

INSTRUCTIONS FOR MAKING THE WIND TURBINE Mk3

The Wind Turbine uses an electric motor/generator to generate a d.c. voltage, sufficient, in a reasonable breeze, to light an LED. There is provision for three blades which can be altered in pitch, giving the opportunity to experiment with 2 or 3 blades and various pitch angles to obtain maximum performance. The model can also be powered by an AA battery so that it can act as a fan.



Topics learned: Principles of wind powered generation of electricity; the benefits and problems. Gears and gear ratios. Electric motors/generators. Application of LED. Testing electrical machines.

Tools required: Posidrive and flat bladed screwdrivers, soldering iron and solder, scissors, wire cutters, wire insulation strippers

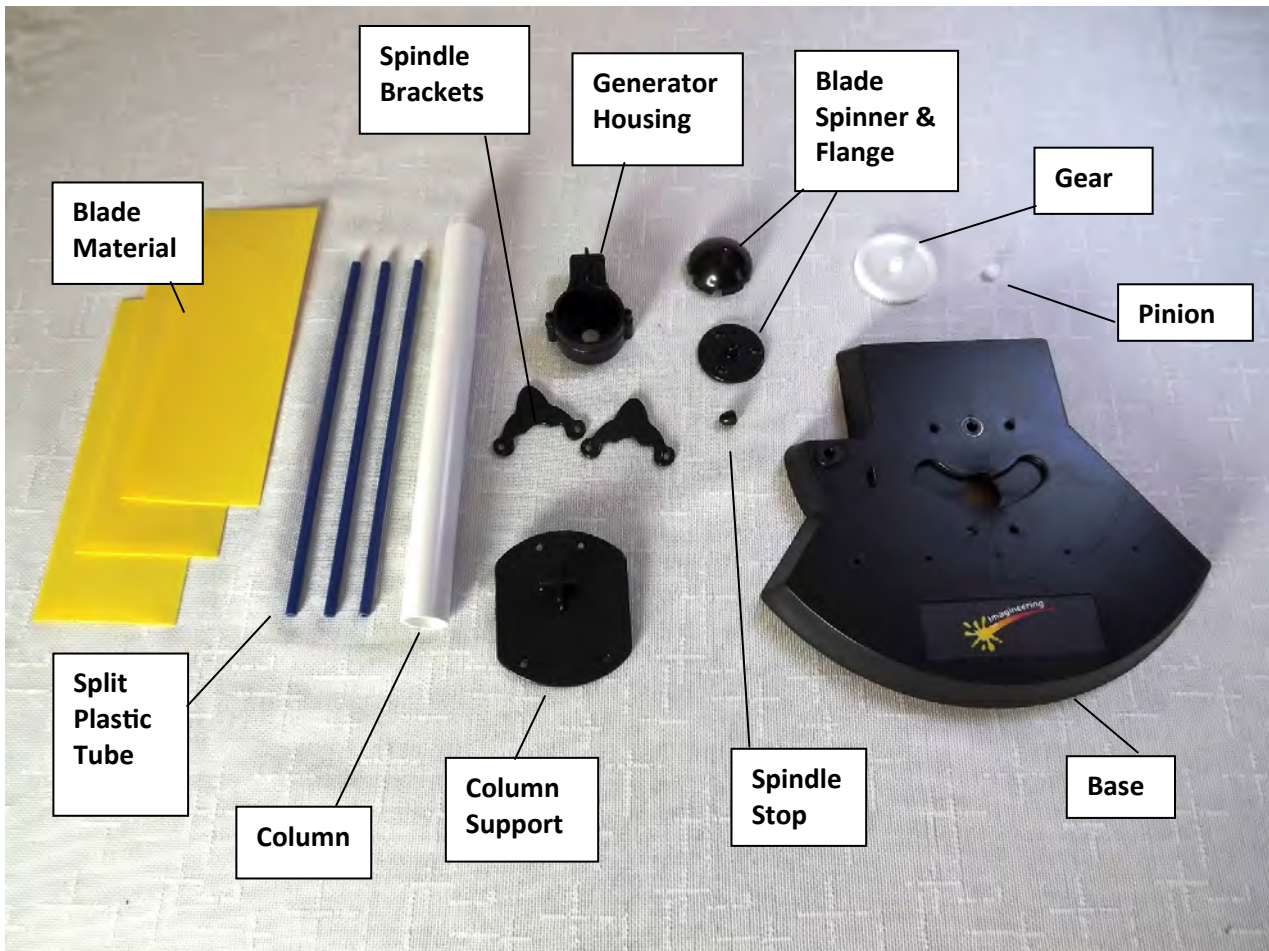
Safety: Observe rules for safe use of tools, especially the soldering iron.

