need is the propeller you have tested and the pitch setting on the hub that you found best suited.

What to do if no pitch setting was performing well enough

If none of the tested pitch settings provide the expected or desired performance for your platform, the collected flight test data can serve as a basis for designing a fully customized propeller.

By sharing the measured RPM, pitch setting, and airspeed achieved in each test, we can estimate the aerodynamic drag characteristics of your aircraft. Combined with your target performance requirements (required air speed and expected engine operating RPM) this information enables the development of propeller geometry specifically tailored to your platform's aerodynamic and power characteristics.

To learn more about how custom project works, contact us at sales@mejzlik.eu.



Important disclaimer

Before each flight, all 10 bolts (4 securing bolts and 6 bolts to the engine) must be tightened to 10-14 Nm.

Complete disassembly of the propeller is not permitted. The propeller is balanced as a complete assembly, and full disassembly may introduce imbalance. Such imbalance can lead to increased vibration and potential damage during operations.

If full disassembly is unavoidable, clearly mark each blade to indicate its original position and corresponding side of the hub to ensure correct reassembly.

Pitch setting of 0° is **not** equal to pitch setting with no thrust. It is equal to approximately 22° of pitch (depending on the propeller diameter). The exact setting to pitch in inches conversion table can be found in the propeller datasheet.