Intro to Fastener Ergonomics 130

The lifting of impact wrenches and the posture while using them may be an ergonomic concern partly because of the power-to-weight ratio of the impact wrench. This power-to-weight ratio is defined as the power the tool generates compared to the weight of the tool.

Ratios show a comparison between two quantities and are usually written in one of three forms. The two quantities are 1) written as a fraction, 2) separated by a colon (:), or 3) separated by the word “to.”

For example, if a larger impact wrench generates 720 ft-lb of torque and weighs 12 lb, the power-to-weight ratio can be written in three different ways.

$$\frac{720 \text{ ft-lb}}{12 \text{ lb}} \qquad 720 \text{ ft-lb: } 12 \text{ lb} \qquad 720 \text{ ft-lb to } 12 \text{ lb}$$

Because the ratio can be written as a fraction, the ratio can be reduced or simplified like a fraction. To reduce a ratio, find a common factor in both the numerator and denominator and divide out the common factor in both the numerator and denominator.

In the previous example, 720 and 12 are both divisible by a factor of 12. Simplify the ratio by dividing both by 12.

$$\frac{720 \text{ ft-lb}}{12 \text{ lb}} \begin{matrix} \div 12 \\ \div 12 \end{matrix} \equiv \frac{60 \text{ ft-lb}}{1 \text{ lb}}$$

If it is difficult to find a common factor as large as 12, start with dividing out a smaller common factor, and repeat the process until the ratio can no longer be reduced.

$$\frac{720\ ft\text{-}lb}{12\ lb} \begin{matrix} \div 2 \\ \div 2 \end{matrix} = \frac{360\ ft\text{-}lb}{6\ lb} \begin{matrix} \div 2 \\ \div 2 \end{matrix} = \frac{180\ ft\text{-}lb}{3\ lb} \begin{matrix} \div 3 \\ \div 3 \end{matrix} = \frac{60\ ft\text{-}lb}{1\ lb}$$

EXERCISES:

1. An impact wrench that generates 100 ft-lb of torque weighs 3 pounds. What is the power-to-weight ratio of the wrench? Write the ratio in three different forms.

2. An impact wrench generates 360 ft-lb of torque and weighs 8 pounds. What is the power-to-weight ratio written as a fraction? Simplify the ratio if possible.