**This is an Education Kit – not a Toy.
It requires adult supervision during construction.
The Kit contains small parts and is NOT suitable for children under 8yrs of age.**

1. Parts

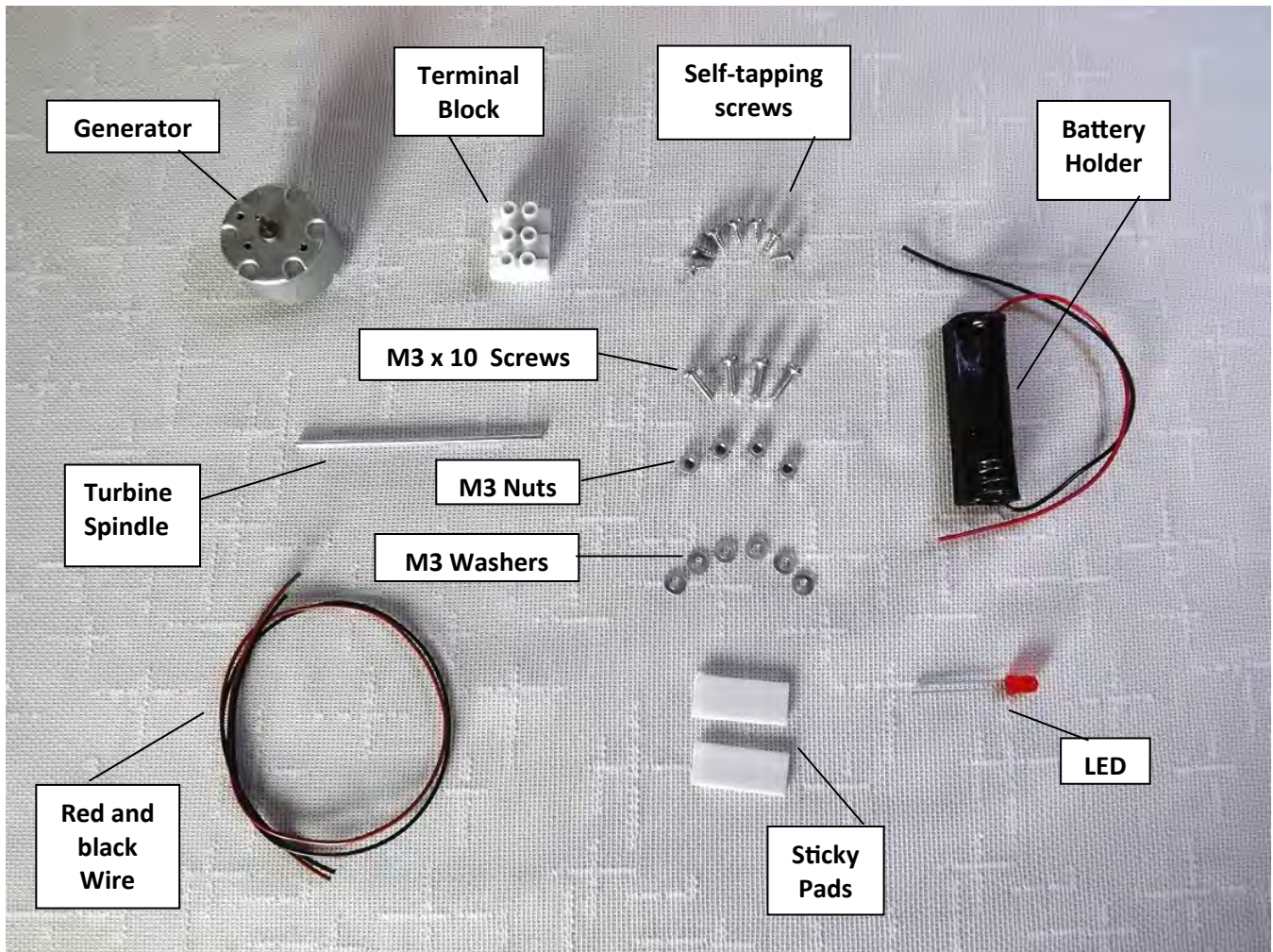
Check that you have the parts and put a tick in the column by each one.

