3.4.3 KUKATE34 rotor

Simple construction

This rotor is used to drive our OPEN WINDMILL - KUKATE wind turbines. It consists of water pipe spars and twelve rotor blades made of curved sheet metal. This ingeniously simple and easy-to-build construction is astonishingly effective from an aerodynamic point of view and is ideal for our ideal for our purposes.

We use such rotor blades for the KUKATE34, KUKATE34M and the KUKATE34E.

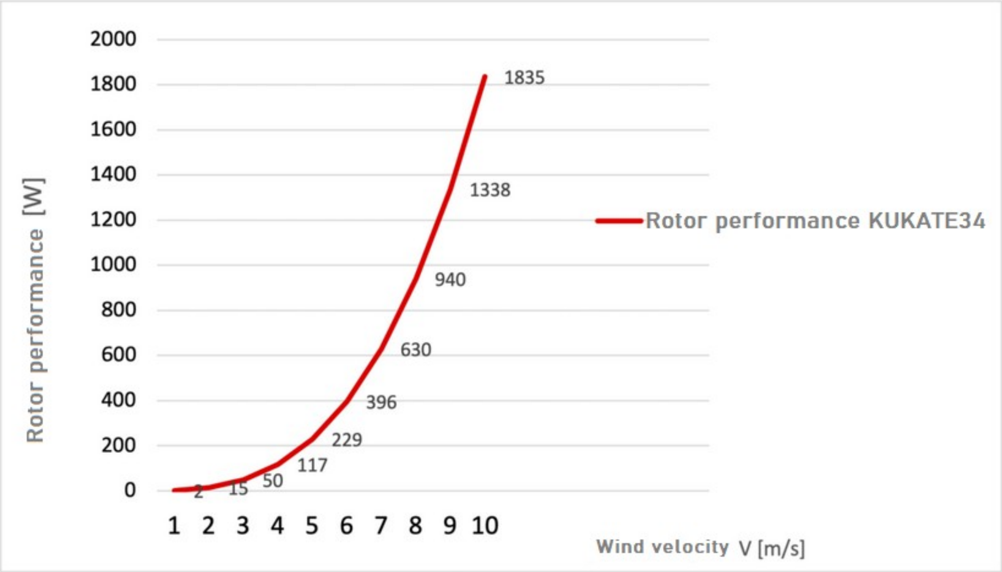
Many applications for self-builders

Self-builders can realize drives for any purpose with this twelve-bladed wind turbine.

The technical facts of our rotor

Under TECHNOLOGIES > GENIAL ROTOR CONCEPT (Hyperlink on GENIAL ROTOR CONCEPT) can technical interested people and experts can read, how the ingenious simplification of the aerodynamic ideal wing to the extremely well suited KUKATE34 wing is realized.

The aerodynamically effective rotor area corresponds to the circular ring area swept by the wings. The is 6.6m² for the KUKATE34 rotor.



It has a coefficient of power of 0.35. The coefficient of performance is so high because we in the area calculation the inner "pane" is not taken into account.

As you can see, the wave power at:
- 7m/s wind speed approx. 600W.
- 10m/s wind about 1700W.
- 12m/s laminar air flow 2500Watt.

We have recalculated the rotor power according to a slightly different theory and have come to a very similar result as the diagram above already shows:

Rotor	
Incoming flow	Luv
	12
Rotor diameter (outer) Rotor blade profile length x profile wide	3,4 m 1000mm x 370mm
Wing material	Steel or aluminium sheet 2mm
Profile shape	Curved plate 1:10 to 1:8 (between 36 and 40mm
High speed number	1,1
Abgle of attack of the Profile chord to rotor plane	38°
Shaft diameter	40mm steel
Shaft bearings	Plummer block with deep groove ball bearings
Shaft performance	5m/s: 220W 7m/s: 600W 8m/s: 900W 10m/s: 1700W
Nominal wind speed	6 m/s
Nominal air pressure	1013 mbar
Nominal temperature	15°C

Parameters of the KUKATE34-Rotors

Determined values of the KUKATE34 rotor

Wind speed v_{wind} [m/s]	**Rotational speed** n[1/min]	**Performance** P_{drive}[W]	**Torque** M_{drive}[Nm]	**Start torque** M_{start} [Nm]
1	6,2	2	3	3
2	12,4	14	11	13
3	18,5	47	24	29
4	24,7	111	43	52
5	30,9	216	67	81
6	37,1	373	96	117
7	43,3	598	131	159
8	49,4	885	171	208
9	55,6	1260	216	263
10	61,8	1728	267	325

We can take the extremely important starting torque here in the "Starting torque" column. It is many times higher in relation to fewer and narrower rotor blades.

