Notes and Lessons learned on
How to use an Induction Motor used as AC Generator

Single phase motors:

Technique: Three phase motors are easer than single phase motors. The smaller the motor the larger the capacitance that may be needed. For single phase motors chouse those that are capacitor run type motors. To get into the ball park for small single phase motors as a rule of thumb start with twice the capacitance found to be used to run as a motor. Temporally wire this in place of the run capacitor. As a starting point put about 30 to 60 microfarads across the output or where one would plug it into the wall. Turn the motor at least 80% of rated motor speed and more optimally about 10%-20% faster than rated speed. Below about 75% of rated speed it will drop suddenly out of excitation (resonance). Once you have it turning fast enough to create excitation the next step is to measure output voltage at the plug that would normally plug into a wall socket. If you get in the range of .5 to 2 volts you are not in exaction yet. But the good news is you have some residual magnetism that is causing the resulting voltage. If below .5 then the possibility is you may need to zap the unit by plugging it into a voltage source for a short time. This can be done with high voltage DC or by simply plugging the motor into a 110 AC source for a very short time. Once you have between .5 and 2 volts AC on can then start the tuning process. Start by adding more or lowering capacitance for the motor run capacitor. Adjust this to produce maximum open circuit voltage at the motors output. Then go up and down with the capacitance value that you have hanging across the motors output. At some point excitation or resonance will kick in and the voltage will jump up above 40 volts or so. Keep adjusting capacitance until this reaches a maximum for the speed chosen.

Some things I have learned. Always start the unit without a load. Once exaction voltage shows up then apply a load. Apply the load gently in stages not all at once a full load. If too much load is applied the unit will fall out of exaction and the voltage will drop to zero. I have found that this sometimes can cause the motor to loose residual magnetism and rezapping then becomes necessary. If you are not generating more than .2 volts or so then zapping will be needed.

To get your first induction motor to generate can be a bit of a challenge. Don't get overwhelmed by it. It is rely quite easy once one learns the concept of tweaking capacitance to increase voltage starting with excitation coils first.

Harbor freight Tools Chicago electric 1" Clear Water Pump Item 1479 sells for about $25 on sale. Voltage in 110 V at 60 Hz, 1/2 HP, 5.5 amp, 2850 RPM with maximum head lift (output) of 115 ft, and 330 gallons per hour. Motor run capacitor is 16 uf.

Test results: Running at as fast as I could test it using a 3/8 inch drill at 2300 RPM (80% of rated speed). Below 2000 RPM it falls out of excitation and the voltage drops from 40 volts down to about 1 or 2 volts all at once. At 2300 RPM and using a motor run

capacitor of 30 uf with a 240 uf capacitor across the output I was able to get an open circuit voltage of about 58 volts AC. This became 53 volts and .28 amps with a 60 watt light bulb load. With two 60 watt light bulbs it became 49 volts at .56 amps. With three 60 watt light bulbs it became 43 volts at .88 amps. With four 60 watt light bulbs it became 37 volts at 1.07 amps or about 39 watts of power. Any more load at the speed and it would fall out of exaction and stop generating. I feel that if one were able to turn this unit at 3100 to 3500 RPM that the story would be quite different in that it would be generating between 300 and 600 watts. My tests were done right on the lowest edge of resonance and workability due to not having a faster drive motor.

If you find a motor that needs zapping all the time then try hooking a 8 to 10 uf capacitor in series with a 40 watt light bulb and in series with the exciter run field coil. Blinks at about 20 cycles per sec brightly.

26-46 uf run cap works but higher uf tends to drop out excitation. 31-26 works best at 2300 rpm. 58 volts at plug and 120 volts at run cap open circuit.

Running off run cap (26 uf)
103 V .415 amp 60 watt bulb = 42 watts delivered
82 V .735 amp 2 x 60 watt bulbs = 60 watts delivered
both bulbs tuned on at same time will loose excitation and need to rezap it.

The above was all counter clock wise facing the pump:
The next is clockwise or the way the water would turn it if it flows into the outlet or backward through the pump.

