

A Motor Has A Power Of 7,150 Foot-pounds Per Second. Find The Horsepower Of The Motor. A) 8,599,000 B)

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Understanding the power output of motors is crucial in various engineering, industrial, and mechanical applications. When a motor's power is specified in foot-pounds per second, it's essential to convert this measurement into horsepower—a more familiar and standardized unit of power in the United States and many other regions. In this article, we will explore the process of converting foot-pounds per second to horsepower, apply the conversion to the given problem, and analyze the implications of the resulting horsepower value. Whether you are an engineer, a student, or a hobbyist, this comprehensive guide will clarify the conversion process and help you determine the correct horsepower for this motor.

Understanding Power Units: Foot-Pounds Per Second and Horsepower

What Is Foot-Pound-Second (ft-lb/sec)?

Foot-pounds per second is a unit of power that measures how much work a motor performs over time. Specifically, it indicates the amount of work done when a force of one pound-force moves an object one foot in one second.

- Foot-pound: A unit of work or energy, representing the work done to move one pound-force over a distance of one foot.
- Per second: Indicates the rate at which work is performed, i.e., power.

What Is Horsepower (hp)?

Horsepower is a traditional unit of power developed in the late 18th century, primarily used in the automotive and mechanical industries.

- Definition: One horsepower equals 550 foot-pounds per second.
- Historical Context: Named after James Watt, who compared the power of steam engines to draft horses.

Converting Foot-Pounds Per Second to Horsepower

To convert from foot-pounds per second (ft-lb/sec) to horsepower (hp), use the fundamental conversion factor:

$$1 \text{ hp} = 550 \text{ ft-lb/sec}$$

The general formula for conversion is:

$$\text{Horsepower} = \frac{\text{Power in ft-lb/sec}}{550}$$

This formula simplifies the process and allows easy calculation when you know the power in foot-pounds per second.

Step-by-Step Calculation for the Given Motor

Given:

- Power of the motor = 7,150 foot-pounds per second
- Possible options: A) 8,599,000 B) [Assuming the question asks for the exact value or the closest estimate]

Step 1: Write down the conversion formula:

$$\text{Horsepower} = \frac{7,150 \text{ ft-lb/sec}}{550}$$

Step 2: Perform the division:

$$\text{Horsepower} = \frac{7,150}{550}$$

Step 3: Calculate:

$$\text{Horsepower} \approx 13$$

So, the motor's horsepower is approximately 13 hp.

Analyzing the Multiple-Choice Options

The options provided are:

- A) 8,599,000
- B) [Likely the correct or closest value]

Given our calculation:

- Estimated horsepower: 13 hp

Implication:

- The options listed (8,599,000) do not match the calculated value.
- 8,599,000 horsepower is astronomically high and physically unreasonable for a motor with 7,150 ft-lb/sec power.

Conclusion:

- The correct answer based on the calculation is neither option A nor B as provided, but the most accurate is approximately 13 horsepower.

Further Clarification and Context

Why Is the Calculated Power Significantly Lower Than the Given Options?

The options seem to be in the millions, which suggests they might be representing a different unit, a different scale, or perhaps a typo or misinterpretation in the question.

Possible explanations include:

- The options are in units of power different from foot-pounds per second.
- The question might be asking for total energy or a different measure.
- The options could be in watt-hours or another unit, requiring further conversion.

How to Confirm the Correct Choice?

- Verify the units involved in the options.
- Confirm whether the question refers to horsepower directly or some other measure.
- Reassess the context: Is the power in foot-pounds per second or another measure?

Additional Conversion Tips and Calculations

Converting Foot-Pounds Per Second to Watts

Since 1 foot-pound per second is approximately 1.355818 watts, you can convert the power to watts before converting to horsepower:

$$\text{Power (W)} = 7,150 \, \text{ft-lb/sec} \times 1.355818 \approx 9,676 \, \text{W}$$

Then, convert watts to horsepower:

$$1 \text{ hp} = 745.7 \text{ W}$$

$$\text{Horsepower} = \frac{9,676}{745.7} \approx 13 \text{ hp}$$

which aligns with our previous calculation.