But the speeds are also important, especially if we want to generate electric power. From the speeds, it is easy to calculate the required transmission ratio from the rotor speed to the generator speed at the corresponding generator speed with the corresponding shaft power.

Simple components

The connection of blades, hub and shaft is very simple. Sheet metal, flat iron, steel "water pipes", two metal washers and the shaft made of 40mm round steel are simple starting materials. In addition there are screws.

Construction plan for the KUKATE34 rotor
Under the following link you can download the rotor construction excerpts necessary for the rotor construction from the general
construction plans for the KUKATE34K:
(LINK after "4.4.3 KUKATE34 Rotor).

For experts the rotor is changeable:

The angle of attack of the rotor blades can be easily changed - even the number of blades is variable. If you want to build a rotor of 4m - 5m diameter, you extend the shaft by 100mm to the front. On the extension you push a tube and clamp the rotor blades with steel rods - similar to the sailing windmill rotor (link to sailing windmill rotor 4.4.1). We need this bracing because the rotor at its develops considerable axial forces to the rear at its rated speed. Otherwise, in a storm, these forces could bend the tube spars if the rotor has a diameter of more than 3.6m. If you want to build a rotor with a smaller diameter, you should reduce the size of the components accordingly. downsize accordingly. Important screw connections should not be smaller than M8. If necessary you can choose
M6 connections - but no smaller ones. The screws should be of at least 8.8 quality.

Recommendation for training and school projects

A KUKATE-rotor with a diameter of e.g. 2m will start to turn easily even with little wind. begin. Pupils and students can do interesting experiments on the use of wind energy with it and gain a lot of experience. We recommend the alignment of the wind turbine into the wind with the help of the KUKATE flag regulation.

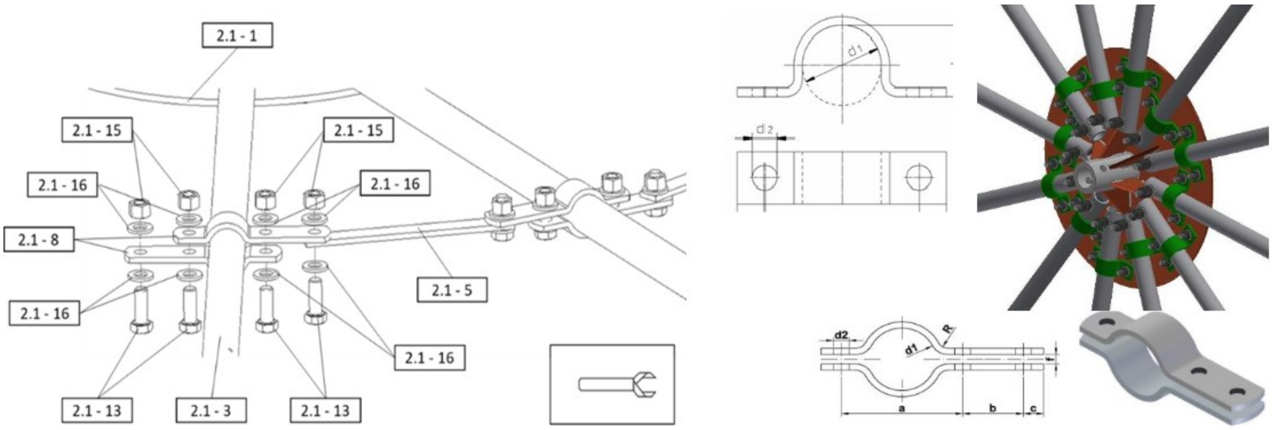
The following applies to self-constructed rotors:

Match shaft diameter to rotor diameter.

The shaft should be at least as thick in mm as the rotor is in decimeters - well rounded up! For larger rotors, you must also adapt the hub disks to the thicker shaft required. For the For the inner hub disk we recommend 12mm thick plate and for the front 6mm.
Such changes always require good design knowledge.
The RoWiTool rotor design program is very helpful for your own rotor designs. Please compare the corresponding chapter (link after 3.4.2 and 4.4.2.)

Rotor KUKATE34 with pipe clamp variant:

We built the prototype of the rotor with only ONE hub plate made of 10mm thick sheet metal and screwed the pipe spars with purchased strong pipe clamps (DIN 1539 and DIN 3567). If you want, you can make the rotor also like this.



You can also easily build the ring that accurately positions the rotor blades with asymmetrical pipe clamps. We are looking forward to your experience reports, especially if you build a rotor with a different diameter.

(You can reach the construction plans under the column construction plans).