

## The Force Control Story...

### History

#### 1959...

**Force Control**, a division of New Castle Products, was founded in New Castle, Indiana in the year of 1959. The ***Oil Shear Principle*** was initially developed and used in clutch/brake, foot mounted brakes and large drive systems under the brand names of *Positrol* & *Powr-Con*. The primary customer were power plants, treatment plants and government applications.

#### 1969...

Corporate headquarters was moved to the present location in Fairfield, Ohio and was joined with Dixie Machine Company.

#### 1970's...

Patented the *Posidyne* Oil Shear Clutch/Brake. Developed new clutch/brake products for the post office, fan/clutch for Transit Buses, clutch/brake for concrete equipment, snow making equipment, and manufacturing equipment for the appliance, glass, pulp & paper, packaging, wood products, and food processing industry.

#### 1980's...

The Multi-Speed Drive, Two-Speed Drive, and High-Speed Reversing Drive was developed for mechanical indexing applications in the automotive industry. Also developed the Posistop motor brake for machine tool applications.

#### 1990's...

Building product focus. Developed the *Posiweave* for the fence industry, shingle auto-catcher and blenders for the roofing industry, and CLPC closed loop-positioning controller for high-speed drive positioning applications.

#### 1995...

Developed the *MagnaShear* Electric Brake, *MagnaShear* Two Speed Drives, and E-Stop Brakes for automotive lift and transfer applications.

#### 2000's...

Large product focus. Improved Dynamometer and energy absorber brakes. Increased size and horsepower handling capability by adding brakes for off shore oil rig and drawworks applications.

#### 2008, 2009...

Developed and launched the Quick Mount and Coupler *MagnaShear* Electric Brake line of products.

#### 2011...

Expanded Brake line of products to include Marine Duty products.

### Facilities and Services

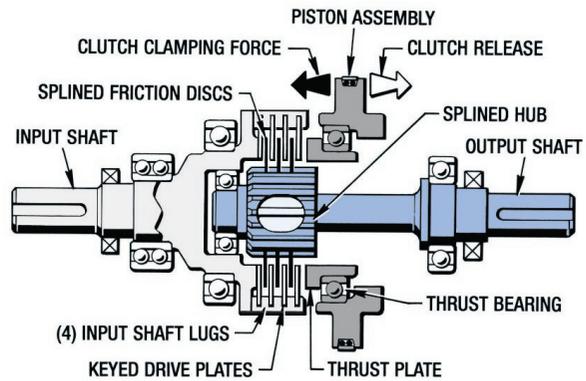
Force Control Industries Inc. headquarters is located in Fairfield, Ohio a few miles north of Cincinnati. Our Current manufacturing campus has three manufacturing facilities with over 100,000 Sq. Ft of manufacturing space along with administrative offices.

We are ISO 9001/2000 certified resulting in the highest level of quality and service our customers have come to expect in a Force Control product. Our quality and service level is assured by our sales force, engineering, research and development, modern computer controlled machining and turning equipment, inspection, assembly, complete benchmark testing of all assembled units, inventory control and our complete shipping department. We also have a complete factory rebuild and repair service for all of our products. Field Service Technicians are available to assist in installation and onsite service and repair.

# The Basic Designs and how they work...

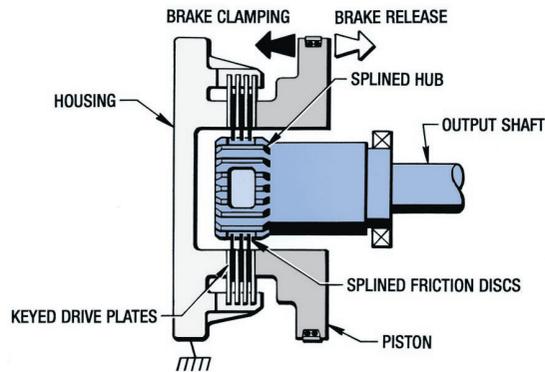
## Clutch

A clutch consists of multiple rotating steel drive plates keyed or pinned to the input shaft and alternating friction discs splined to the hub of the output shaft. Pressure acting on the non-rotating piston exerts clamping pressure on the clutch stack through a thrust bearing and a rotating thrust plate. The clutch is engaged and torque is transmitted from the input shaft to the output shaft.