Plastic parts



ITEM	DESCRIPTION	NUMBER	CHECK
1	Base	1	
2	Column support	1	
3	Column	1	
4	Generator housing	1	
5	Spindle bracket	2	
6	70 tooth gear	1	
7	10 tooth pinion	1	
8	Blade Flange	1	
9	Blade Spinner	1	
10	Spindle stop	1	
11	Blade Material	3	
12	Split Plastic Tube	3	

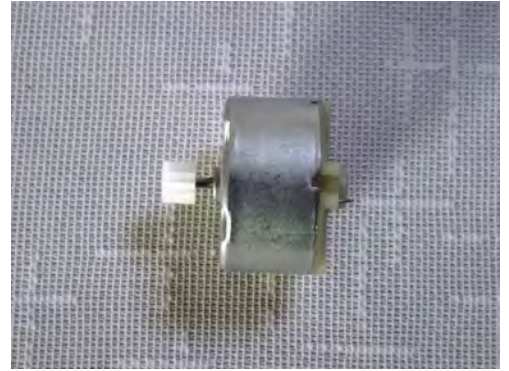
Fasteners and electrical items



ITEM	DESCRIPTION	NUMBER	CHECK
13	Generator	1	
14	Turbine spindle	1	
15	6mm x 4 self-tapping screws	7	
16	M3 x 10 Posidrive screws	4	
17	M3 Nuts	4	
18	M3 Washers	6	
19	Connecting Wire – 330mm red	1	
20	Connecting wire – 330mm black	1	
21	Battery holder	1	
22	LED	1	
23	Terminal block	1	
24	Sticky Pads	2	

2. Generator and Housing

- a. Push the pinion onto the generator shaft



- b. Fit the generator into its housing. Secure it in place with the two spindle brackets and self-tapping screws and washers. Do not tighten the screws fully – you will need to adjust the backlash of the gears when they are assembled.



3. Spindle and Gears

- a. Attach the Blade Spinner to the Blade Flange, using 3 self-tapping screws



- b. Press the Turbine Spindle into the hole in the flange. Take great care not to push on the spindle with your hand. Instead, push down on the Blade Spinner with the Spindle supported on a hard wooden surface.



- c. Push the large gear onto the shaft, with the boss adjacent to the flange. Fit 2 washers onto the shaft.



d. Thread the spindle through the bearing holes in the two spindle brackets, so that the two gears mesh together. You will have to adjust the brackets so that the spindle is correctly aligned and there is enough backlash between the gears to let them turn freely without binding. You should be able to insert a piece of paper between the teeth of the two gears to get the right backlash. Tighten the 4 screws, but do not over-tighten or the threads will strip. Fit the Spindle Stop to the end of the Spindle, allowing a little clearance.

