Copper and Electricity: Efficient Motors

Answers

1. Figure 1 shows how the efficiencies of two motors depend on their load. (100% load means that they are turning the maximum load for which they were designed.)

a) What would the efficiency be at zero load? Explain your answer.

Zero efficiency because the motor is doing no work.

b) At what load are these motors operating most efficiently?

100% load for greatest efficiency.

c) Suppose the standard motor cost half the price of the more efficient motor. Use the graph to explain why this doesn't necessarily make it a good choice.

The standard motor is a few percent less efficient. This means that its electricity consumption will be a few percent more than that of the higher efficiency motor. Over the lifetime of the motor, the total cost (purchase + running costs) will be greater.

2. The force on a current-carrying conductor varies with the current, the magnetic field strength and the length of the conductor. How does force vary with:

a) current?

Proportionally

b) magnetic field strength?

Proportionally

c) length of the conductor in the magnetic field?

Proportionally

3. The torque on a rotor varies with the angle of the plane of the rotor coil to the magnetic field. At what angle is the torque

a) a maximum?

Any one of 0°, 180°, 360°

b) zero?

90° (and 270°)

4. Calculate the force on a wire of length 5 m carrying a current of 4 A at 90 ° to a magnetic field of flux density 2×10^{-3} T.

0.04 N

5. Referring to Figure 2, for which two types of losses are all of the following statements true?

i) Increase as load increases

ii) Zero when there is no load

iii) Related to resistance

iv) Related to flow of current

Stator and rotor losses.

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