



Electric Power Systems Workshop

Intro to Electric Ducted Fans

Electric ducted fans (EDF's) operate very similarly to propellers, though much less efficient and at much higher speeds. Likewise they usually take twice the amount of power to get the same performance than with a propeller. They consist of a rotor (also known as the impeller), the housing (or shroud), and the motor. The motor is mounted to the housing using stator vanes, which not only mount the motor, but also keep the airflow from swirling.



Types and sizes of fans:

Most EDF units come in a tractor configuration (like a puller prop). However, some fans come in a pusher configuration, though this is far less common. Ideally the fan would have stator vanes on both the inlet and outlet side, but they usually are only on the outlet. The common fan sizes are measured in mm and are 50, 64, 70, 90, and 120. The one shown at right is a 120mm EDF unit made by RC Lander, and distributed by Nitroplanes.com.

What affect the performance of a EDF unit?

- **Fan swept area (FSA):** The FSA is the area of the blade disc when looking from the front. If you used the fan blades to saw into a piece of foam, the FSA would be the area that gets cut out by the fan blades. This number is very useful in determining the exhaust size and the inlet size, and is usually specified by the manufacturer.
- **Pitch of the blades:** The pitch of the blades increases the speed of the exhaust, as does constricting the airflow on the exhaust. However, *higher pitch* fans usually cannot spin as fast because the blades are easier to stall. When the blades stall it is similar to a wing stall. The load on the motor goes down, but the exhaust thrust decreases to almost nothing. *Lower pitch* blades will spin faster and generate more thrust. The same can also be said for the *number of blades*.
- **Ducting:** The ducting should be free of obstructions, and somewhat smooth. Also there should be no drastic 'steps' in the ducting and the cross-sectional area of the duct at any point should be greater than or equal to the FSA.
- **Power input and balance:** Power is usually limited by the motor, and how much cooling airflow it gets. In-runner motors simply mount into the fan by friction fit and a couple of

bolts. Out-runner motors only bolt to the inside of the mounting plate, and likewise allow airflow around the motor. Just like a propeller, the rotor should also be balanced. Balancing decreases the load on the motor and bearings, and increases the thrust put out by the fan.