SVIAB
SVENSK VINDKRAFT INDUSTRI AB
SWEDISH WIND ENERGY INDUSTRY CO

Description of Wind Turbine VK240

VK240 consists of: generator, turbine rotor, machine frame, tail and charge regulator. The main components are described below.

Generator

The generator is a 3-phase synchronous generator of reluctance type. It has no windings in the rotor, which means that no slip rings are needed. The rotor is made of laminated dynamo sheet metal, which is mounted on a steel shaft carried in sealed ball bearings.

The six stator poles are also made of laminated dynamo sheet metal and are mounted in the stator house made of soft steel. Each pole is fitted with a compound exciter winding, i.e. it consists of one shunt connected and one series connected exciter winding.

This gives optimal speed/power adaptation between the turbine and the generator.

The 3-phase alternating current is rectified by means of diodes, which are located in the rear compartment of the generator. The current to the shunt connected excitation winding is received from three separate diodes.

In the rear compartment of the generator there are terminal blocks for the internal connection of the generator and for the main cable from the generator. The generator can easily be reconnected from 12 to 24 volt or vice versa.

The end shields and the diode cover are made of cast aluminium alloy. The generator is completely sealed and is therefore well protected.

At 270-300 RPM the generator begins to deliver power which happens at 2-3 m/s wind speed.

Machine frame

The generator is mounted on the machine frame, which is made of cast aluminium alloy.

The tail is hinged to the machine frame and can move approx. 90 degrees between two rubber stops. The hinge is provided with an inclined pin carried in plastic bushings.

The yaw bearing is built in into the machine frame. The yaw shaft with flange is made of steel. The flange is mounted on the top of the tower with six bolts. The yaw bearing is fitted with conical roller bearings.

The yaw shaft is hollow. The main cable is drawn through this and hangs free inside the tower. Slip rings are therefore not necessary.

Tail

The purpose of the tail is to keep the turbine rotor facing the wind direction up to 10 m/s wind speed. At wind speeds above 10 m/s the turbine will turn out of the wind due to the inclined pin of the hinge. The weight of the tail turns the turbine back to the wind when the wind speed drops.

The arm of the tail is made of rectangular steel pipe. The vane is made of steel plate and is fixed to the arm with screws.

Charge regulator

The batteries must be protected against excess charging, which can seriously damage them. The wind turbine is therefore provided with a charge regulator.

The function of the charge regulator is as follows: When the voltage of the batteries has reached a preset level, the charge regulator connects a consumer (dump load) in parallel to the batteries.

The dump load consist of a heating element or heating cartridge, which makes the surplus energy usable as heat.

The charge regulator is designed for use with lead-acid batteries, preferably of so called “deep cycle” type. In contrast to starting batteries in cars, this kind of batteries can stand repeated deep discharge, which is needed for this kind of application.

Technical Data

General

Wind speed where charging starts	2-3 m/s
Max power output at wind speed	11-12 m/s
Machine frame	Cast aluminium
Yaw shaft	Steel with greased roller bearings
Tail	Galvanised and painted steel
Colour	Black (other colour on request)
Power control	Turbine is automatically turned out of the wind when wind speed is above 10 m/s
Charge regulation	Electronic charge regulator included
Surplus energy	Can be used for heating purposes
Warranty	3 years, if tower according to SVIAB’s specifications is used

Generator

Generator type	3-fas synchronous
Voltage	12 or 24 volts
Max power	750 W
Rotational speed when charging	250-800 RPM
Number of poles	6
Magnetisation	Compound
Rotor	Without windings, slip rings and brushes
Protection code	IP 44

Turbine rotor

Number of blades	3 pcs
Diameter	2.4 m
Blade profile	NACA 4412-24
Blade material	Polyurethane

Planning of a Wind Turbine Installation

When a wind turbine installation is planned, you must consider factors such as siting of the wind turbine, yearly energy production, voltage drop in the power lines, charging losses etc.

Siting

To achieve a high production from the wind turbine, it should be placed in an open, windy place. The more flat the terrain is, the more even the wind is. A point of land near the water is a good site, unless there is a steep slope behind because the wind becomes turbulent close to a mountain side.

The wind speed increases with the height above the ground, so a high tower means larger energy production.

