



# VELOCITY-RC WM 400 DUCTED FAN INSTRUCTION MANUAL

## OVERVIEW

The WM 400 Fan Housing is designed to be extremely rigid and is manufactured using carbon and special formulated ABS plastic compound.

To add to the fundamental strength of the housing, solid ribs are designed on the fan housing.

This helps to maintain the very light and strong structure which is laid out to be highly resistant to vibrations and resonance.

Precision moulding ensures smooth airflow and support the truly awesome performance.

Due to the very high possible operating power levels of the motors used in these fans (up to 1.7kW), it is essential that the Main housing will not distort.

WM 400 fan are extremely high performance and designed to withstand the high loads and G Forces of high performance operation. The blades and the hub are tooled as a single piece with special consideration to strengthening the design of the blades. The rotor is tooled in a way to allow special aluminium bush which is precision machined to take the conical shaft adapter.

The CNC machined shaft adapter that relays on two grub screws is made from anodized aluminium. At these very high rotational speeds it is most important that the motor shaft is truly concentric and runs true with the hub attached.

A final adjustment is available with the shaft and motor assembly using an arrangement of 2.5mm grub screws in the shaft adapter as a stop for the axle. For motors that have cooling holes for airflow into the motor then this can be optimised by setting anything up to a 2mm gap between the rotor hub and stator/motor assembly. A strong flow of air is achieved from the front of the fan wheel through to the gap which is situated in the low pressure area of the fan. Motors that are sealed require a gap setting of 0.5mm.

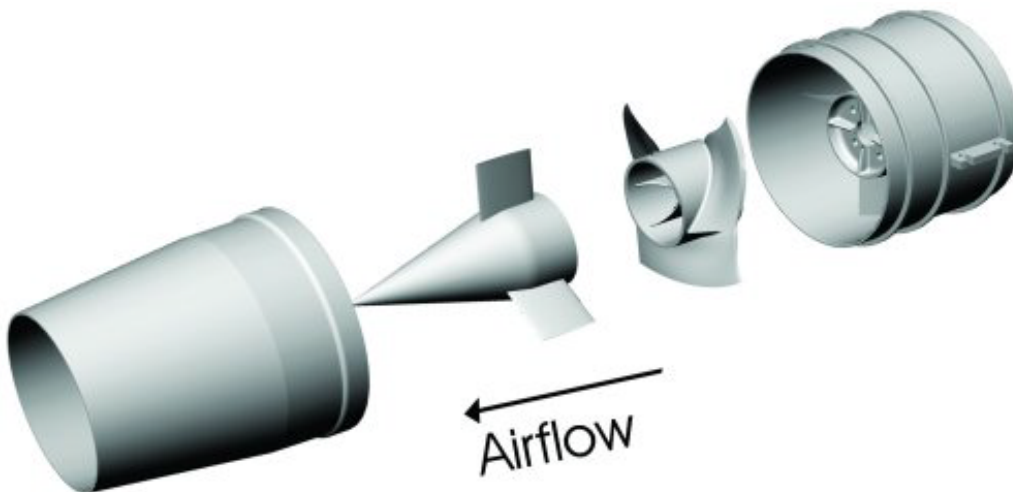
## TECHNICAL SPECIFICATIONS

The WM 400 fan is totally new and advanced EDF which is designed using full size calculation and flow prediction methods as well as taking account of much lower Re-numbers which derive from the slower velocities and smaller fan blades, in comparison to full size praxis.

WM 400 is a high quality fan which has proven all the predictions. In contrast to other EDF's it has have inlet guide vanes, which is arranged in front of the rotor. This layout is inherently more efficient for small ducted fans than the usual found make up with the outlet guide vanes behind the rotor.

The WM 400 has the following design advantages:

- High efficiency of better than 80% (usually 60-65% are the norm on other EDF's)
- High power absorption capacity at lower rotational velocities
- High pressure development, which allows the use of small air intakes and exit nozzles
- High tolerance to inlet flow deficiencies and long ducting

