

How to Select a Reduction Gearhead

Following is a step-by-step procedure which details how one selects a precision gearhead. The procedure includes the calculations necessary to determine the appropriate speeds, torques, and ratios.

Minimum Data Necessary to Specify a Gearhead:

- Required Output Torque [M_o]: oz-in.
- Radial Shaft Load: oz.
- Axial Shaft Load: oz.
- Required Output Speed [n]: rpm.
- Maximum Available Space [*diameter, length*]: mm.

Calculation Example:

- Required Output Torque = 17 oz-in.
- Radial Shaft Load = 72 oz.
- Axial Shaft Load = 14.4 oz.
- Required Output Speed = 30 rpm
- Maximum Available Space = 18mm diameter, 60mm length.

Step #1: Pre-Selection:

From the MicroMo catalog, choose a gearhead that has a continuous output torque greater than the one required for the application. If the required torque load calls for intermittent use, selection is based on the output torque for intermittent operation. In this example, we must select a gearhead for continuous operation. Searching for a unit with desired diameter, length, and shaft loading characteristics, we find that gearhead 16/7 meets the specified parameters:

- Continuous Output Torque = 42.5 oz-in.
- Radial Shaft Load = 108 oz.
- Axial Shaft Load = 18 oz.

To calculate the theoretical reduction ratio, the maximum available motor input speed for this gearhead is assumed to be 5,000 RPM. Dividing the available input speed by the required output speed will give you the reduction ratio required:

$$\frac{5000}{30} = 166.67$$

From the catalog data sheet, select a ratio that is equal to or less than the theoretical one. In this case, the closest match would be **159:1**.

Step #2: Confirming Calculations:

The input speed to the gearhead is the product of the output speed and the actual gearhead ratio,
 $30 \times 159 = 4770 \text{ rpm}$

This is the new required input speed.
 Calculating the input torque requirement,

$$M_i = \frac{M_o}{i \times h}$$

where:

h = efficiency of the gearhead expressed as a decimal between 0 and 1

i = the reduction ratio

M_i = the input torque needed

M_o = the required output torque specified

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Substituting:

$$M_i = \frac{17}{159 \times .60} = 0.178 \text{oz} - \text{in}$$

For continuous operation the motor suitable for the gearhead must be capable of producing twice the required output torque. For this example, MicroMo DC motor type 1624E024S supplied with a 14 VDC motor input voltage will produce the required speed and torque. We recommend that when you specify, you select a "ball park" component, then verify its performance in your actual application. Recording the applied voltage and the observed current values at the unit's operating point will help you select the appropriate motor + gearhead.

In the practical world, the application of an "ideal" motor + gearhead drive is not always possible. This is especially true if you would like to specify with off-the-shelf components. As no other micromotor company offers a wider range of motors with matching gearheads, we encourage you to consult our Applications Engineering Department if you would like a no-cost, no-obligation review of your application requirements.