

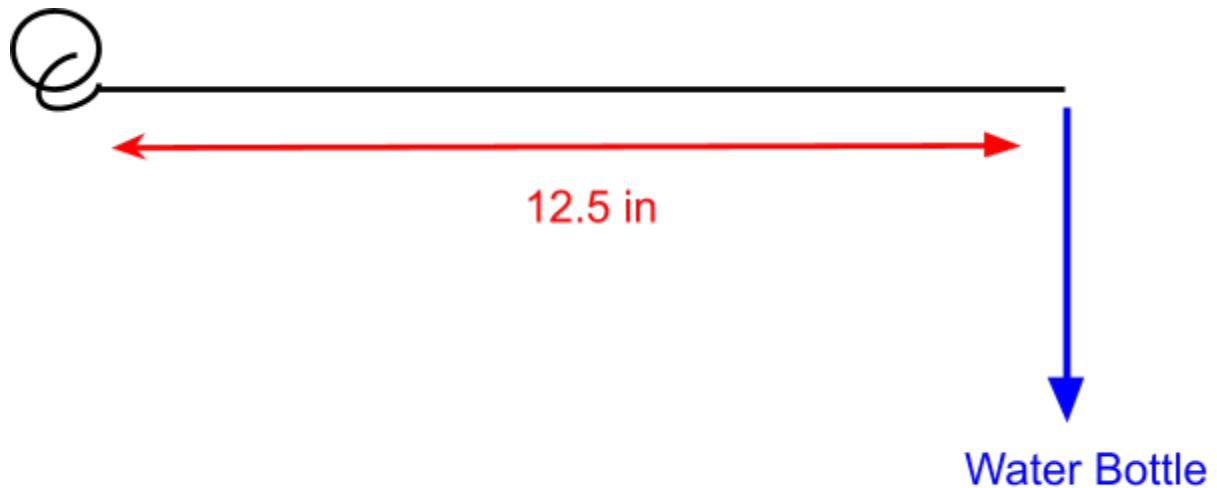
Torque Calculations

Overview

To estimate the torque required to rotate the blinds, I conducted a simple experimental test using the existing blind hook mechanism. The blind control stick, which connects to the internal hook that opens and closes the blinds, was positioned horizontally. A string was tied to the end of the stick, and a partially filled water bottle was attached to create a measurable load. The mass of the bottle was estimated based on the volume of water in it, and the torque was calculated as the product of this weight and its horizontal distance from the rotation point where the stick connects to the hook. This provided a practical estimate of the torque needed for the motor selection, accounting for the mechanical resistance of the blinds and static friction.



Blind Mechanism



Free Body Diagram

Known Values/ Assumptions

Water Bottle Was filled to $1 \frac{1}{3}$ cups

Density of water in lb/ft³: 62.4

Assume safety factor of 2

Distance from string to hook: 12.5 in

Calculations

$$62.4 \text{ lb}/\text{ft}^3 * 0.0114 \text{ ft}^3 = 0.71136 \text{ lb}$$

$$(12.5 \text{ in}) / (12 \text{ in}/\text{ft}) = 1.04166667 \text{ ft}$$

$$0.71136 \text{ lb} * 1.04166667 \text{ ft} = 0.741 \text{ lb} \cdot \text{ft}$$

$$0.741 \text{ lb} \cdot \text{ft} * 2 \approx 1.5 \text{ lb} \cdot \text{ft}$$

Speed Calculations

Known Values / Assumptions

Revolutions to close blinds from open position: 6 rev

Time desired: 10 second

Calculations

$$6 \text{ rev} / 10 \text{ sec} = 0.6 \text{ rev/sec}$$

$$0.6 \text{ rev/sec} * 60 \text{ sec/min} = 36 \text{ RPM}$$

Horse Power Calculations

Calculations

$$Horse\ Power = \frac{Torque * RPM}{5252}$$

$$Horse\ Power = \frac{1.5 * 36}{5252} = 0.0102\ hp$$