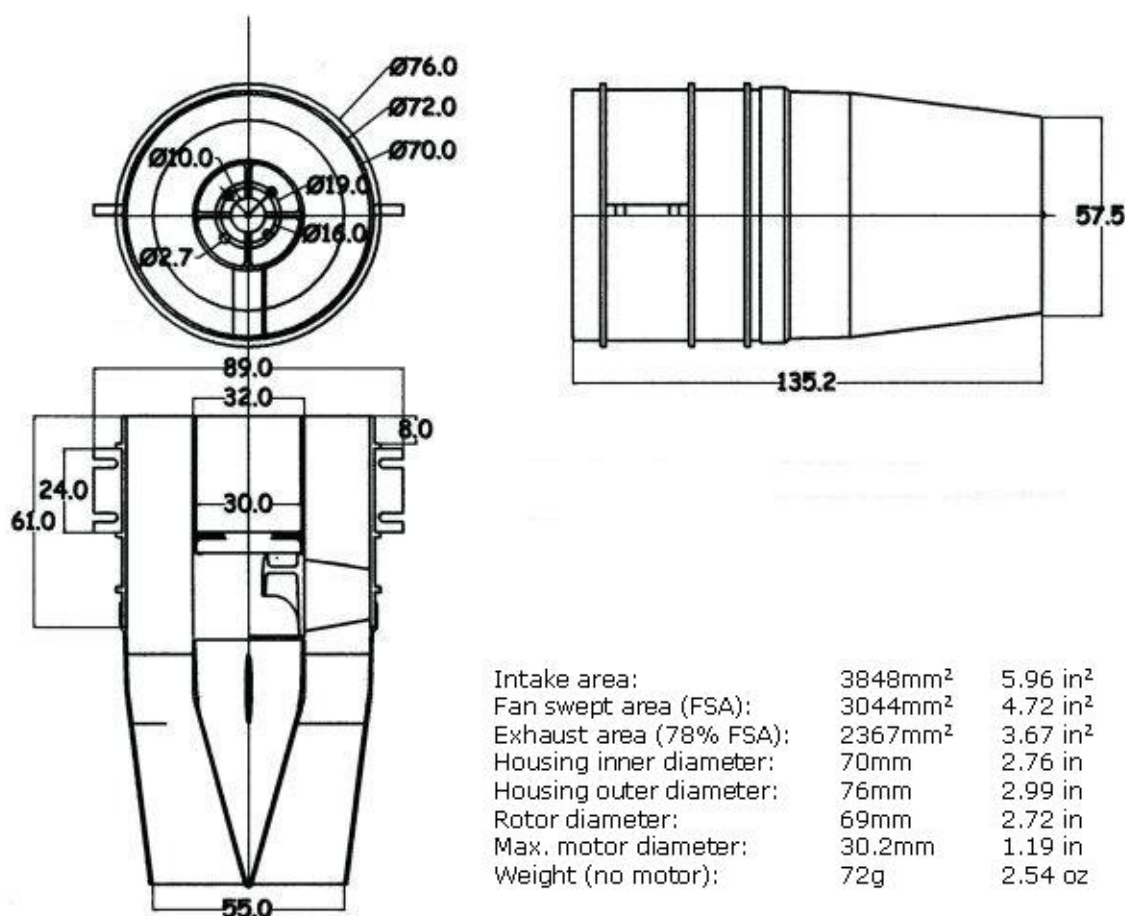


Intake area:	3848 mm <sup>2</sup>	5.96 in <sup>2</sup>
Fan swept area (FSA):	3044 mm <sup>2</sup>	4.72 in <sup>2</sup>
Exhaust area (78% FSA):	2367 mm <sup>2</sup>	3.67 in <sup>2</sup>
Housing inner diameter:	70 mm	2.76 in
Housing outer diameter:	76 mm	2.99 in
Rotor diameter:	69 mm	2.72 in
Max. motor diameter:	30.2 mm	1.19 in
Weight (no motor):	72g	2.54 oz
Max. motor power:	1.7 kW	

