

Instructions for

## Turbo-Fan 500

Order no. 7249/53



The Turbo-Fan 500 impeller unit was developed by our team of experienced model flyers for semi-scale electric-powered model jets. The result is that the Turbo-Fan 500 is designed specifically to cater for the very special requirements of EDF (electric ducted fan) models. Our development goal was not simply maximum possible static thrust. Instead we aimed at optimising the efficiency of the impeller at the typical airspeeds of electric model jets, and in this we succeeded. Two of the key factors in this are the smoothly profiled, aerodynamically clean flow transitions and the geometric washout of the rotor and stator blades.

Any standard electric motor with a maximum diameter of 37.5 mm can be installed: e.g. Johnson 6421, 7.2 V. The Turbo-Fan's compact external dimensions of 56 x 92.5 mm (length x diameter) and 111 mm  $\varnothing$  intake diameter make installation an easy task, and facilitate the efficient aerodynamic design of fuselages and engine nacelles.

The static thrust generated by the ducted fan unit depends primarily on the output power of the electric motor installed, but it is also influenced by the airflow conditions in the model. In any case the measured static thrust can only be used as a broad guideline for the maximum permissible weight of the model to be propelled.

The Turbo-Fan 500 is supplied in kit-form, as the carefully optimised design demands manufacture of separate component parts. Assembling the standard version is straightforward and requires no templates of any kind. All the joints are glued using low-viscosity (thin) cyano-acrylate. If you wish, it is possible to fine-tune the unit by varying the pitch of the rotor blades before gluing the joints permanently.

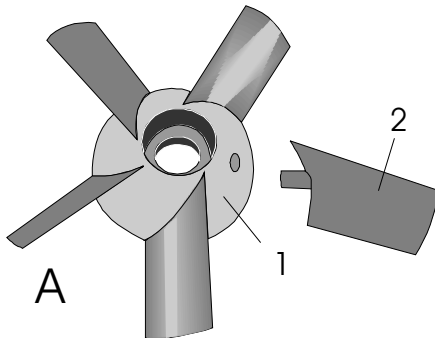
<b>Set contents</b>			<b>Order No.</b>
1	ABS fan ring	90/91 $\varnothing$ x 50 mm	7249 /60
1	Motor mount	37.5/40 $\varnothing$ x 36 mm	/64
1	Rotor hub	40 $\varnothing$ x 17.5 mm	/65
5	Rotor blades		/66
6	Stator blades		/67
1	Taper collet	3.17 mm motor shaft, with cap nut	
1	Brass rod	0.5 $\varnothing$ x 100 mm	7732 /05
1	Brass rod	0.8 $\varnothing$ x 100 mm	7732 /08
1	Brass rod	1.0 $\varnothing$ x 100 mm	7732 /10
2	Screws	M3 x 8 mm	7775 /08

Remove rough edges from all parts and de-grease the joint surfaces before assembling the unit.

<b>Option</b>		<b>Order No.</b>
1	Engine nacelle kit with outrigger for A 10 and similar models	7249 /52
1	Taper collet, 3.17 mm bore, 2 locking screws and cap nut	7249 /69

## Rotor

Lay the rotor hub (1) on a flat base and push the spigot of the rotor blades (2) into the appropriate holes (Fig. A). Adjust the angle of the rotor blades so that their trailing edge also rests on the base surface (standard setting).



This is the procedure for changing the standard blade pitch:  
 To increase pitch: pack up the rotor hub;  
 To reduce pitch: pack up the trailing edge of the rotor blades.

You can select the most appropriate pitch from the measured values for various motors which are printed in the appendix.

To pack up the rotor hub locate the brass rod of the correct thickness, bend it into a V-shape and place it under the rotor hub. Press down on the rotor hub with your finger whilst adjusting the individual blades, and rotate the blades until they touch the base surface where they meet the rotor hub.

To pack up the rotor blades locate the brass rod of the correct thickness and place it under the trailing edge of the blade, about 5 mm from the rotor hub. Rotate the blade until it touches the rod.

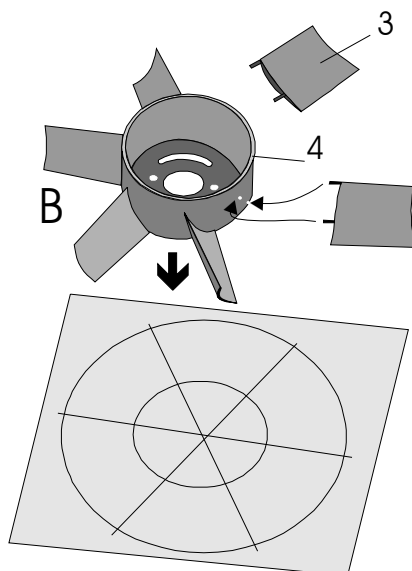
Glue the blades in place using low-viscosity cyano, working very carefully: glue must be applied to the joint between the rotor blades and the rotor hub, the outboard end of the blade spigots at the rotor hub, and also the inner end of the rotor blade spigots inside the rotor hub. Apply plenty of adhesive on the inside, and - even though it is cyano - allow the glue to cure fully for 24 hours.

