

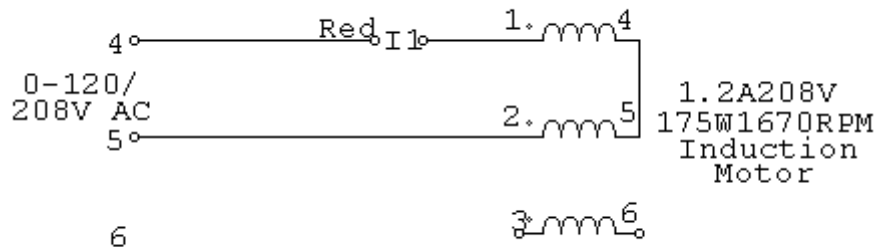
## MACHINES LAB - 6

### SINGLE-PHASE INDUCTION MOTORS

A three phase induction motor will continue to run as a single phase induction motor if one of the three line fuses is blown. The phase current would increase and the torque developed is not uniform. However, the three phase machine would not start when only two fuses are good. In the first part of the experiment, you will verify the above. In the second part, you will conduct a load test on a single phase (capacitor start) induction motor.

#### PART A: Three Phase Induction Motor.

Step 1: Connect the circuit shown below. Set the voltage control to zero.



Step 2: Set the voltage control to 50. The induction motor would not run. Make sure that I<sub>L</sub> does not exceed 1.5 A. Set the voltage control back to zero.

Step 3: Ensure that the belt couples the induction motor to the PRIME MOVER in the Prime mover/Dynamometer module. We now use the DC machine in the module (Prime mover) as a motor to start the three phase induction motor. (connected to the single phase mains). Set the **MODE** switch (outside the dynamometer load control panel) to **PRIME MOVER**. Set the toggle switch to read speed.

**Step3: Connect terminal 7 (Positive of 0-120V DC) on the Power Supply Unit to the terminal marked 1 (Red terminal) on the Prime Mover Input. Connect terminal N (Negative of 0-120V DC) on the Power Supply Unit to the terminal marked 2 (Black terminal) on the Prime Mover Input.** Now the prime mover (dc motor) is provided with appropriate input voltage.

Step 4: Increase the speed of the prime mover by turning the voltage control. Set it about 70.

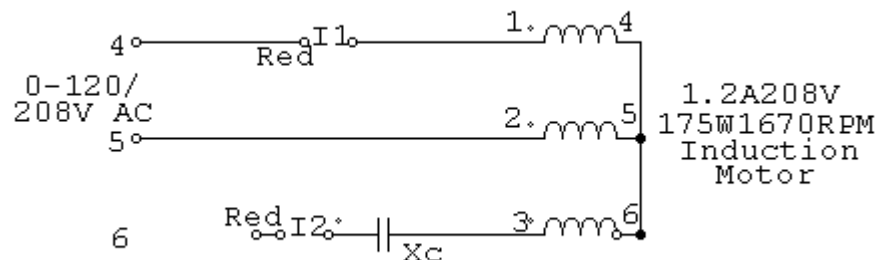
Step 5: Disconnect the wire connecting terminal 7 (Positive of the DC Power supply) to terminal 1 (Prime mover input). The prime mover is now not powered. Note that the induction motor continues to run.

Step 6: Set the voltage control to zero. Interchange the leads connecting the induction motor. (Connect terminal 4 of power supply to terminal 2 of the induction motor. Connect terminal 5 of power supply to terminal 1 of the induction motor.)

Step 7: Connect terminal 7 (Positive of the DC Power supply) to terminal 1 (Prime mover input). Repeat steps 4 and 5. Note that the induction motor continues to rotate. The reversal of the input voltage has no effect on the direction of rotation of the single phase induction motor. It depends on the direction of rotation of the prime mover.

## PART B: STARTING THE MOTOR WITHOUT A PRIME MOVER

Step 1: We can start a three phase induction motor on a single phase voltage supply by sending a current through the third phase winding. It should be out of phase with the other winding current. Set the voltage control to zero

