



Hydroelectric Power Plant Lab

Creating Your Own Electric Powerplant

LAB ONE: (KINETIC ENERGY INTO MECHANICAL ENERGY)

Pre-Lab Instructions and SAFETY:

In this lab, you will convert pressurized air into electrical energy by means of a Pelton Wheel. You will also calculate the Wattage produced by the Pelton Wheel generator in stages at various pressures.

Pre-Lab Instructions

- 1). This lab is designed to be used with compressed air instead of water.
- 2). Assemble an air nozzle, In-line regulator, and male air connector. This will be used to operate the RB Manufacturing Pelton Wheel instead of a water hose. *All parts can be obtained from Harbor Freight.*



+



+



3). Use a lubricant such as 3-In-One oil to lubricate the two shaft bushings. With compressed air, the Pelton Wheel shaft will spin at higher rpms than when used with water. Also, the water helps to cool and lubricate the shaft.

4). Using a long 3/16" x 6" drill bit, drill the nozzle to a larger diameter to accommodate the air nozzle.



SAFETY SAFETY SAFETY SAFETY SAFETY SAFETY

5). SAFETY. Safety with compressed air is paramount!!

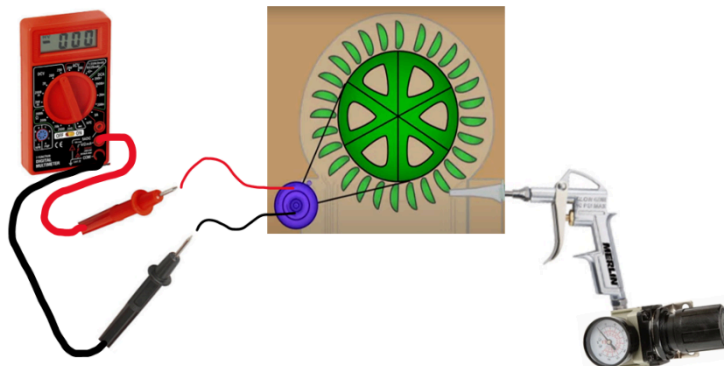
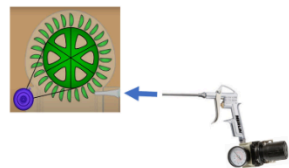
- a. **DO NOT** point or direct nozzle at or towards anyone or body part!
- b. **TREAT** the air nozzle as a loaded firearm!
- c. **PEOPLE** have died playing with compressed air!
- d. **LUNGS** have been popped, eyes blown out of sockets, air forced into blood veins causing a heart attack, intestines blown up causing a most painful death.

SAFETY SAFETY SAFETY SAFETY SAFETY SAFETY

LAB ONE: (KINETIC ENERGY INTO MECHANICAL ENERGY)

Experiment Procedure:

1). Select the AC voltage position on your multi-meter and attach the multi-meter leads to the output wires of your Pelton Wheel generator. Adjust the air regulator to 10 psi and insert the air nozzle into the Pelton Wheel nozzle as shown and squeeze the trigger. *You may need to nudge the wheel to initiate movement.* Observe and record the voltage on your lab worksheet.



2). Repeat lab question number one with 20 psi air pressure and again at 30 psi. Record your results on your lab worksheet to the right.

PSI	VOLTS
10	
20	
30	

3). (*Disconnect the multi-meter*). Attach the LED strip to the Pelton Wheel supply leads and apply 10 psi, 20 psi, and 30 psi of air pressure (remember, you may have to nudge the wheel to initiate operation). Evaluate and record your finding(s) below. Be sure to include thoughts about how flow and pressure influences the production of electricity.

). Connect the LED light strip as shown, measure and record (below) the flow of electricity (amperage) and the force of electricity (voltage) from the generator at 10 psi, 20 psi, and 30 psi (you may have to

AMPS

VOLTS

PSI	VOLTS	AMPS	WATTS
10			
20			
30			

nudge the wheel to get it to move at 10 psi). *Make sure the appropriate positions are selected on the multi-meters, and the multi-meter is turned on.*

5). Using the data collected of AC voltage and amperage, calculate and record the Watts generated at 10psi, 20psi, and 30psi on the chart to the right.

6). Using your calculated Watts figures for each pressure variable, solve for Gallons Per Minute (GPM) using the following formula:

$$\text{Watts} = \text{head height} \times \text{GPM} \times 0.18 \times .050$$

-or-

$$\text{GPM} = \text{Watts} / \text{head height} \times 0.18 \times 0.50$$



PSI	WATTS	GPM
10		
20		
30		

Post-Lab Questions (written answers):

☐ When you look at the Pelton Wheel, where have you seen any of these parts before?

☐ How have you seen these parts used before?

- In general terms, how does the Pelton wheel work?

- Do you think this Pelton Wheel can provide enough electricity to:
 - a. Charge your cell phone?
 - b. Power a laptop?
 - c. Start a car?
 - d. Turn on the lights in your house?

- What are some other things you think the Pelton Wheel example cannot do?

- Why can't the power Wheel do those things?

Activity Extensions

Use different bulbs with different Watt ratings such as an Infinity bulb or a 12VAC Halogen bulb as both shown below. Measure the amount of voltage and amperage required to illuminate the bulbs.