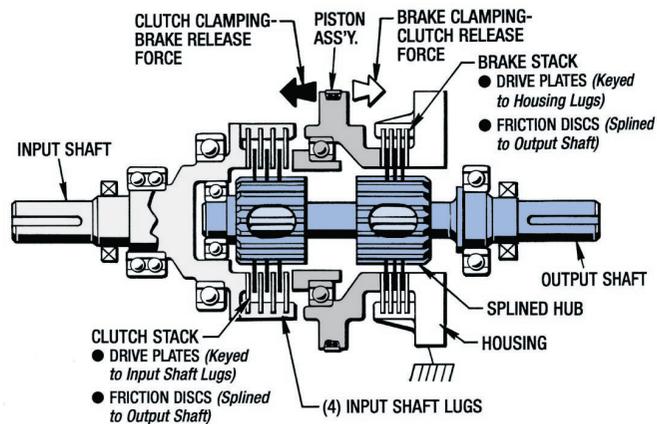
## Brake

A brake consists of multiple rotating steel drive plates keyed or pinned to the housing and alternating friction discs splined to the hub of the output shaft. Pressure acting on the non-rotating piston exerts clamping pressure on the brake stack. The brake is engaged and torque is transmitted from the output shaft to the housing.



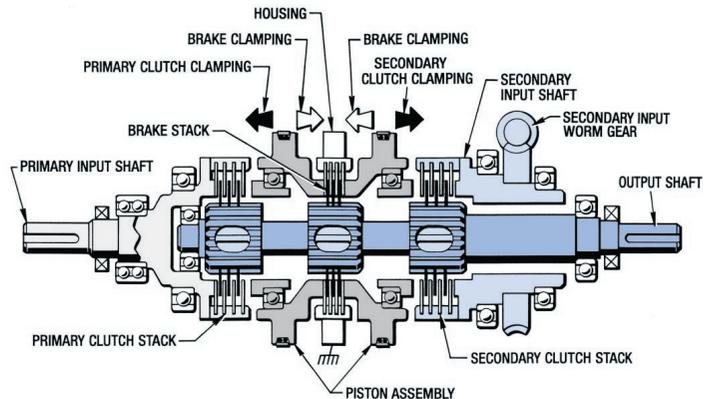
## Clutch/Brake

A clutch/brake is a combination of both a clutch stack and a brake stack operating about a common output shaft. As a centrally located piston assembly is shifted to exert clamping pressure on the clutch stack, torque is transmitted from the input shaft to the output shaft. When shifted away from the clutch stack to the brake stack, the clutch is automatically released and braking torque is transmitted to the output shaft. The single-centrally located piston prevents clutch and brake overlap.



## Dual Clutch/Single Brake

A dual clutch/brake consists of two clutches and a brake operating about a common output shaft. Two separate pistons are used to exert clamping pressure on either the primary clutch, secondary clutch or the brake. The primary and secondary input shafts may be driven in a variety of ways to select different speeds or directions as desired.



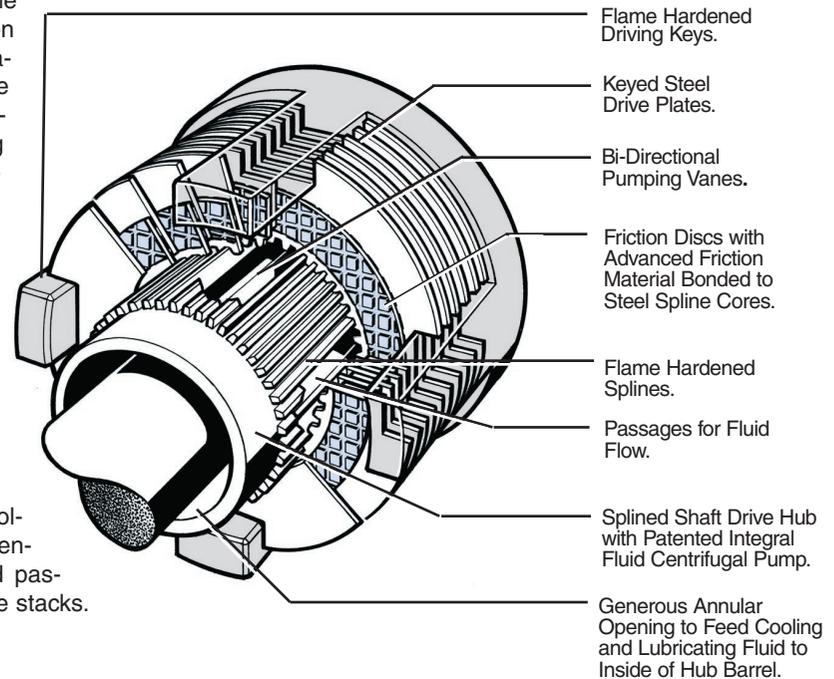
## The Heart of Force Control Clutches and Brakes