Summary and Final Thoughts

- The power of the motor is 7,150 foot-pounds per second.
- To convert to horsepower, divide by 550.
- The resulting horsepower is approximately 13 hp.
- The options given (A) 8,599,000 or (B) [unspecified] are inconsistent with this calculation.
- It's essential to verify units and context when interpreting such problems.

Key Takeaways:

- Always confirm units before conversion.
- Use the correct conversion factor: $1 \text{ hp} = 550 \text{ ft-lb/sec}$.
- Understand that very large numbers in options might indicate different units or data errors.

Conclusion

Determining the horsepower of a motor based on its power in foot-pounds per second is a straightforward process involving standard conversion factors. For the given scenario, the motor's power of 7,150 ft-lb/sec converts to approximately 13 horsepower. Always verify the units and context when dealing with multiple-choice options or large numerical values, ensuring accurate interpretation and calculation. This understanding is fundamental in mechanical engineering, machinery design, and energy management, enabling professionals to make informed decisions about motor specifications and performance.

Frequently Asked Questions

What is the formula to convert foot-pounds per

second to horsepower?

Horsepower (HP) can be calculated by dividing foot-pounds per second by 550, since 1 horsepower equals 550 foot-pounds per second.

Given the motor's power is 7,150 foot-pounds per second, what is its horsepower?

Horsepower = $7,150 / 550 \approx 13.00$ HP.

Is the given motor power of 7,150 foot-pounds per second equivalent to approximately 8,599,000 horsepower?

No, 7,150 foot-pounds per second corresponds to about 13 horsepower, not 8,599,000.

What might be the correct interpretation of the options if the question asks for horsepower?

The correct horsepower is approximately 13 HP; the options may be formatted differently or refer to different units.

Could the given options be in different units or scales?

Yes, it's possible that the options are in different units or represent total energy or power over time; clarification is needed.

Why is the option 'A) 8,599,000' unlikely to be the correct horsepower for this motor?

Because converting 7,150 foot-pounds per second directly yields around 13 horsepower, making 8,599,000 an implausible value for horsepower.

What is the importance of understanding units when calculating horsepower from foot-pounds per second?

Understanding units ensures accurate conversion; since $1 \text{ HP} = 550 \text{ ft-lb/sec}$, dividing the power in foot-pounds per second by 550 gives the correct horsepower.

Based on the calculations, what is the best answer

choice for the motor's horsepower?

The best answer is approximately 13 horsepower; none of the options listed seem correct based on standard conversions.

Additional Resources

Motor Power and Horsepower Conversion: An In-Depth Analysis

Understanding the power output of motors is essential across various engineering, industrial, and mechanical applications. When analyzing a motor's performance, one of the key metrics used is horsepower, a unit historically associated with the power of horses but now a standard measure for engines and motors. In this detailed review, we will explore how to convert a motor's power given in foot-pounds per second into horsepower, focusing on the specific problem: A motor has a power of 7,150 foot-pounds per second. Find the horsepower of the motor. We will also discuss the significance of this conversion, the underlying physics, and practical considerations.

Understanding Power Units: Foot-Pounds Per Second and Horsepower

What is Foot-Pound Per Second?

- Definition: Foot-pounds per second (ft-lb/sec) measures the rate of work or power in terms of energy transferred per unit time.
- Origin: Derived from foot-pounds, a unit of work or torque, combined with seconds to measure power.
- Application: Common in mechanical and engineering contexts, especially in systems involving torque and rotational work.

What is Horsepower?

- Historical Context: Developed by James Watt to compare the power of steam engines with draft horses.
- Standard Definition: One horsepower (hp) is defined as 550 foot-pounds per second.
- Significance:
 - Widely used in automotive, industrial, and machinery specifications.
 - Provides a standardized way to compare engine and motor outputs.

The Conversion Formula: Foot-Pounds Per Second to Horsepower

The fundamental relation to convert foot-pounds per second into horsepower is based on the definition:

$$\text{Horsepower} = \frac{\text{Power in foot-pounds per second}}{550}$$

where:

- Power is the rate of work done per second.
- 550 ft-lb/sec is the equivalent of 1 hp.

Why 550?

- This number was established historically based on the original definition of horsepower.
- It provides a simple, direct conversion factor.

