# Direct drive motors diagram

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Direct-drive motors meet the high-torque needs of large inertia rotary loads. Increasing the pole count increases the rotor diameter, total flux, and torque moment arm which produces the higher output torque. The large hole in the center of the shaft comes from the magnetic pole design and may be used for channeling wires and process fluids when necessary.

Traditional high-performance rotary machines such as tables, robots, turrets, and pedestal assemblies typically run on standard servo-motors connected to rotating members through transmissions. The transmissions are usually gears or belts that convert the high-speed, low-torque of servomotors to the low-speed, high-torque needs of the rotary machine. However, in some cases the transmission can become a limiting factor or introduce errors that some applications can''t tolerate. For these, direct-drive rotary motors might be the most efficient solution.

Direct-drive torque motors use unconventional magnetic-path designs to provide torque matched to the load. Their magnetic pole count is higher than standard designs, and the diameter of the rotor is larger — both of which add to the total flux of the machine as well as the torque moment arm generating higher torque output. As an added benefit, the magnetic pole design requires less space and provides a path for wires and cooling fluids to run through the center of the motor.

But magnetic-circuit designers have a particularly tough job with these motors because the steps needed to maximize torque output also produce undesired torques, such as cogging and torque ripple. Often, this can degrade system response, accuracy, and smooth operation. The goal is to produce large, undistorted torque and smooth output.

Without a transmission, the motor can reach higher accelerations with higher accuracy as well. Systems using direct-drive motors are not susceptible to the problems usually encountered by those using transmissions, such as gear chatter, belt stretching, and loss of accuracy from imperfect transmission component geometries. Furthermore, acceleration is limited only by the load and motor. Taken together, these advantages allow direct-drive systems to control motion with extraordinary speed and accuracy.

A final problem that can be solved with direct drives is resonance between motor and load. Because high-performance motion systems often rely on closed-loop control, they use high gain loops to obtain the best response possible. However, the compliant couplings usually used between motor and load cause oscillations of about 300 to 1,000 Hz. These oscillations occur at or near a frequency where the load and motor inertias resonate across the compliant coupling. Compliance in standard motors is high because the motor shaft is comparatively long and narrow.

As shown in the diagram, loads may be coupled to direct-drive motors on a large diameter, effectively eliminating resonance in servosystems. And while standard servosystems usually limit load inertia to no larger than 5 to 10 times the motor inertia, direct-drive motors have no such limit. The load inertia is often hundreds of times larger than the motor inertia with no negative effects.

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Learn how a DC motor works to understand the basic working principle of a DC motor. We consider conventional current, electron flow, the winding, armature, rotor, shaft, stator, brushes, brush arms, terminals, emf, electromagnets, magnetic attraction as well as detailed animations for how the dc motor works.

DC motors look something like this above, although there are quite a few variations. These are used to convert electrical energy into mechanical energy and we can use these for example in our power tools, toy cars and cooling fans.

Wrapped around the T shaped arms of the rotor are the coil windings which carry the electrical current from the battery. As the current passes through the coils it produces an electromagnetic field, we control the timing and polarity of this magnetic field to create rotation.

The ends of the coils are connected to the commutator. The commutator is a ring which has been segmented into a number of plates which sit concentrically around the shaft. The plates are separated and electrically isolated from each other as well as the shaft. The ends of each coil connect to different commutator plates, they do this to create a circuit and we''ll see that in detail shortly.