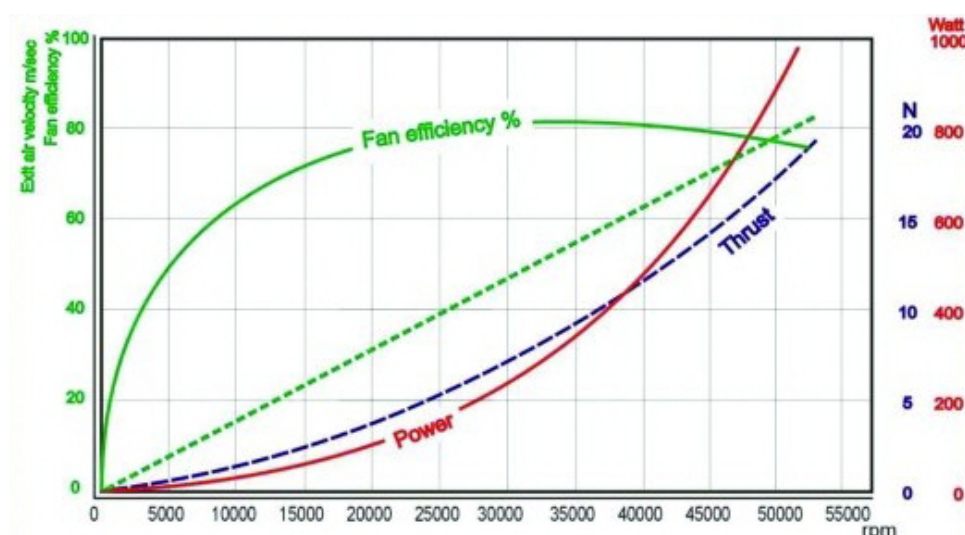
## **SAFETY INSTRUCTIONS (Read before first use!)**

- The WM 400 ducted fan system is only to be used in non man-carrying RC models. Any other use is prohibited.
- Please read and follow the assembly instructions carefully.
- Run your Fan unit only outdoors and installed in your model or on a test stand with chip protection.
- Never run the Fan unit while holding it in your hands.
- When running the fan unit do not stay in front of or beside it. Never hold your hand in front of the intake. Stay away from the jet stream of the fan unit.
- Remove all loose parts like clothes, tools etc. before starting the fan unit.
- Always mount the rotor unit properly on the shaft. Never use the fan unit when realizing unusual vibrations. Stop it immediately and find the cause before running it again.
- Never exceed the maximum allowed power (see "Technical Specification").
- Cool down all drive components - particularly battery and motor - before starting for another flight.
- Never exceed the maximum allowed voltage for your fan drive system.
- Before the first use make sure that all screws are tightened properly, especially the grub screws fixing the rotor.
- Never run the fan if you there are damaged parts on the fan unit.
- Never attempt to repair damaged parts.
- Never look into the fan as it is running.
- Never point the fan in the direction of anyone.

## Dimensions WM 400 Fan unit



## Performance graph WM 400 Fan unit



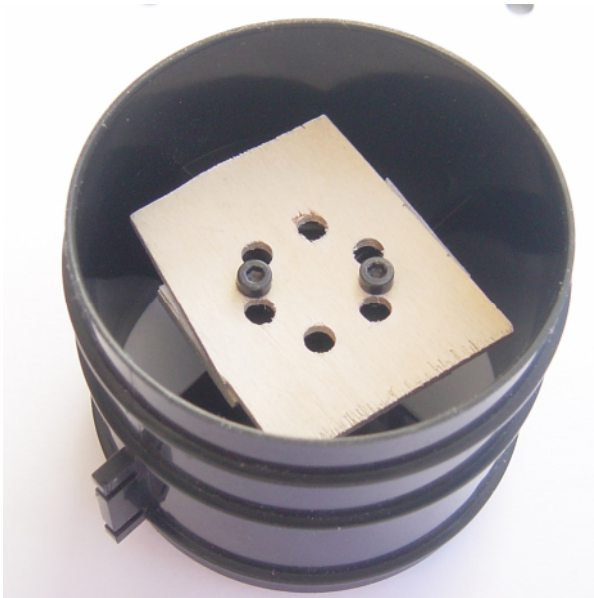
Static Thrust of WM 400 EDF at various rpm and shaft powers.  
Values without duct losses for engine installation and short nozzle  
with 55mm exit diameter.

## Assembly instructions for the WM 400 fan unit



### Package list:

1. Thrust nozzle
2. Exit cone
3. Rotor
4. Fan Housing
5. Grub screw adaptor
6. Washer
7. Hex nut
8. Allen wrench



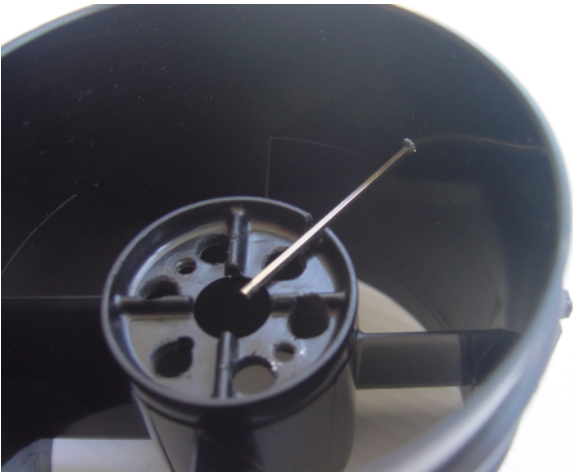
If you are using a motor with cooling holes allowing airflow through the motor and if you are using a high power setup, it is recommend drilling corresponding holes into the motor mounting plate.