Running off run cap oc 96 volts (26 uf)
95 volts at run cap 26 uf
75 volts 7 amps one bulb
56 volts 12 amps two bulbs

running off plug OC 66 volts (26 uf)
61 volts 6.2 amps one bulb
57 Volts 12.1 amps 2 bulbs

running off plug OC 66 volts (31 uf)
61 volts 6.2 amps one bulb
57 Volts 12.1 amps 2 bulbs
53 volts 16.3 amps 3 bulbs

I think less vibration when running this way

Box Fan test results:

Clock wise facing the fan:

Starts at 38 volts not turning then goes to 77 volts OC at 1170 RPM 1uf off run capacitor when 1uf was load capacitor Exciter current was into output plug and light was brightest had a 4 uf in series with 40 watt bulb. Shows 33 volts across plug 0 rpm and 47 volts at above rpm. Now shifting to provide ac excitation across run 1 uf capacitor voltage at plug is 35.8 volts zero rpm. 49 at rated speed. 116 volts 1137 rpm across run capacitor.

.4 volts at plug and 1.4 volts at run capacitor is tune up values for 1 uf run and load capacitance. Could not get more than about 2 volts out of this thing when tuned up. Recommend not trying multi-speed motors convent them to PM motors.

Counter click wise facing the fan:

.7 volts 2 uf on plug and 1 uf at 1.1 volt as run cap
2446 rpm was this

no go into resonance.

Drilled a .5 inch hole the depth of a magnet for 6 magnets equally spaced around the rotor. Takes a couple of hours to take apart a 19 inch box fan, center punch the and drill half inch holes for the magnets. Use crazy glue and harden with some baking soda sprinkled on it. Sand off the excess and put it back together. Use .5” by 3mm round magnets.

Varnish rotor.

Voltages clock wise facing motor
Plug
Low 2.4 volts ac
Med 2.3
High 2.1

4.1 across yellow and blue run cap leads

4.2 counter clock wise
2.5
2.3
2.1

The 6 coils need 3 poles or 6 magnets with alternating N-S around the rotor. Doesn’t work to have them all pointing out. Get the voltage above.

Had to disconnect and reconnect the basic coils so they were not interfering with each other. Ran lead wires outside the motor for 4 sets of coils.

New measurements are:

Ohms	OC voltage	RPM	Volts	Amps	Load
136	79.5	2400	33.5	.235	60 Watt light
38	19.6	2400	13.9	.145	60 watt light
27	14.6	2400	10.8	.13	60 watt light
62	63.6	2400	40.2	.255	60 watt light
38+27	34.8	2400	21.9	.185	60 watt light
38+27		2670	15.8	.29	12 volt battery
38+27		2000	15	.21	12 volt battery
38+27		1120	11.1	.055	12 volt battery
62	63.6	2400	16.2	.41	12 volt battery
62		1100	12	.16	12 volt battery
136	79.5	2400	16.2	.30	12 volt battery
136		1300	12	.16	12 volt battery

Pictures of Fan motor with magnets in rotor.

Links
http://www.qsl.net/ns8o/Induction_Generator.html

OPERATING 60 (50) CYCLE INDUCTION MOTORS AS GENERATORS

http://users.aber.ac.uk/iri/WIND/TECH/MISC/MotorsAsGenerators.html

Converting common induction motors to low rpm alternators
http://www.otherpower.com/otherpower_experiments_motor_convert.html

Using Induction Motors as Generators
http://www.smallhydropower.com/induction.htm

Electric motors and generators good for understanding motors and how they work
http://www.physclips.unsw.edu.au/jw/electricmotors.html

http://www.redrok.com/cimtext.pdf

http://www.windpower.org/en/tour/wtrb/async.htm

Induction Generation: an exciting possibility
http://www.microhydropower.com/staffpubs/staff4.htm

Good discussion on Diesel powered motor back into a grid will it work.
http://groups.google.com/group/alt.energy.homepower/browse_thread/thread/fbd220cbb37a9fc4/6e227bf4bf31167d%236e227bf4bf31167d