Selecting a Gearmotor

A gearmotor is an electromechanical device using an electric motor to drive a geartrain encased in a housing. Geartrain reduces output speed while increasing available torque. Gearmotors are designed to move an object in a given direction and at a rate of speed (RPM) while providing required twisting force (torque). Selection should be easier once load input performance requirements are identified. It is critical to know the speed and torque requirements of the load to be driven. Unusual loads or harsh environments must be considered before a driving device is selected. Horsepower is not a factor in selecting a standard gearmotor, since each gearmotor was predesigned for a specific performance level. For some applications, more detailed design criteria may be required.

Mechanical Considerations

Speed. How fast should equipment or an object move? Output speeds are available from less than 1/2 RPM (revolution per minute) to nearly 350 RPM, depending on motor type and gear ratio. Based on your application, you may need to consider whether additional modified speeds will be produced through sheaves or sprocket-type drive systems before determining gearmotor output speed.

Starting Torque provides initial power to get things moving. On large conveyors, starting torque requirement may be high while a small rotating display cabinet may require very little torque to overcome resistance. Small gearmotors typically have "start" and "run" torque specifications shown due to their lower overall output capabilities. Starting torque ratings can be lower than maximum running torque ratings. Heavier duty gearmotors are usually only rated for their full-load (running) torque capability since starting torque is relatively high.

Running Torque (Full Load) is the continuous twisting force needed to keep things moving after initial start and must maintain power under all variable load situations to provide adequate service. Running torque listed in the catalog is the maximum torque available for safe, continuous operation. Frequent starts and stops will require use of starting torque more frequently. This could result in excessive heat buildup, causing premature motor failure.

Speed

Torque

From	Into	Multiply By
in.-lb.	ft.-lb.	0.0833
ft.-lb.	in.-lb.	12
in.-oz.	in.-lb.	0.0625
in.-lb.	in.-oz.	16

How to Measure Torque

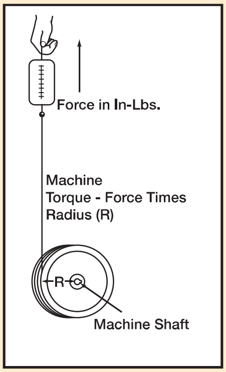
Caution: Disconnect Power Before Proceeding

Torque required to drive a machine may be measured by using a flat grooved pulley, a cord, and a spring scale rated in lbs. Pulley must be rigidly attached to machine's drive shaft, with cord wrapped several times around pulley. Do not allow cord to overlap. The other end is tied to the scale. When the scale is pulled, it will turn the pulley. When the pulley first starts to turn, the scale will register starting force required in pounds.

Force registered on scale, in pounds, when multiplied by radius of pulley (radius is measured from the center of machine shaft to center of cord), in inches, yields the starting torque, in in.-lbs. required by machine.

If torque characteristics of the machine (load) vary during its operating cycle, torque must be determined at the point in the cycle where it is the greatest.

If pulley can be turned (by pulling on cord) at a rate equal to normal speed of driven equipment, an indication of running torque can be obtained. If load of machine is almost entirely due to friction, running requirement will be essentially the same regardless of speed. However, if load is primarily the result of inertia or windage (air drag), characteristics of the inertia or windage elements must be known.



Electrical Considerations

Before you can select the best gearmotor for your application, you need to identify your intended power supply. AC and DC input gearmotors from 12VDC to 460VAC are available. This chart provides typical characteristics of different motor types as a guide for your selection.

Type	Starting Torque	Reversible	Speed Controllable	Features
Shaded Pole	Low	No	No	Rugged, relative low cost
PSC	Medium	Yes	No	Reversible, quiet operation
Split-Phase	Med/High	Yes	No	Fairly high start torque
Capacitor-Start	High	Yes	No	Heavy-duty start-ups, dual voltage
3-Phase	High	Yes	No†	Simple, reliable, high start power and efficiency
DC	High	Yes	Yes*	Speed controllable, high start torque
Universal AC/DC	High	Yes	Yes*	Speed controllable, relatively low cost, simple operation

† Inverter-Duty motors can be controlled with an inverter.
(*) Performance matched speed controls are available for many catalog gearmotor listings.

Loads

Driven items connected to and driven by the gearmotor output shaft constitute the load. Not all loads coupled to gearmotors have steady speed and torque requirements. Some loads demand power surges from the gearmotor during running cycle. This can be abusive to gears. Also, environmental conditions and space restrictions need to be taken into account. 2 types of loads that require careful consideration before selecting a gearmotor are Overhung (Radial) Load and Shock Load.

Overhung (Radial) Load (OHL) is the perpendicular force pushing against the side of an output shaft. This force is either from a weight hanging on the output shaft or from a sprocket, pulley, or gear being used on the shaft. Every gearmotor has an OHL specification, which should not be exceeded.

If you plan to use a sprocket, pulley, gear, or any weight suspended directly on the shaft, calculate OHL to aid selection of the gearmotor. First, use the formula below to determine the pounds of load. Second, multiply pounds of load by the appropriate drive factor at right to determine actual OHL ratings in pounds on center of output shaft.

$$\frac{\text{Full-Load Torque (Requirement of Gearmotor) x 2}}{\text{Pitch Dia. of Sprocket, Pulley or Gear}} = \text{Lbs. of Load}$$

Shock Load. Some applications subject gearmotors to loads that transmit shock or abrupt peak loads back to the gearmotor. Shock load can create peak loads several times greater than gearmotor torque rating. For example, when a heavy object accidentally is dropped on a running conveyor, this causes shock to gears and may even break them. Be sure the gearmotor is rated high enough to handle maximum anticipated shock load conditions.