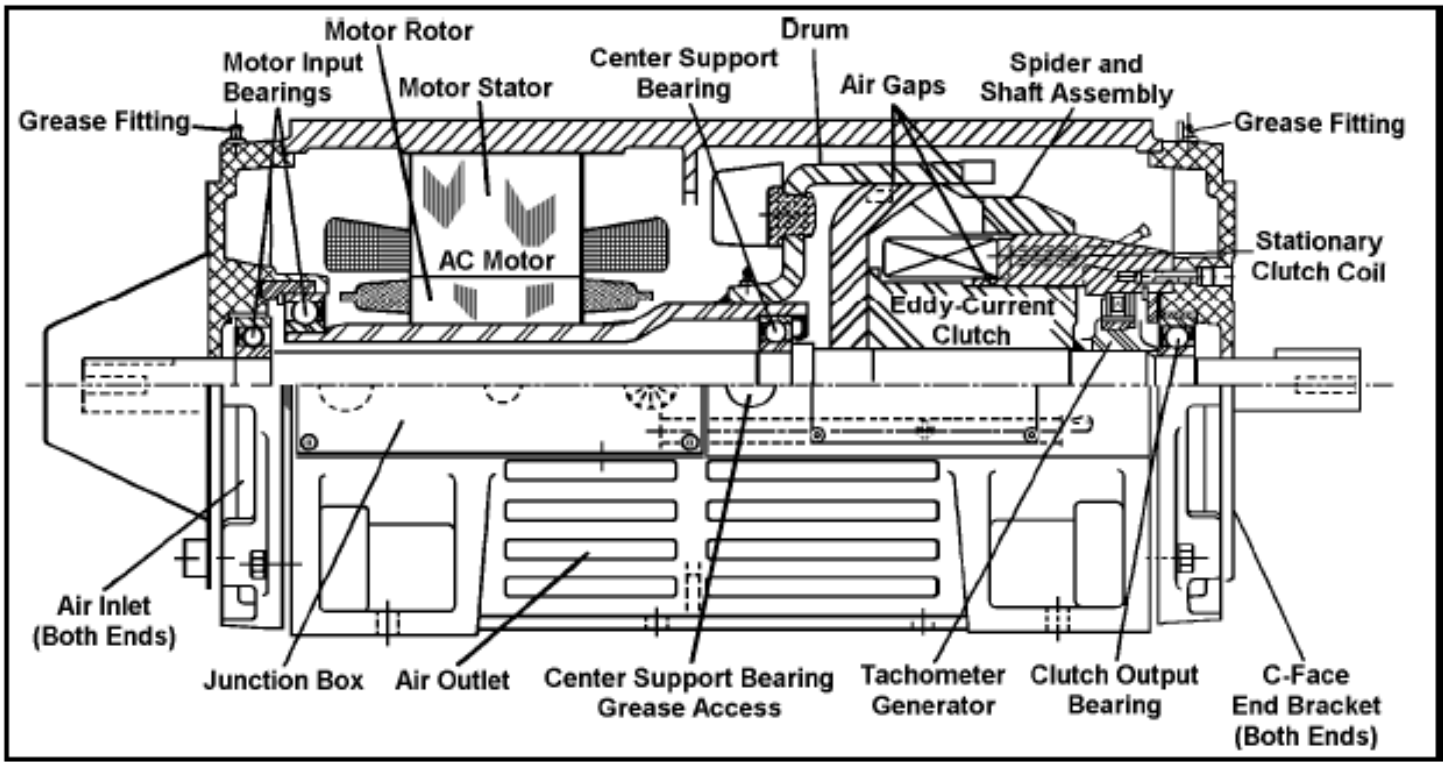
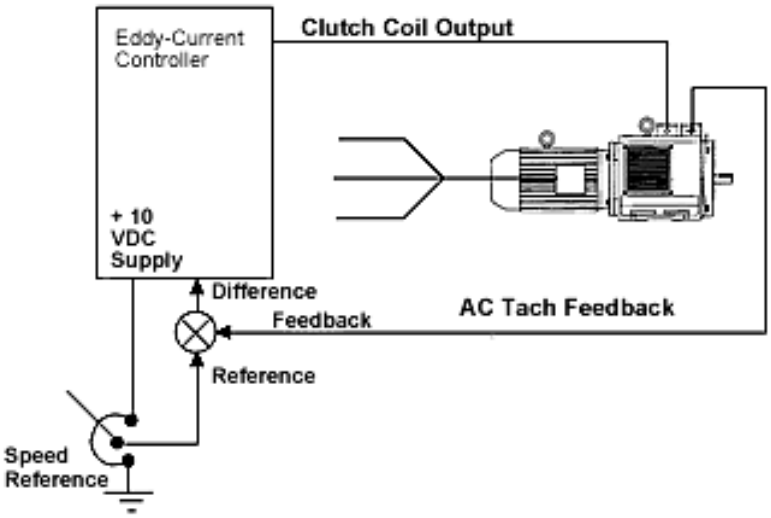
Shop Tech Talk February 2011