Applying the Conversion to the Given Problem

Given Data:

- Power of motor $(P = 7,150 \text{ ft-lb/sec})$

Step-by-Step Calculation:

$$\text{Horsepower} = \frac{7,150}{550}$$

- Performing the division:

$$\text{Horsepower} = 13 \text{ (approximately)}$$

- Calculation details:

$$7,150 \div 550 \approx 13.00$$

Result:

- The motor's power in horsepower is approximately 13 horsepower.

Clarifying the Multiple-Choice Option

The provided options in the original question included:

- A) 8,599,000

Since our calculation yields approximately 13, this option clearly does not match the direct conversion. It's possible that the question intended to ask for the total power in a different unit, or there might be a typo or misinterpretation.

Note: The only logical conclusion based on standard units and conversion is that the horsepower is approximately 13 hp, which is far less than 8,599,000.

Additional Considerations and Context

Is the Given Power Realistic?

- A power of 7,150 ft-lb/sec equates to about 13 hp.
- Comparison:
- Small automotive engines typically range from 100 to 300 horsepower.
- Industrial motors can have thousands of horsepower.

Thus, a motor with 13 hp is relatively modest in industrial terms but significant for small machinery or specialized applications.

Possible Confusions:

- Unit Misinterpretation: Sometimes, people confuse foot-pounds per second with foot-pounds per minute or hour.
- Scaling Factors: If the question was misphrased or if the power was given in another unit, the conversion might differ.

Practical Implication:

- The conversion process illustrates how foundational units translate into more familiar measures.
- Ensures engineers and technicians correctly interpret power ratings.

Deep Dive: Broader Context of Power Measurement

Mechanical Power in Different Units

Unit	Equivalent in ft-lb/sec	Notes
Horsepower (hp)	550 ft-lb/sec	Standard conversion factor
Watt (W)	1 ft-lb/sec $\approx$ 1.355818 W	SI unit of power
Kilowatt (kW)	1,000 W	1.355818 ft-lb/sec $\approx$ 1 kW

Conversion to Watts and Kilowatts

- For completeness, converting 7,150 ft-lb/sec to watts:

$$\begin{aligned} & \left[\right. \\ & 7,150 \times 1.355818 \approx 9,686 \text{ W} \\ & \left. \right] \end{aligned}$$

- Or approximately 9.69 kW.

This contextualizes the motor's power in the SI system, making it easier to compare with international standards.

Practical Applications and Significance

Industrial Machinery

- Motors in manufacturing plants often specify power in horsepower or kilowatts.
- Proper conversion is critical for selecting appropriate motors for specific loads.

Automotive Engines

- Vehicle engines are rated in horsepower, requiring conversion from torque and rotational speed if needed.

Mechanical Design and Safety

- Understanding power ratings informs safety margins, energy consumption estimates, and performance expectations.

Summary and Final Thoughts

The core takeaway from this analysis is that a motor with a power of 7,150 foot-pounds per second equates to approximately 13 horsepower when using the standard conversion factor:

$$\begin{aligned} & \left[\right. \\ & \boxed{ \text{Horsepower} \approx \frac{\text{Power in ft-lb/sec}}{550} } \\ & \left. \right] \end{aligned}$$

This straightforward conversion underscores the importance of understanding units and their relationships in engineering calculations. It also highlights the necessity for clarity in problem statements, especially when multiple units and scaling factors are involved.

In conclusion, while the multiple-choice options provided might seem inconsistent at first glance, the direct and accurate conversion based on standard definitions confirms that the horsepower of the motor is approximately 13 hp, not the 8,599,000 listed as option B. This emphasizes the importance of proper unit conversion in engineering analysis and underscores the value of foundational knowledge in physics and measurement units.

Additional Resources for Further Reading

- Mechanics of Materials and Machine Design by R.C. Hibbeler – for understanding power, torque, and rotational dynamics.
- Fundamentals of Engineering Thermodynamics by Moran and Shapiro – for a broader perspective on energy and power units.
- Online Conversion Calculators – for quick unit conversions and verification.

Disclaimer: Always verify the units and context of any problem before performing conversions to ensure accuracy.

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