Correct alignment



Incorrect alignment

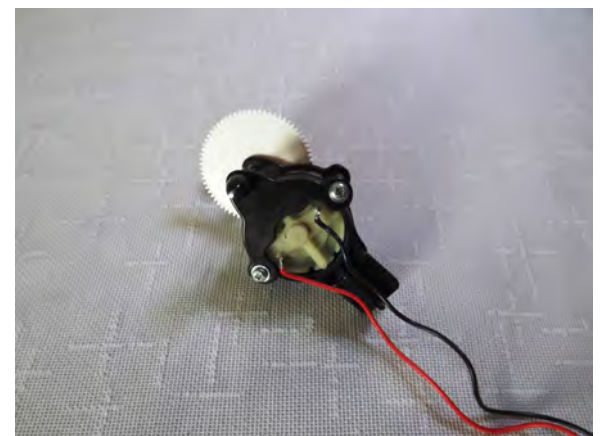


4. Assembly and Connecting up

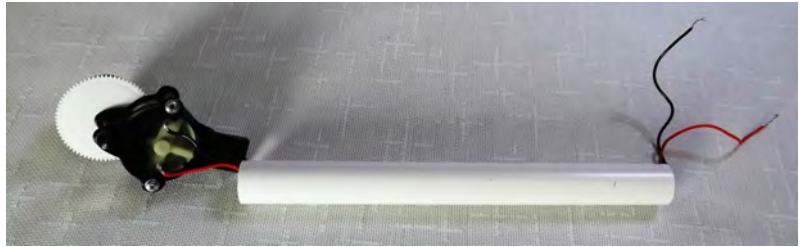
a. Fit the Column support to the base with the M3 screws and nuts (note that the hexagonal insets under the base hold the nuts while you tighten the screws).



b. Using the two 330mm lengths of wire, strip the ends and solder each wire to the generator terminals (red to positive and black to negative terminal).



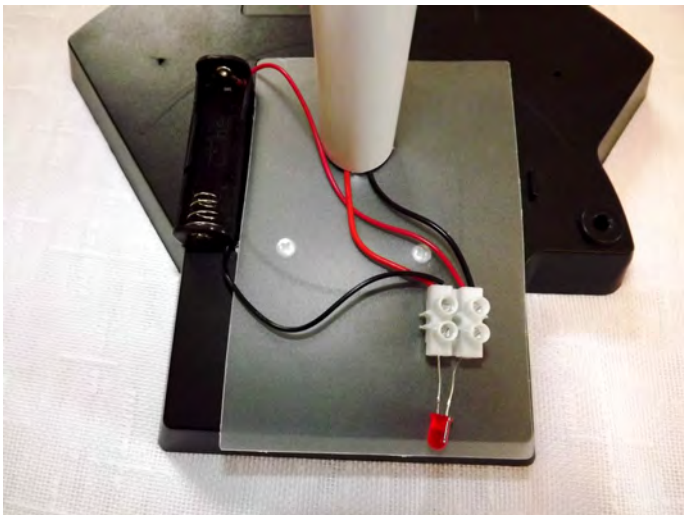
c. Thread the wires through the column and insert the generator housing into the column. Then fit the column onto the column support.



d. Using the sticky pads, attach the terminal block and the battery holder to the base.



e. Attach the Generator and Battery Holder wires and the LED to the Terminal Block as shown (note that black and red wires are connected together).

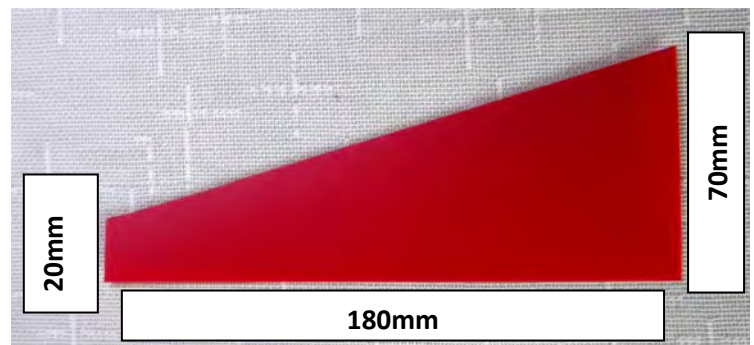


**Note: Plastic sheet
under the wires is
not part of the model**

NOTE: Because the LED only passes electricity in one direction, it will only illuminate when the generator turns in one direction. You may need to swop the LED wires round after you have finished the model.

