

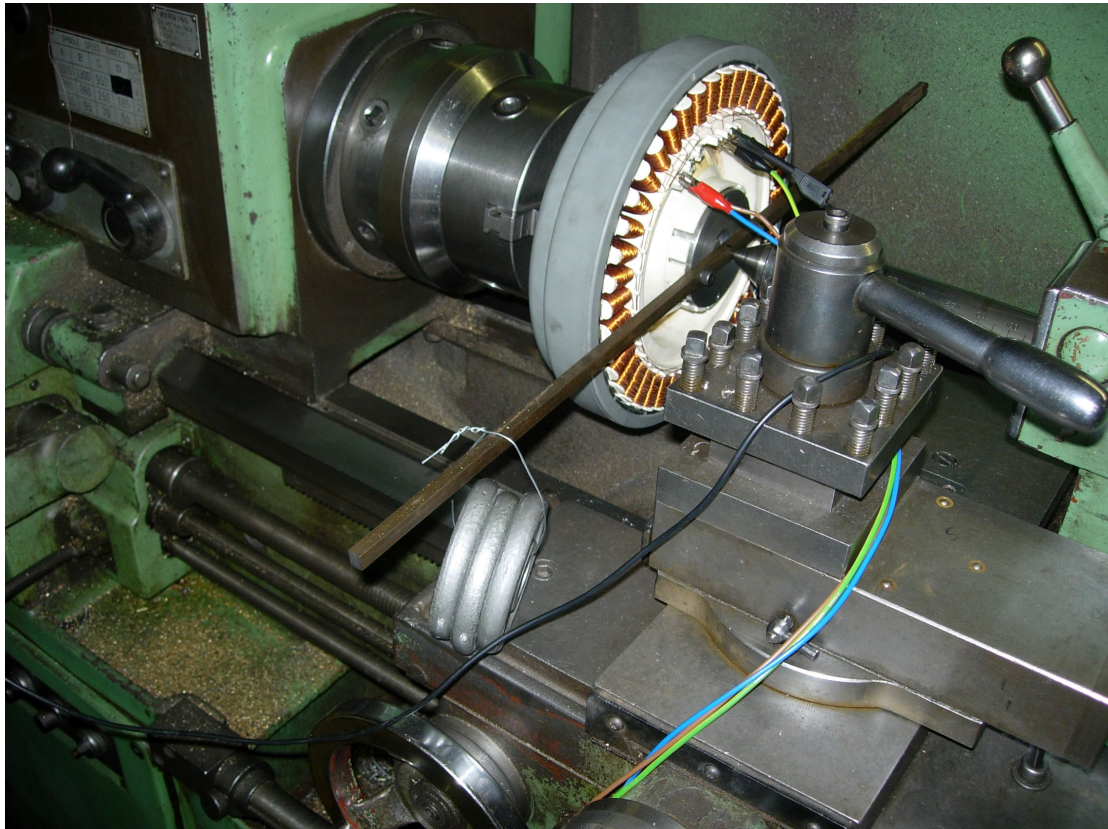
Fisher and Paykel Smartdrive motor – suitability as an alternator

Two Fisher and Paykel Smartdrive washing machine motors were liberated from washing machines and tested to gauge their suitability as alternators. Apparently there are three versions of this motor – the difference being the windings. The windings have either 0.6, 0.8 or 1.0mm wire diameters. In our testing one motor had 0.6mm wire diameter whilst the other had 1.0mm wire.

These motors have proven popular for use as alternators in renewable energy developments – particularly small wind turbines. We found however that there was a dearth of information available on these versatile motors, so we decided to test them and publish the results.

The alternators were tested over a range of speeds and loads. A mathematical model of the alternator was then developed using regression techniques and this was used to determine performance at a wider range of speeds and loads. The results are shown in the alternator characteristic graphs below. Please note that these graphs extrapolate the characteristics well beyond what was tested (we did not test above 1300rpm for instance) so please use these with caution. At the higher power outputs the windings may also get hot (and the winding resistance will increase, altering the characteristic) – we did not test for long enough to get to steady state conditions. Note also that the sample size in testing was a grand total of one – there may well be significant variation from motor to motor.

A picture of our high tech testing set up involving a lathe, lever arm, weights a multimeter and some light globes is shown in the pictures below:





The model that we found to best fit our test results was:

$$V = (k_1 - k_2 * i) * w - i * R$$

$$T = (k_1 - k_2 * i) * i + k_3 * w^2$$

Where

V= winding output voltage, rms, volts

i = winding current

w = alternator speed in rad/s

R = winding resistance

T = torque, Nm

(note 1 rpm is 0.10417 rad/s)

These motors are 3 phase. Our testing was performed on one winding only.

Motor	R ohms	k ₁	k ₂	k ₃
0.6 wire	16.2	7.719	3.233	2.5008E-05
1.0 wire	1.33	1.102	0.0535	6.4274E-05