## Fan ring

Push the pins of the stator blades (3) into the front notch and the lateral hole of the motor mount (4) after removing any rough edges from the holes. Lay the motor mount on the drawing, front side (mounting holes / vent holes) facing down, and place the motor on top to weight it down. Align the leading edge of the stator blades with the drawing and glue them to the motor mount using cyano. Press the parts together firmly and allow the adhesive to cure fully (Fig. B). When the glue has cured sand the outside profile of the stator blades with a sanding block to remove the injection-moulded attachment points.

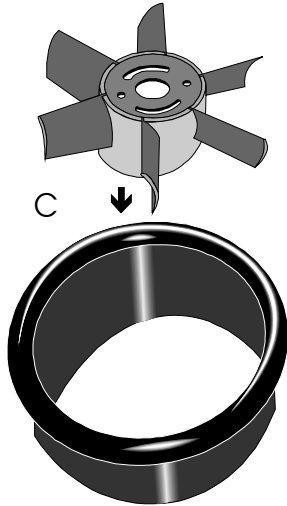
Lay the fan ring (5) on a flat surface and slide the motor mount (complete with stator blades) into it to the point where the opening for the motor also rests flat on the base surface (Fig. C). Glue the stator blades securely to the fan ring using cyano.

## Final assembly



Fit the motor in the motor mount (4) and tighten the retaining screws. Insert the taper collet in the rotor hub (1) and fit the cap nut lightly. Slip the rotor and taper collet on the motor shaft. Ensure that the trailing edge of the rotor blades (2) are as close as possible to the leading edge of the stator blades (3) without actually touching them. Tighten the cap nut **very firmly** (otherwise there is a danger that the rotor might come adrift at very high rotational speeds), holding the rotor where the blades meet the hub - not at the blades' trailing or leading edge.

**Caution:** the motor shaft should not feature a ground-in flat section, as this reduces the security of the taper collet, i.e. there is an increased risk that it will not hold. If you use a motor shaft with a 'flat' you do so at your own risk. In this case ensure when assembling the parts that one slot of the taper collet is vertically above the ground-in flat section of the shaft, and take care to tighten the cap nut very thoroughly (see drawing D). For motors with a 3.17 mm Ø shaft featuring a 'flat', a collet with two locking screws is available as an accessory under Order No. 7249/69.



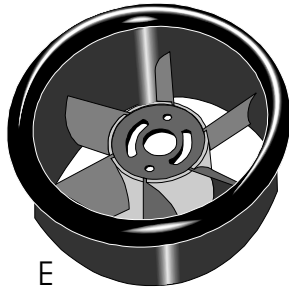
**Caution:** the front end of the motor shaft must not foul the cap nut; shorten the motor shaft if it is too long, or move the motor further back by fitting a packing piece.

Carefully turn the rotor by hand and check that it spins freely, without fouling at any point - this is important. If the rotor blades touch the fan ring, sand back the blades using abrasive paper: slip the abrasive paper inside the fan ring and turn the rotor carefully to remove excess material.

You may find that it is very difficult to release the rotor from the taper collet after loosening the cap nut. If this should happen, loosen the cap nut only lightly, then tap the cap nut with a small hammer to loosen the collet's grip. The rotor can then be pulled off.

### Installation

There are various methods of mounting the ducted fan assembly in a model; note that the intake ring (6) will not always be required if you install the unit inside a fuselage:



1) Glue a plywood outrigger to the fan ring at right-angles, and use this to attach the assembly to the model's fuselage (e.g. on the A 10) or wing.

2) Glue two wooden rails to the fan ring on opposite sides, and screw the Turbo-Fan to the fuselage in this way.

If you intend installing the Turbo-Fan 500 inside a fuselage, please note that the edges of the fuselage air intake openings must feature a radius of 5 mm (like the intake ring). The area of the air intake must be at least 5100 mm<sup>2</sup> (81 mm Ø; two intakes: half the stated area each), and the efflux area must be 4600 mm<sup>2</sup> (77 mm Ø).

The Turbo-Fan should be arranged in the model as close as possible to the efflux, and the internal duct between Turbo-Fan and efflux should be straight and smooth (apply high-gloss film to the surface).