If the wind turbine is placed in forest terrain the tower has to be considerably higher than the treetops for the wind to be effective.

Yearly energy production

The yearly energy production of VK240 at different median wind speeds measured at hub height is presented in the table below.

Median wind [m/s]	Yearly energy prod. [kWh]
4	800
5	1400
6	2000
7	2600
8	3000

12 or 24 volts?

Since the generator sometimes produces a high current, the voltage drop in the cables will affect the result.

The power loss in the cables depends on the current, and since the current is half as big at 24 V as at 12 V, the losses will be smaller in a 24 V system. This makes the higher voltage prefferable.

For the same reason, the distance between generator and batteries should be a short as possible.

Some appliances can only be connected to 12 V (radio, TV, etc) but there are adapters to buy that halve the voltage, so this should not be a problem if you choose to build a 24 V system.

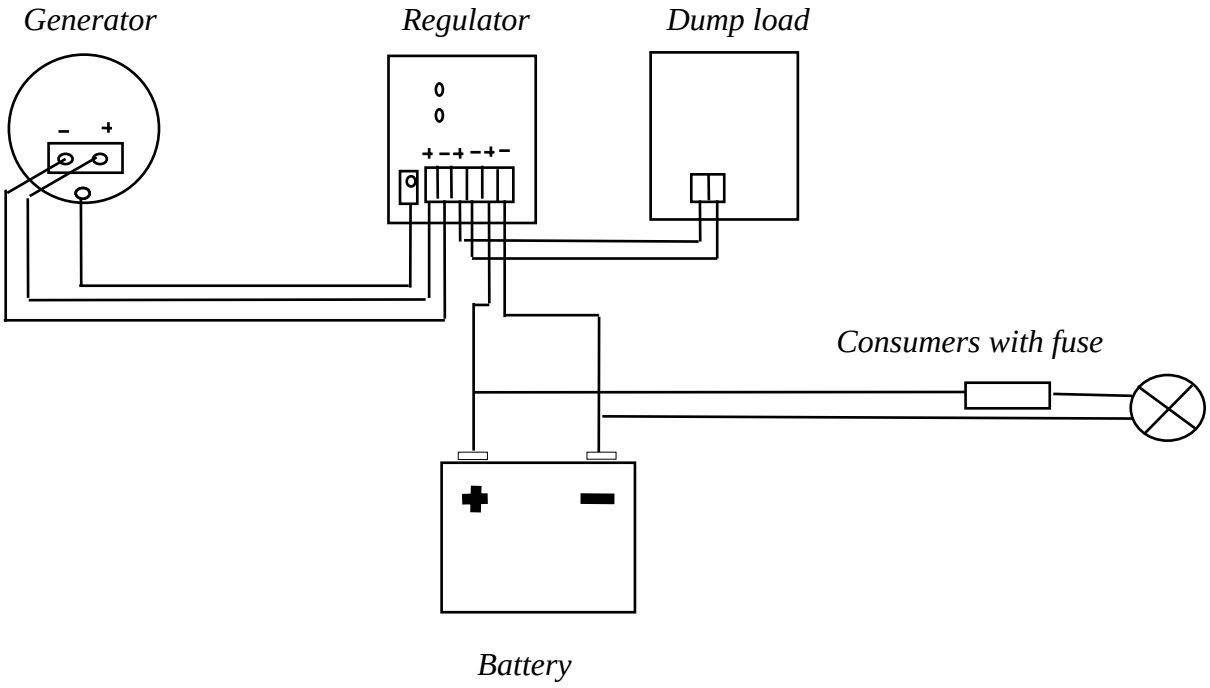
If you have appliances that require alternating current (or if you e.g. want to use a local AC-grid in the house) you can use an inverter for this purpose. The inverter contains power electronics that convert the DC from the batteries to AC, which we are used to get from the public grid.

Inverters are available for both 12 and 24 V battery voltage.

Hybrid system

A hybrid system means that you combine a wind turbine with another power source, e.g. photovoltiacs or a diesel generator. For example, a diesel generator can automatically start and charge the batteries, if the energy of the wind is not enough. SVIAB's wind turbines are very suitable for such applications. For planning of a hybrid system, you are welcome to contact SVIAB.

Example of Installation



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