### A Patented Fluid Recirculation System

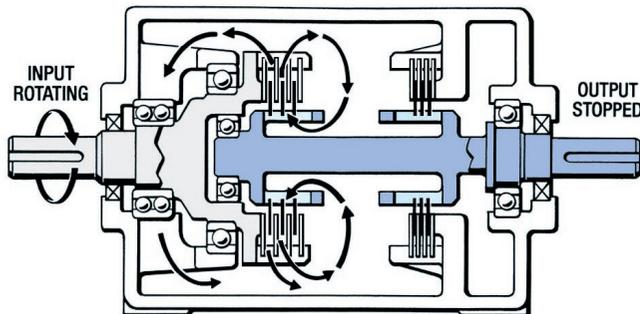
**Force Control oil shear clutches and brakes** are of the wet or hydroviscous type which transmit torque between lubricated surfaces. Fluid is used to provide both lubrication and cooling to the friction surfaces. Many competitive clutches and brakes depend on friction between dry surfaces surrounded by air to transmit torque. During engagement of dry surfaces, high heat caused by slipping is difficult to dissipate quickly causing wear, inaccuracy and short service life.

**Force Control** wet clutches and brakes not only operate in a lubricating and cooling fluid but have patented fluid recirculation systems which are necessary to assure fluid is maintained between the friction surfaces when it's needed. Without a good recirculation system centrifugal force can quickly throw the fluid out of the stack which then becomes dry increasing wear rate.

**Force Control's** output shaft hub design allows the cooling and lubricating fluid to flow into generous annular openings in the end of the hubs and out radially extended passages to the I.D. of the multiple surface clutch and brake stacks.

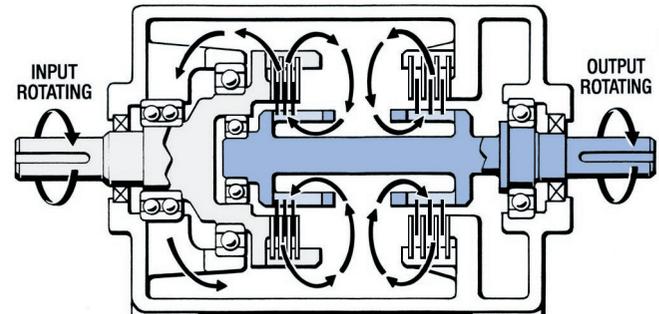


### The Force Control Recirculation System puts the Fluid where it's needed - when it's needed.



#### Fluid flow through a clutch, brake engaged...

When the clutch input shaft begins to rotate, fluid resting inside the barrel of the clutch is drawn out through radially extended passages by the centrifugal force of the rotating drive plates. The natural level of the fluid supply inside the unit housing replenishes the fluid drawn out of the hub barrel. Recirculation is established. The fluid flowing across the friction surfaces carries the heat of engagement to the sump for dissipation through the housing or a heat exchanger. Cooled fluid is returned.



#### Fluid flow through a brake, clutch engaged...

The brake hub, like the clutch hub on the rotating output shaft pumps fluid through the radially extended passages to the I.D. of the brake stack. Centrifugal force of the rotating hub and friction discs causes the fluid to flow through the brake stack providing cooled fluid to the friction surfaces. Fluid flow is established in preparation for brake engagement.