Use a drilling gauge from plywood to drill the holes exactly.



For an easy access to the grub screw in the rotor adaptor drill a 2mm hole into the fan housing.

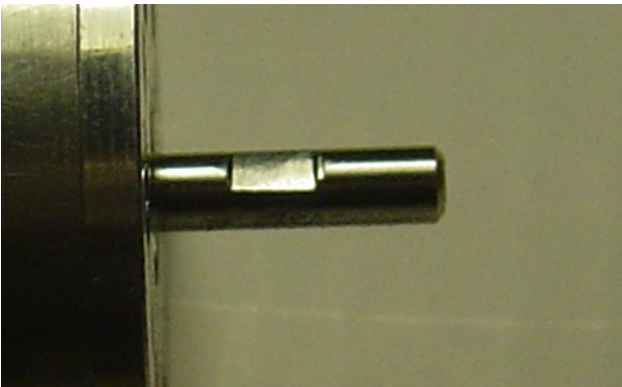




The position should be between two inlet guide vanes. Cut out a U-shaped access for the allen wrench into the motor mount reinforcement.

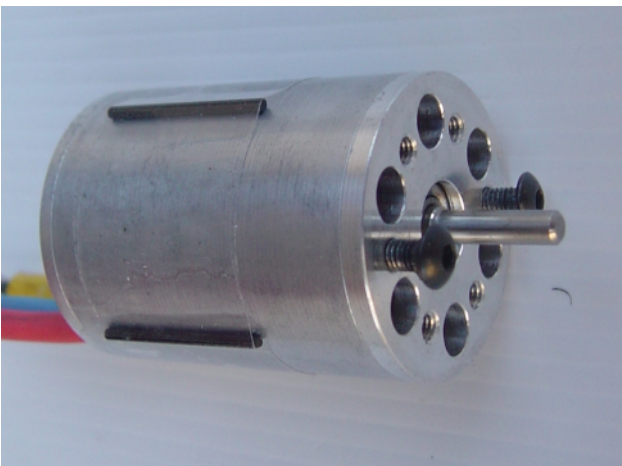


Cut a slit into the fan rotor adapter on the end with the thread. It's easy to do this with a hacksaw.



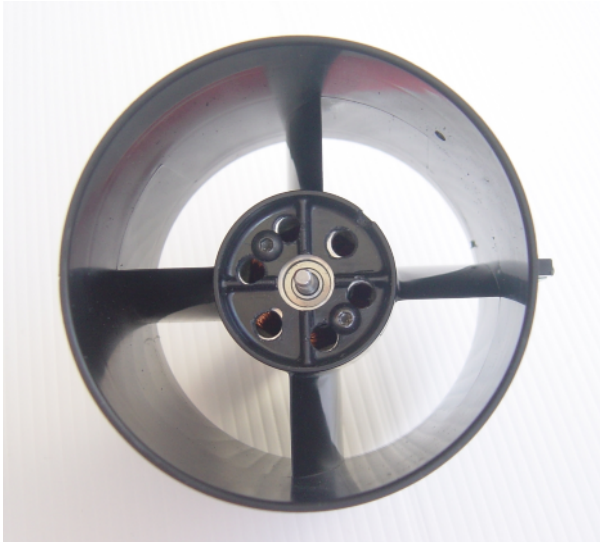
To avoid spinning of the Motor shaft, flat on the motor shaft.

The flattened area starts at a distance of 3mm from the motor front plate and should be about 5mm wide.



Attach 4 carbon sticks or similar with adhesive tape to the motor. The diameter of the carbon stick depends on the motor diameter and should be the half of  $32\text{mm} - \text{Motor diameter}$  (e.g. for a motor with 29mm outer diameter  $\rightarrow (32-29) / 2 = 1.5\text{mm}$ ).

This will help to center the motor in the motor housing.



Slide the motor into the motor housing and fix the motor with two screws. Use a small amount of Loctite 222 or similar to secure the screws.

