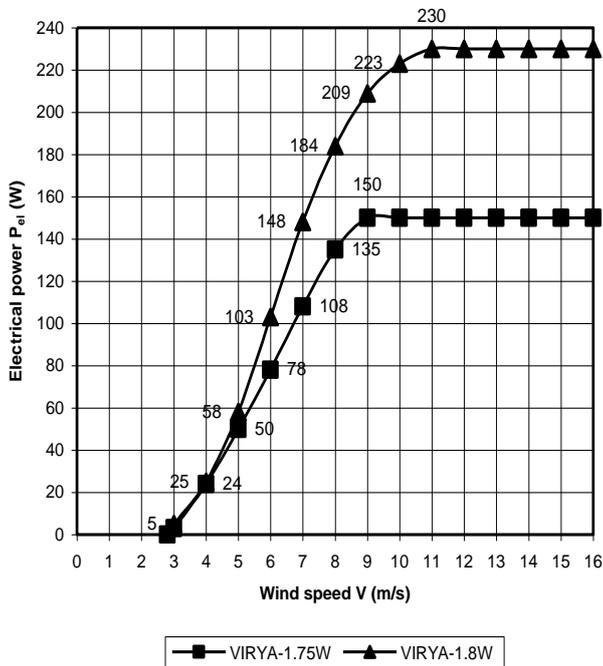


Free licence for manufacture and sale of windmills
VIRYA-1.75W and VIRYA-1.8W
 December 2018

**P_{el} -V curves VIRYA-1.75W and
 VIRYA-1.8W windmills**



Specification

	VIRYA-1.75W	VIRYA-1.8W
Diameter	D = 1.75 m	D = 1.8 m
Number of blades	B = 2	B = 2
Design tip speed ratio	$\lambda_d = 7$	$\lambda_d = 6.25$
Gear ratio	i = 1	i = 1
Rotor eccentricity	e = 0.15 m	e = 0.15 m
Generator type	axial flux	radial flux
Number of poles and phases	?-pole, 3-phase	8-pole, 3-phase
Height tower pipe	H = 2 m	H = 2 m
Total tower height	H _{tot} = 7.5 m	H _{tot} = 7.5 m
Mass with tower pipe only	m = 19 kg	m = 22 kg
Starting wind speed	V _{start} = 3.2 m/s	V _{start} = 2.3 m/s
Cut in wind speed (if started)	V _{cut in} = 2.8 m/s	V _{cut in} = 2.6 m/s
Rated wind speed	V _{rated} = 9 m/s	V _{rated} = 11 m/s
Survival wind speed	V _{surv} = 35 m/s	V _{surv} = 35 m/s
Nominal battery voltage	U = 12 V DC	U = 24 V DC
Power at rated wind speed	P _{rated} = 150 W	P _{rated} = 230 W
Rotor calculations	report KD 669	report KD 664
Generator description	report KD 595	report KD 644
Licence fee	free	free

Kragten Design

Kragten Design (KD) is a one man engineering office founded in 1989 and specialises in windmill design. Up to now 24 windmills with rotor diameters from 1 to 4.6 metre haven been developed and more than 660 KD-reports haven been written. Adriaan Kragten, B.Sc., worked for fifteen years in the Wind Energy Group, Faculty of Physics of the University of Technology Eindhoven, one of the parties of the former CWD (Consultancy services Wind energy Developing countries).

The address of KD is: Kragten Design
 ing. A. Kragten
 Populierenlaan 51, 5492 SG Sint-Oedenrode, The Netherlands
 Telephone: +31 413 475770
 e-mail: info@kdwindturbines.nl

More information about Kragten Design and its products is given on: www.kdwindturbines.nl

Description of the windmills

The rotor blades of the 2-bladed VIRYA-1.75W and VIRYA-1.8W windmills are made out of wood. A W is added behind the name to distinguish them from the VIRYA-1.75 and the VIRYA-1.8 with cambered stainless steel blades. The VIRYA-1.75W has blades with a Gö 611-10% airfoil made out of hard wood. The VIRYA-1.8W has blades with a Gö 611-12% airfoil made out of water proof plywood. The rotor calculations and the rotor drawings for the VIRYA-1.75W are given in public report KD 669. The rotor calculations and the rotor drawings for the VIRYA-1.8W are given in public report KD 664.

The VIRYA-1.75W makes use of an axial flux PM-generator of the Chinese company Hefei Top Grand model TGET165-0.15KW-500R. This generator was bought and measured in 2015 and the measurements are given in public report KD 595. This generator was tested for some years in combination with the 2-bladed VIRYA-1.65 rotor with cambered stainless steel blades but this rotor appeared to be too noisy. It is expected that the VIRYA-1.75W rotor with wooden blades is more silent but this has not yet been verified. The VIRYA-1.8W makes use of a radial flux PM-generator with no iron in the coils. This generator is made from a 6-pole asynchronous motor frame size 71. This generator is described in public report KD 644.

The VIRYA-1.75W and the VIRYA-1.8W make both use of the head and tower of the VIRYA-1.8 windmill. The VIRYA-1.8 tower has a 2 m tubular upper section and a 6 m tubular lower section. Photos of the drawings of the head and tower of this windmill are given in the public manual part 2 of the VIRYA-1.81 windmill. The only modification is that for the VIRYA-1.75W, a 2 mm aluminium vane blade has to be used in stead of a 1 mm stainless steel vane blade to get a rated wind speed of 9 m/s and that a special bracket is needed to mount the axial flux generator. A drawing of this bracket is given in KD 669.

The windmills are provided with a “hinged side vane safety system” to limit rotor speed and thrust at high wind speeds. The rotor axis is offset from the tower axis. The vane juts out along the rotor and the vane blade is connected to the vane arm using hinges. At low wind speeds, the vane blade hangs in almost vertical position and the rotor is perpendicular to the wind. At wind speeds higher than about 5 m/s, the rotor starts to turn gradually out of the wind. At very high wind speeds the rotor turns out of the wind by about 70° and the vane blade is almost horizontal. The behaviour of this system is very stable and the rotor speed is well controlled.

The VIRYA-1.75W and VIRYA-1.8W windmills have not yet been built and tested but the safety system has been tested in many bigger windmills. May be I will test the VIRYA-1.75W in future on the 12 m tower of the VIRYA-4.2. I will certainly not build and test the radial flux generator of the VIRYA-1.8W, so someone else has to build the first prototype and test if the idea really works. I am interested to hear about the results and will answer questions if it is not quit clear how to build and test a prototype.

These two windmills are designed primarily for serial manufacture in developing countries. However, a prerequisite is that the prescribed material is available. Kragten Design cannot supply materials and parts such as bearings, generators, magnets etcetera. The required workshop skills are sawing, drilling, turning, milling (only VIRYA-1.8W generator) and welding.

Licence conditions

No licence is required for manufacture and sale of the VIRYA-1.75W and the VIRYA-1.8W so anyone is allowed to build and sell these windmills. It is advised to not deviate from the drawings. Although these windmills have been designed carefully, no responsibility is accepted for the operation of a windmill neither as a whole, nor for any of its separate parts.