Application Note to the Field	Motor Power and Torque
Application Note Number: 1602-2	**Date:** Feb. 2, 2016; Revised Sept. 2022

A *correctly* sized motor provides enough power and torque to satisfy the application, while minimizing motor costs and energy costs.

When sizing a motor for a gear pump, torque is the most important consideration. Torque required for an application will vary with pressure, viscosity and flow rate.

Example:

An application requires 50 in-lbs of torque (T). The pump speed (n) needs to be 875 RPM to provide the required flow rate. What horsepower motor should be used?

This equation is used to calculate horsepower: $$\mathbf{HP} = \frac{\mathbf{T\ [in\text{-}lbs] * n\ [RPM]}}{\mathbf{63{,}025}}$$

If a **VFD** will be used, the *nameplate* RPM of the motor must be used for n (e.g., 1750 RPM):

HP = (50 [in-lbs] ∗ 1750 [RPM]) / 63,025 = 1.39

Therefore, a 1.5 HP motor with a sufficient constant torque turndown ratio should be used for the application. If a VFD is used, be sure the motor has a constant torque turndown ratio; certain fractional horsepower (< 1 HP) motors are not rated for this turndown. Contact the motor manufacturer for details.

If a **Gearbox** will be used, first, calculate the gearbox ratio based on the RPM requirements. If a 1750 RPM motor is used, a 2:1 gearbox will be required to achieve 875 RPM.

A gearbox reduces the speed output, and increases the torque output by the given ratio. The output torque required from the gearbox is 50 in-lbs. With a 2:1 ratio, this requires an input torque of 25 in-lbs. The calculated horsepower then becomes:

HP = (25 [in-lbs] ∗ 1750 [RPM]) / 63,025 = 0.69

Therefore, a ¾ HP motor could be used with the 2:1 gearbox to achieve the required results for the application.

Note: The mechanical power required at the conditions of the application (torque and speed) is called the *brake horsepower*. The brake horsepower (BHP) for this application is given by BHP = (50 [in-lbs] ∗ 875 [RPM])/63,025 = 0.69. This value is independent of any control devices used with the motor (VFD, gearbox, SCR control, etc.). The electrical power supplied to the motor (P_{in}) can be determined from the motor's *nameplate efficiency rating* (E) given in percent (%). The power consumption (in kilowatts) is then given by the following formula:

$$P_{in}\text{(kW)} = (\text{BHP} * 0.746) / (\text{E}/100)$$

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