The motor mounting holes are specially designed with 2.8mm hole diameter. The purpose is to create a self locking feel for the 3mm motor nut when it is being tightened to the motor inside the stator tube. This is to ensure the motor sits at true centre inside the fan housing.



Press the fan rotor adapter onto the motor and tighten the hex screws against the shaft. Be sure to place one of the screws at the position of the flattened motor shaft. Use a small amount of Loctite 222 or similar to secure the screws.



Fit the rotor over the fan rotor adapter. Slide the washer from aluminium over the adapter and tighten the hex nut as shown on the picture. Use a small amount of Loctite 222 or similar to secure the hex nut.

Be sure not to allow the adapter end and the motor face come in contact or it will cause rubbing against each other resulting damage to the motor.

There must leave a gap of about 2.5mm distance between the motor end and adapter face.

Spin the rotor with your hand freely to ensure there is not rubbing against anything inside the housing before getting the fan running.

Once the fan is running at it's optimum level, install the thrust cone and exit nozzle to the back of the fan.

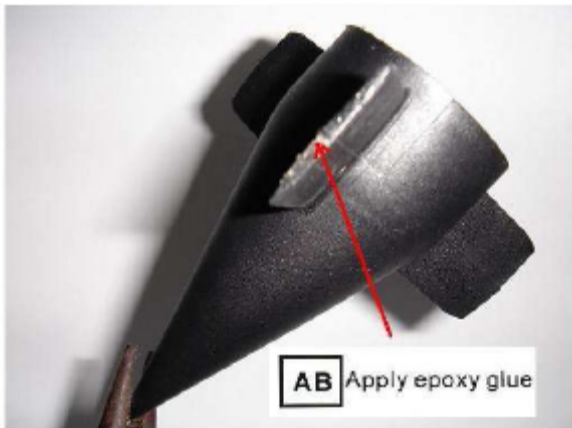


## Installation of exit nozzle and thrust cone



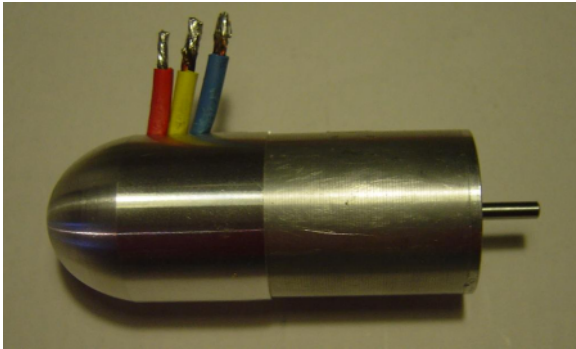
The WM 400 thrust nozzle and exit cone comes in two parts. The cone is assembled inside the thrust nozzle with epoxy glue.

Take note that the exit cone is specially designed to sit at a certain depth inside the thrust nozzle. Do not over insert inside as it will cause the thrust nozzle to deform in shape.



To attach the cone to the thrust nozzle firmly, apply a light sanding process with light grit sanding paper on the 3 tips of the blades of the cone. The same goes for the inside of the thrust nozzle where the blades will touch. This will allow the epoxy glue to bond firmly.

## Motor wire connections



If you are using the additional available Motor cone, feed the motor wires through the slot in the cone. To avoid short circuits the wires must be isolated well. Depending of the type of isolation it's recommended to add an additional isolation with heat shrink tube. The slot will help to arrange the wires exactly in line. This will minimize the aerodynamic drag.



Another possibility to connect the motor wires is to use copper stripes. You may use this method with or without the use of the motor cone. Pay attention for a proper isolation between each copper stripe as well as between copper stripes and motor case and/or motor cone.

## First run

Keep in mind all the points of the chapter "SAFETY INSTRUCTIONS". If you are familiar with the "Safety Instructions" start the fan at very low rpm.

1. Check for correct direction of airflow. If the direction of airflow could be wrong, stop running the fan, disconnect the battery and swap two motor wires or change turning direction in the ESC settings if available.
2. If the direction of airflow is correct, increase the rpm to about  $\frac{1}{4}$  of power. Check for vibration and /or unusual noise. The rotor must rotate smoothly within the housing and the blades may not rubbing on the fan housing. If there are unusual vibrations or noise or the blades are rubbing on the housing do not proceed running before the reason is found and the problem is solved.
3. If the fan runs smoothly, slowly increase rpm to full power. Stop running immediately if you recognize unusual vibrations or unusual noise.
4. After this first run disconnect the battery from the ESC and check the fan for rubbing, cracks or other damaged parts.