BrotherHobby Folding 1660-3

Folding propeller for the BrotherHobby Avenger 5215 V5 motor

Installation, inspection and maintenance manual



Read the safety instructions in Chapter 1 before use. This product is intended for persons aged 14 and over.

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1. Safety instructions

1.1 Before you start

- Read this entire manual before installation and first flight, and keep it for future reference.
- Propellers are spare parts for FPV drones and multicopters. This product is intended for **persons aged 14 and over**. Younger persons may only handle the product under adult supervision.
- Always use the propellers in accordance with the manuals for the drone, motors and flight controller (FC) they are intended for.

1.2 Rotating propellers

Propellers spin at very high speed in flight. A rotating propeller can cause **serious cuts and lacerations** and damage eyes or property. A broken-off blade or a loose propeller is thrown into the surroundings at high speed.

- **Always install and remove propellers with the drone switched off.** Motors can start unexpectedly, for example after an accidental Arm (motors enabled) or a configuration error.
- Carry out bench tests of the motors, configuration in the configurator (e.g. Betaflight) and checks of the direction of rotation **with the propellers removed**.
- When the drone is switched on, do not stay in the plane of rotation of the propellers, do not reach into their range and keep a distance from people and animals.
- Folded blades swing out sharply into the working position when the motor spins up, and their reach is the same as that of a fixed propeller.
- Large propellers have a high mass and tip speed – being struck by a rotating propeller causes serious injury.
- We recommend wearing safety glasses when working on the drone and during tests.
- Never try to stop a spinning propeller with your hand or an object.

1.3 A damaged propeller is dangerous

A propeller with a cracked, bent, broken or worn blade may disintegrate in flight. An unbalanced propeller also causes vibrations that stress the motor, bearings and flight controller and impair the drone's handling.

Never straighten, glue or grind a damaged propeller – always replace it with a new one.

2. Product description

2.1 About the product

Three-blade 16" folding propeller for large long-range and heavy-lift drones. It is designed **exclusively for the BrotherHobby Avenger 5215 V5 motor** and cannot be mounted on any other motor. The blades pivot on three pins that are screwed directly into the motor bell and are held from above by a three-arm propeller adapter secured with a flange nut on the motor shaft. At rest the blades can be folded; when the motor spins up, centrifugal force swings them out into the working position. The propellers are supplied as a pair for both directions of rotation (CW and CCW).

▶ **Set for one motor**

- 3 propeller blades,
- 3 threaded pins – the axes on which the blades pivot,
- 6 spacers – below and above each blade,
- spring,
- propeller adapter (three-arm top plate),
- flange nut.

2.2 How to read the propeller designation

Propellers are usually marked with a code that gives the diameter, pitch and number of blades. For example:

Notation	Example	Meaning
short code	1660-3	diameter 16", pitch 6", 3 blades

- **Diameter** is determined by the drone frame – the propeller must fit into the frame with clearance from the arms, the other propellers and the drone body.
- **Pitch** is the distance the propeller would theoretically move forward in one revolution. A higher pitch means higher speed and a higher motor load, a lower pitch means smoother flight and lower current draw.
- **Direction of rotation** – propellers are sold in pairs for both directions of rotation, see Chapter 3.3.

2.3 Material

The propeller blades are made of fibre-reinforced plastic; the pins and the nut are made of metal.

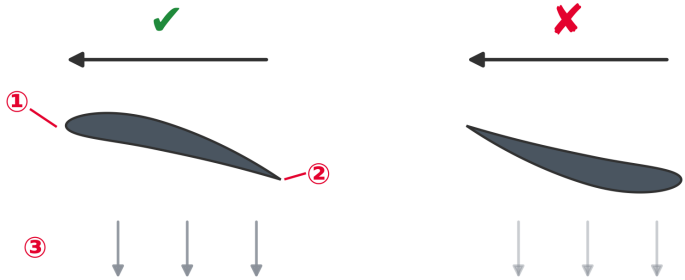
- The material is stiff and strong, less flexible, and damps vibrations well.
- Typical damage is cracks, especially at the blade eye, a chipped leading edge and a bent pin.
- Cracks are often hairline and hard to see – inspect the blades against the light.

3. Orientation and direction of rotation

The most common installation mistake is a **propeller fitted upside down** or a **propeller for the opposite direction of rotation**. The drone then flips over after Arm, does not take off or behaves unstably.

3.1 Leading and trailing edge

Each propeller blade has two edges. The **leading edge** ① is rounded, thicker and **sits higher** – it goes first when the propeller rotates and “scoops” the air. The **trailing edge** ② is thin, sharp and sits lower. The propeller pushes air ③ downwards, towards the drone frame.



Cross-section of a propeller blade. The arrow at the top shows the direction of blade movement. Left: correct – the rounded leading edge ① leads, the trailing edge ② is at the rear. Right: propeller fitted upside down – the sharp trailing edge leads and the propeller produces almost no thrust.