### Using the system for the first time

- 1) The Turbo-Fan must not be run except when installed in the fan ring. Do not stand to the side of the Turbo-Fan, nor in front of it.
- 2) Do not run the Turbo-Fan whilst holding the unit in your hand - injury hazard.
- 3) The taper collet must be tightened firmly to avoid any danger of the rotor coming adrift at high rotational speeds. Check the Turbo-Fan carefully before each run.
- 4) Ensure that there are no objects in front of or to one side of the air intake which could be sucked in, as this would damage the rotor.
- 5) Do not attempt to repair damaged rotor blades and rotor hubs. Replace the damaged parts.
- 6) The impeller system is used at the operator's own risk as we are unable to monitor the conditions of its use.

Run the motor at low speed initially; do not increase speed until you are confident that there is no hint of binding or fouling. Increase speed gradually; note that the maximum rotational speed is 20,000 rpm, and this must never be exceeded.

The maximum input power of the Turbo-Fan 500 is 300 Watts.

### Drawing showing method of aligning stator blades

**Johnson 6421, 7.2 Volt**

Rotor blade packing 1 mm

V/U	I/A	P/W	S/N
10.5	14.6	153	4, 5
12.3	18.5	228	5
13	20	260	6
13.2	23	304	7

Rotor blade packing 0.5 mm

V/U	I/A	P/W	S/N
9.2	15	138	4, 5
10	17	170	5
12	22	264	6
13	24.2	315	7

Standard; no packing

V/U	I/A	P/W	S/N
8.8	16	141	4, 5
9.3	17	158	5
10.6	21	223	6
12	25	300	7

Rotor hub packing 0.5 mm

V/U	I/A	P/W	S/N
8.5	18	153	4, 5
9.2	20	184	5
10	24.5	245	6
11.3	28	316	7

**Mabuchi 540 VZ, 7.2 Volt**

Rotor blade packing 1 mm

V/U	I/A	P/W	S/N
8	17.7	142	4, 5
8.7	20.3	177	5
9.6	24.7	337	6
10.3	29.4	303	7
11.6	33	383	8

Rotor blade packing 0.5 mm

V/U	I/A	P/W	S/N
7	19.4	136	4, 5
7.6	21	160	5
8.5	27	230	6
9.4	31	292	7
11	39	429	8

Standard; no packing

V/U	I/A	P/W	S/N
7.5	20.3	152	4, 5
7.8	22.5	176	5
8.7	27	235	6
9.7	33	320	7
10.5	36	378	7, 6

**Engine nacelle for Thunderbolt A 10****Order No. 7249/52**

2 required

**Outrigger**

For our Thunderbolt A 10 we recommend two Mabuchi 540 7.2 V VS motors wired in series with fourteen NC cells of 1200 mAh capacity.

Cut the outriggers (10) from 8 mm thick obechi and bevel the ends to match the curvature of the centre of the fuselage (see Thunderbolt A 10 plan).

File channels 0.5 mm deep where the copper strips fit. Epoxy the outrigger (10) to the side of the assembled Turbo-Fan 1000, with its intake ring (6) glued in place. Check that the parts are at right-angles.

Cut out the vacuum-moulded ABS parts for the motor fairing (11). Cut down both shells at the air cowl end to leave an overall length of 130 mm, as shown on the plan. Check that the motor fairing has a diameter of 40 mm, then glue the shells together. Cut the fairing down on one side at the 36 mm point to accept the copper strips (12).

Screw the motor to the motor mount (4) and glue the copper strips (12) in the channels in the outrigger. Bend the ends to meet the motor terminals and solder the joints. Tape the motor fairing (11) to the motor mount (4); this ensures that it can be released again easily at any time if necessary.

**Engine nacelle**

Glue the tapered styrofoam component (13) to form a closed ring. Prime the inside of both styrofoam parts (13 + 14) and apply self-adhesive high-gloss film to them. Cut off the excess film using a razor blade. Glue the styrofoam parts together using white glue, taking care to leave an 8 mm wide slot for the outrigger (10) in parts (14). Sand the outside of parts (13 + 14) to the shape shown on the plan. Cover the exposed styrofoam surfaces with tissue paper using thinned white glue as adhesive. Allow the glue to dry very thoroughly, then remove the overlaps by rubbing carefully with a sanding block (240 - 320-grit). Apply a coat of Glutofix (wallpaper paste) to the tissue-covered surfaces. The styrofoam parts (14) can then be glued to the plywood bearer (10) on each side using one drop of cyano, so that the parts can easily be separated again at any time.

**Caution:** if the motor shaft has a ground-in 'flat', use the 3.17 mm Ø taper collet with two grubscrews, Order No. 7249/69. Otherwise there is a risk that the rotor could come adrift from the motor shaft.

**Set contents**

1	Styrofoam ring	110 Ø x 120 mm
1	Styrofoam ring	110/90 Ø x 50 mm
1	Obechi outrigger	120 x 54 mm
2	Motor fairing	Vac. moulded ABS parts
2	Copper strips	0.5 x 5 x 125 mm