5. Making and Fitting the Blades

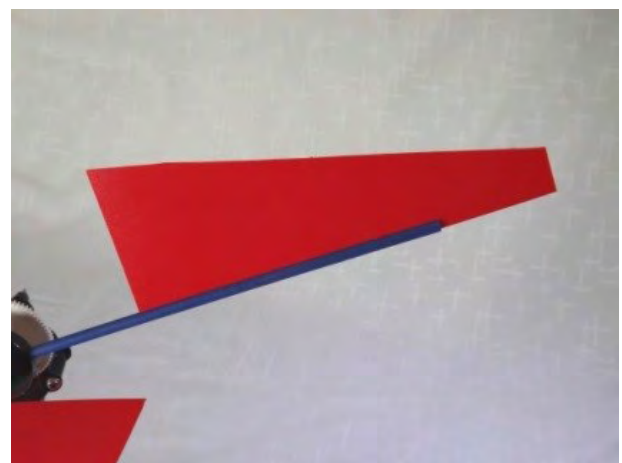
a. The blades are made from plastic sheet. Using a pencil and ruler, mark the blades to the dimensions shown. Cut them to size with scissors



b. Push the split plastic tubes into 3 of the holes round the Blade Spinner.

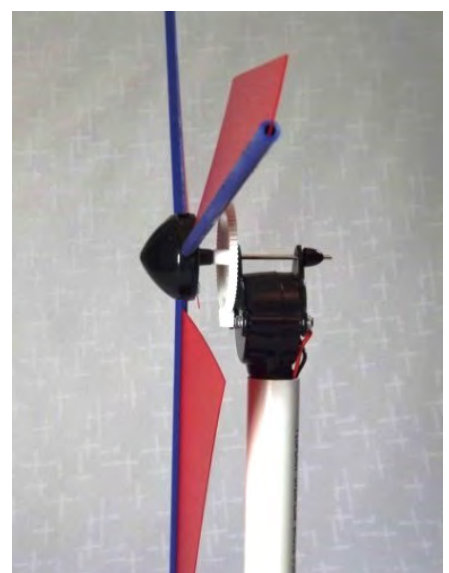


c. Slide the blades into the slits in the tubes as shown, so that the tube forms the leading edge as the blade is rotated clockwise (as viewed from the front of the Turbine).



d. Adjust the pitch (angle) of the blades by twisting the plastic tubes in the Spinner.

The Wind Turbine is now complete and should look like the picture on page 1.



6. The Blade settings and further experiments with the Turbine

The Wind Turbine should rotate clockwise in a good breeze or when stood in front of a table fan, and the LED should illuminate. If necessary, reverse the connections of the LED.

An experiment can be carried out to see how the pitch (angle) of the blades affects the speed. The voltage from the generator without any load or connection to the LED is directly proportional to the turbine speed.

Disconnect the LED and, using a multi-meter, measure the voltage output with the blades adjusted to different angles when the turbine is standing in front of a table fan. If you do not have a multi-meter, you can measure the speed of rotation by counting the revolutions in a given time and then convert it to generator speed (the gearing is 1:7).

Similar experiments can be done to see the effect of 2 or 3 blades and also with the blades reversed (wide end outwards).

7. The Turbine as an Electric Fan

If you insert a 1.5 volt AA battery into the battery holder, the turbine will operate as a fan. It should rotate clockwise. If not, check that the connections are as given in the instructions.

8. Finishing touches

When you have finished experimenting, it is a good idea to fix the blades to the split tubes, so that they do not become detached. This can best be done using PVA glue along the joint between the blade and the tube.

Alternatively, Sellotape can be used.