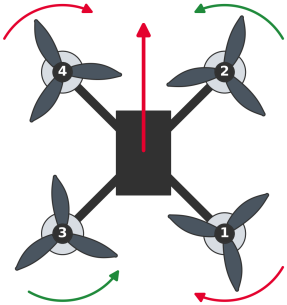
3.2 Which side faces up

The propeller is fitted with the **convex side of the blades facing up** – away from the motor. The leading edges of the blades are higher than the trailing edges and, viewed from above, the rounded edge always leads in the direction of rotation.

- Usually the side with the moulded or printed model designation and the glossier surface also faces up. However, manufacturers do not guarantee this – **the shape of the blade is always decisive**.
- A propeller fitted upside down cannot be corrected by settings in the flight controller. Always remove it and turn it over.

3.3 Direction of rotation – CW and CCW

A quadcopter has two propellers rotating **clockwise (CW)** and two **counter-clockwise (CCW)**, viewed from above. Propellers for the two directions are mirror images of each other and are therefore supplied in pairs. A propeller for a CW motor fitted on a CCW motor pushes air upwards and the drone flips over after Arm.



Top view, the arrow points forward. Betaflight default layout (Quad X, props in): motors 1 and 4 spin clockwise (CW, red), motors 2 and 3 counter-clockwise (CCW, green).

- In the Betaflight default setting the propellers spin **“inwards” (props in)** – the front blades move towards the centre above the nose of the drone.
- With the *Motor direction is reversed* option enabled (props out), all motors spin the opposite way and the propellers are fitted the other way round. This option does not change the motor direction itself – that is set in the electronic speed controllers (ESC) or by swapping the motor wires.
- Check the direction of rotation **with the propellers removed** in the configurator (*Motors* tab), and only then fit the propellers according to the actual direction.

▶ **How to tell which direction a propeller is for**

① **By the blade shape** – a reliable method for all manufacturers. Place the propeller convex side up: the blade rotates in the direction in which its higher, rounded leading edge points.

② **By the marking** – the model designation is moulded on the blades, on some versions also an arrow showing the direction of rotation. Blades for the opposite direction have a different marking (e.g. the letter R). If in doubt, the blade shape applies.

Before the first take-off, turn each propeller by hand in the motor's direction: it must push air down towards the frame.

4. Mounting on the motor

4.1 What you will need

- **BrotherHobby Avenger 5215 V5** motor – the propeller is compatible with this motor only,
- a propeller set for the direction of rotation of the motor (section 2.1),
- a flat screwdriver for screwing in the pins,
- a wrench for the flange nut.

4.2 Installation procedure



Installation steps: ① pins into the motor bell, ② lower spacers, ③ blades, ④ spring onto the shaft, ⑤ upper spacers and propeller adapter, ⑥ flange nut.

Switch off the drone. Sort the blades by direction of rotation – all blades on one motor must be for the same direction; CW and CCW blades must not be mixed.

① Using a flat screwdriver, screw the three pins into the threaded holes in the motor bell and tighten them fully.

② Place one spacer on each pin.

③ Fit the blades onto the pins by their eyes. All blades must face the same side up, with the leading edge in the direction of motor rotation (chapter 3).

④ Slide the spring onto the motor shaft.

⑤ Place the second spacer on each pin and fit the propeller adapter so that its arms sit on all three pins.

⑥ Screw the flange nut onto the shaft and tighten it firmly.

Check that all blades fold and swing out freely and evenly and have no up-and-down play. Repeat for the other motors and finally carry out the check described in section 5.1.

The propeller is designed exclusively for the BrotherHobby Avenger 5215 V5 motor. Do not attempt to mount it on another motor or to modify it.

4.3 Removal

With the drone switched off, hold the motor and loosen the flange nut. Remove the propeller adapter, the upper spacers, the blades, the spring and the lower spacers. Unscrew the pins only if they need to be replaced. Store the small parts so that they do not get lost.

5. Propeller inspection

5.1 Check after installation

- Turn each propeller by hand: it must rotate freely without rubbing against the frame, cables or camera, and the blade must not “wobble” up and down.
- Check that each propeller matches the direction of rotation of its motor (Chapter 3.3) and is the right way up (Chapter 3.2).
- Check that the flange nut and the pins are tight and that the propeller adapter sits on all three pins.
- Check that all blades swing out freely and have no up-and-down play.
- After the first installation or after replacing a motor, check the direction of rotation of the motors in the configurator **with the propellers removed**, and only then fit the propellers.

5.2 Check before every flight and after every crash

- Inspect both surfaces of each blade for cracks, burrs, bent or twisted tips and white stress marks in the plastic.
- Check the blade eyes, pins and propeller adapter – the eyes must not be cracked and the pins must not be bent.
- Check that the flange nut and pins are tight and that the blades move freely; they can loosen after a hard landing. Also check them after the first flights with new propellers and after transporting the drone.
- Listen during the first take-off – a change in sound or vibration in the camera image often reveals a damaged propeller.

