

MEASURING MOTOR EFFICIENCY

*Taken from the Green Schools Tool Kit Manual to be used in conjunction with the tool kit

Objective: Students examine a working motor, measure the temperature at various places in the motor, and find out how efficiently the motor works.

Grade Level: 10 – 12

Background Information:

In motors, as in all electrical equipment, heat is directly proportional to waste. The less efficient the motor windings are, the greater the resistance to current flow and the greater the heat. Because motors rotate, they also experience loss of efficiency due to friction.

Friction in the bearings causes a drag on the motor and results in wasted energy.

Besides indicating that the motor is not running efficiently, heat in a motor is one of the major contributors to early breakdown. It causes insulation on the wiring to “bake” and fail, and causes bearing lubrication to lose effectiveness over time.

Equipment:

- An operating electric motor (as large as possible)
- Infrared thermometer*
- Lubricant for the bearings

* From Green Schools Tool Kit

BACKGROUND

Find a motor that is suitable for the investigation. You may want to consult with the school custodian to find one as large as possible. Smaller motors will work, but it will be more difficult to discern the individual component parts.

Safety Warnings: Use only electric motors for this investigation; Turn off the motor before taking any temperatures; Be sure that students stay clear of any exposed moving parts of the motor.

LEADING THE INVESTIGATION

1. Introduce the investigation by explaining the ideas presented in the Background Information section.
2. Follow the investigation as described on the student page, preferably as a class demonstration or as a lab station set up for students.

FOLLOW-UP

A group of students may want to work with the custodian to evaluate motors throughout the school facility. They should create a list of every motor and its baseline temperature(s). Then one or two months later, return to the motors to check the temperatures and note possible reasons for any change.

Measuring Motor Efficiency

Question

How does lubrication affect the efficiency of a motor?

Your prediction:

Equipment

- An operating electric motor
- Infrared thermometer
- Lubricant for the bearings

Procedure

1. Let the motor run for 20 minutes. Then turn off the motor and take the temperature of the bearings at both ends of the motor and of the main body of the motor.

Temperature of bearings: _____ and _____.

Temperature of the main body of the motor: _____

What do these temperatures tell you?

2. Lubricate the bearings. Let the motor run for 20 minutes. Then turn off the motor and take the temperatures again.

Temperature of bearings: _____ and _____.

Temperature of the main body of the motor: _____

Analyzing the Results

1. What do the temperatures tell you?
2. How do the results compare with your prediction?
3. How does lubrication affect how much energy a motor uses?