Eddy Current Clutch Drives



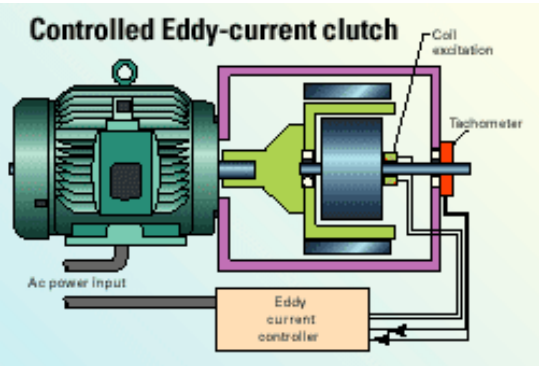
Holland Industrial, 518 West Montgomery Street, Henderson, NC., 27536
Tel: 1-800-232-7541,Fax 1-252-492-2444, E-Mail: sales @ hollandindustrial.com

Operation of Eddy Current Drive



At start, the motor is started across the line, with the clutch disabled — so that it receives no current flow. After the motor has reached its target speed, its controller engages the Eddy clutch.

Eddy-current clutches consist of a field, tachometer, and Eddy-current control module. The control module supplies dc current to the clutch, which in turn causes the load to spin. Feedback from the tachometer is fed to the control module in a PID (feedback controller) set-up. The more torque required by a load, the more current the clutch requires to prevent slippage. But with no load, the least amount of leakage into the clutch can cause the shaft to spin — so holding an unloaded system at zero speed is extremely difficult. Too, no additional torque can be supplied to the load; at best, the load attached to one of these clutches sees 95% of motor speed. For example, with a 1,780-rpm drive motor, load spins at 1,690 rpm; the load never sees full speed. This must be taken into account when sizing for speed and torque.



Theory of Operation: The Eddy Current Drive

In the basic form, the eddy current drive consists of an AC motor and an electrically controlled magnetic clutch. The eddy current clutch is composed of an input drum which is driven by the motor at constant speed, and an output rotor, usually positioned concentrically within the drum.

Both members are constructed of magnetically soft iron (low carbon steel), supported by ball and/or roller bearings, and free to rotate independently of each other, separated by a small air gap.
Control is imparted by means of an electrical field coil, which is strategically positioned to allow magnetic coupling between the input and output members of the clutch. The eddy current brake operates in a similar manner, except that the "drum" member remains stationary.

In a motor, a time-variant magnetic field is generated in the air gap at the poles by means of the current flowing in the windings, the field reversals being accomplished by an alternating current in the AC motor, or by means of brushes and the electro-mechanical commutator in the DC motor.

The eddy current clutch acts as a rotating transformer similar to a motor. In the eddy current clutch, a static DC current produces a magnetic field in the air gap, coupling the rotating input drum and the output rotor. The pole geometry of the coupled output member imprints a pattern of alternating magnetic domains on the drum. Flux reversals are established in the field by virtue of the speed differential between the input and output members, generating eddy currents. A current of high magnitude is generated in the rotating drum, which appears as a single turn secondary winding. This current regenerates the magnetic field, producing a radial coupling force, dragging the output member along. The torque developed herein is essentially proportional to the coil current.

Notes:

1. Since the eddy-current clutch is a torque transmitter, it has no inherent speed sense. Without external control, output speed depends on load. This feature is frequently used to advantage in helper drives, tensioning and winder applications where torque is the prime requirement.
When speed control is needed, the tachometer generator provides shaft speed feedback to an electronic controller. The controller varies field coil current to match speed output with load demand, thus holding desired preset speed.
2. Universal Drive controllers are available that will handle all drive coil voltages.
3. The center support bearing is a usual source of trouble as it is difficult to keep lubricated.

Eddy Current Drive Mfr	Power Range	Control Coil Voltages Available	Speed Regulation	Notes
Eaton Dynamatic	0.75 to 40 HP	VDC 45,90,180 and 220	0.5 % for load changes from no load to full load with tach feedback	You also get a full 34 to 1 speed range at 250 percent of rated torque — great for starting and momentary overload conditions.
Teco ED	0.33 to 150 HP			
Tasc	Up to 110 kW			
Torspec	1 to 125 HP	45v DC,90v DC or 160v DC .		Nema or Metric. Controls available Up to 300% Starting torque, up to 40:1 speed range and 0.5% speed regulation.Some Parts will interchange between Tasc and Torspec units
Heenan	Up to 5,000 kW in liquid cooled			

Holland Industrial, 518 West Montgomery Street, Henderson, NC., 27536
Tel: 1-800-232-7541,Fax 1-252-492-2444, E-Mail: sales @ hollandindustrial.com