5.3 When to replace a propeller

Always replace the propeller if:

- it has any crack, however small, or white stress marks in the material,
- part of a blade is missing or the blade is bent, twisted or frayed,
- a blade eye is cracked, a pin is bent, or a blade has play,
- the drone vibrates after a crash and the vibration does not disappear after replacing the suspect propeller.

Always replace damaged blades with a new set of all three; replace a bent pin. Propellers are consumables and are routinely damaged in flight. Damage to the propeller caused by an impact in a crash or collision is not a product defect.

6. Maintenance and storage

6.1 Cleaning

Remove dust, grass and dirt from the blades with a dry or damp cloth. Do not use solvents, thinners or petrol for cleaning – they attack the plastic and may cause hidden cracks.

6.2 Storage

- Store in a dry place, out of direct sunlight and away from heat sources (e.g. a car dashboard in summer) – heat can deform the blades. In frost, plastics become more brittle and the propeller cracks more easily.
- Store the blades lying loose or in the original packaging so that no other objects press on them. Constant pressure bends the blades. The blades can stay folded while the drone is carried.
- Keep out of the reach of children – sharp edges and small parts (spacers, pins, spring, nut) can be dangerous.

6.3 Balancing

Manufacturers of FPV propellers supply them balanced from the factory. If the drone vibrates even with new propellers, first look for the cause in the motor (bent shaft, worn bearings), the motor mounting or the flight controller settings. Do not balance propellers by sanding or adding glue – this weakens the blade.

7. Troubleshooting

Problem	Possible cause and solution
The drone flips over immediately after Arm and throttle up	A propeller is fitted on a motor with the opposite direction of rotation or is upside down. Check according to Chapter 3. Also check the direction of rotation and motor order in the configurator (without propellers).
The drone does not take off or has noticeably less thrust	A propeller is upside down – the sharp trailing edge is leading. Turn it the right way up.
Vibrations, jittery video, unusual noise	Damaged blade, bent pin, missing spacer or a blade for the opposite direction of rotation, loose nut, bent motor shaft. Check the assembly as described in section 4.2, tighten the nut, check the shaft.
A blade does not swing out or swings out stiffly	A spacer is missing, a pin is bent or a blade eye is damaged. Check the assembly as described in section 4.2 and replace the damaged part.
A blade has up-and-down play	Loose flange nut or pin, or the propeller adapter does not sit on the pins. Tighten the pins and the nut; if the play persists, replace the worn parts.
A propeller came loose or flew off in flight	The flange nut or the pins were not tightened sufficiently. Mount the propeller again as described in section 4.2 and check that everything is tight before every flight.
The propeller rubs against the frame or cables	The frame is not large enough for 16" propellers, or cables or antennas are in the path of the blades. Reroute the cables.

8. Information for the EU and Czech Market

8.1 Importer and responsible person in the EU

The product is placed on the European Union market by the importer stated below, who is at the same time the responsible person within the meaning of Article 16 of Regulation (EU) 2023/988 of the European Parliament and of the Council on general product safety (GPSR).

Importer / responsible person in the EU	Rotorama, s.r.o.
Company ID (IČO)	051 57 692
VAT ID (DIČ)	CZ05157692
Registered office	Okrajová 1351, 674 01 Třebíč, Czech Republic
E-mail	info@rotorama.cz
Phone	+420 252 252 098
Website	www.rotorama.cz

8.2 Product safety and identification

- The propeller is not subject to EU harmonisation legislation requiring **CE** marking and therefore does not bear it. It is placed on the market in accordance with Regulation (EU) 2023/988 on general product safety (GPSR).
- **Product identification:** the model designation is moulded or printed on the propeller and stated on the packaging. The manufacturer and model can also be found on the product page in the e-shop.
- This product is **not a toy** and is intended for persons aged 14 and over.

8.3 Disposal

- The propeller is not electrical equipment – it is not subject to the take-back of electrical equipment and does not bear the crossed-out wheelie bin symbol.
- Dispose of damaged propellers in accordance with the plastic waste sorting rules of your municipality; if in doubt, dispose of them with mixed municipal waste.
- Dispose of the packaging in separate waste collection according to its material.

9. Warranty and rights arising from defective performance

The rights and obligations of the contracting parties are governed by Czech law, in particular by Act No. 89/2012 Coll., the Civil Code, and Act No. 634/1992 Coll., on consumer protection.

- The seller is liable to the buyer for the product being free of defects on receipt. If the buyer is a consumer, a defect may be notified **within two years of receipt** of the product (Section 2165 of the Civil Code).
- If a defect appears within **one year** of receipt, the product is deemed to have been defective already at the time of receipt (Section 2161(5) of the Civil Code).
- When purchasing online, a consumer has the right to **withdraw from the contract within 14 days** of receiving the goods without giving a reason (Section 1829 of the Civil Code).
- Claims should be made with the retailer from whom you purchased the product. The importer's contact details are given in Chapter 8.1.
- The competent body for out-of-court settlement of consumer disputes is the **Czech Trade Inspection Authority**, Štěpánská 796/44, 110 00 Prague 1, www.coi.cz.