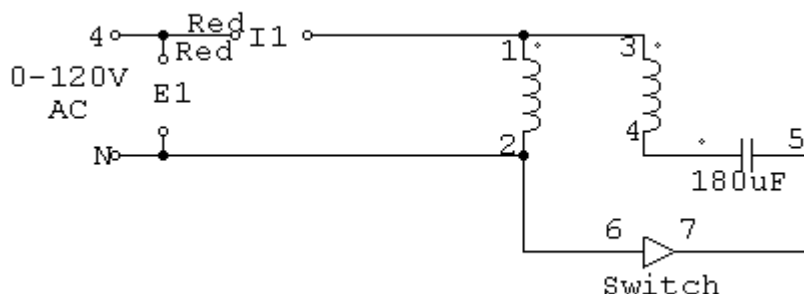


Step 2: Connect the circuit shown. Connect the red terminal of I2 to terminal 4 of the supply voltage. Select  $X_c = 17.6 \mu F$  (150 Ohms at 60 Hz). You have to connect two  $8.8 \mu F$  capacitors in parallel. Set the voltage control at 100. Note the direction of rotation of the motor. Find the angle between I1 and I2 using phasor display. (Use I1 as reference) Now disconnect the capacitor using the toggle switches connected in series with them. Note that the motor continues to rotate. Set the voltage control to zero.

Step 3: Now connect the red terminal of I2 to terminal 5 of the supply (Instead of to terminal 4). Repeat step 2. Notice that the direction of the induction motor is reversed. Note that the position of I2 phasor is changed.

## PART C: LOAD TEST ON A SINGLE PHASE MOTOR.

Step 1: Couple the single phase induction motor with the dynamometer.



Step 2. Set the voltage control at zero. Connect the circuit shown. The switch shown opens when the motor attains a specified speed.

Step 3: Click on Setup base meters. Check in boxes marked Compensated Torque, Torque and speed. Select digital mode of operation. Click on **OK**. Set the programmable meter A to read  $\cos \phi$  [E1,I1}. Set the programmable meter B to read  $P_m/P_1$  i.e., efficiency.

Step 4: Set the MODE switch (Outside Dynamometer Load Control Panel) on DYNAMOMETER. Set the mode switch inside the panel to manual. Set the power control knob (potentiometer inside the dynamometer load panel) at the minimum.

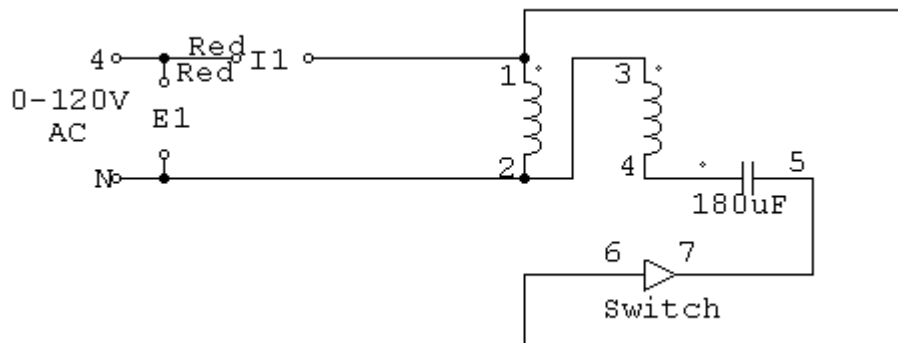
Step 5: Set the voltage control knob at 100. As you turn the knob, the motor picks up speed. You will hear a click sound when the centrifugal switch is turned off. You will see that I1 drops at that time.

Step 6: Enter the DATA in the table. Turn the load control by about five degrees. The load on the motor increases. Record the data. Record the data for several load settings. **Make sure that I1 does not exceed 4.6 A.**

Step 7: Set the load control knob at the minimum. Set the voltage control to zero. Plot Speed Vs  $P_m$ .

#### PART D: REVERSAL OF DIRECTION OF ROTATION.

You can reverse the direction of rotation by reversing the direction of current in the auxiliary winding. Connect the circuit shown. Repeat Steps 5 to 7 of PART C.



DATA: PART B:

Angle of I2 with respect to I1: \_\_\_\_\_<sup>0</sup> (Step 2)

Angle of I2 with respect to I1: \_\_\_\_\_<sup>0</sup> (Step 3)

PART C:

| S. No | E1 | I1 | P1 | Cos Phi | Pm | N | T | Eff. |
|-------|----|----|----|---------|----|---|---|------|
|       |    |    |    |         |    |   |   |      |
|       |    |    |    |         |    |   |   |      |
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|       |    |    |    |         |    |   |   |      |
|       |    |    |    |         |    |   |   |      |

PART D:

| S. No | E1 | I1 | P1 | Cos Phi | Pm | N | T | Eff. |
|-------|----|----|----|---------|----|---|---|------|
|       |    |    |    |         |    |   |   |      |
|       |    |    |    |         |    |   |   |      |
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