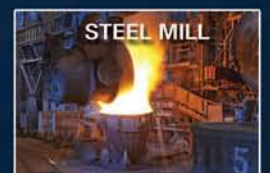
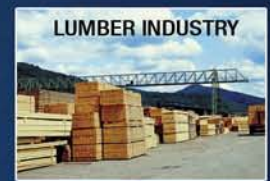


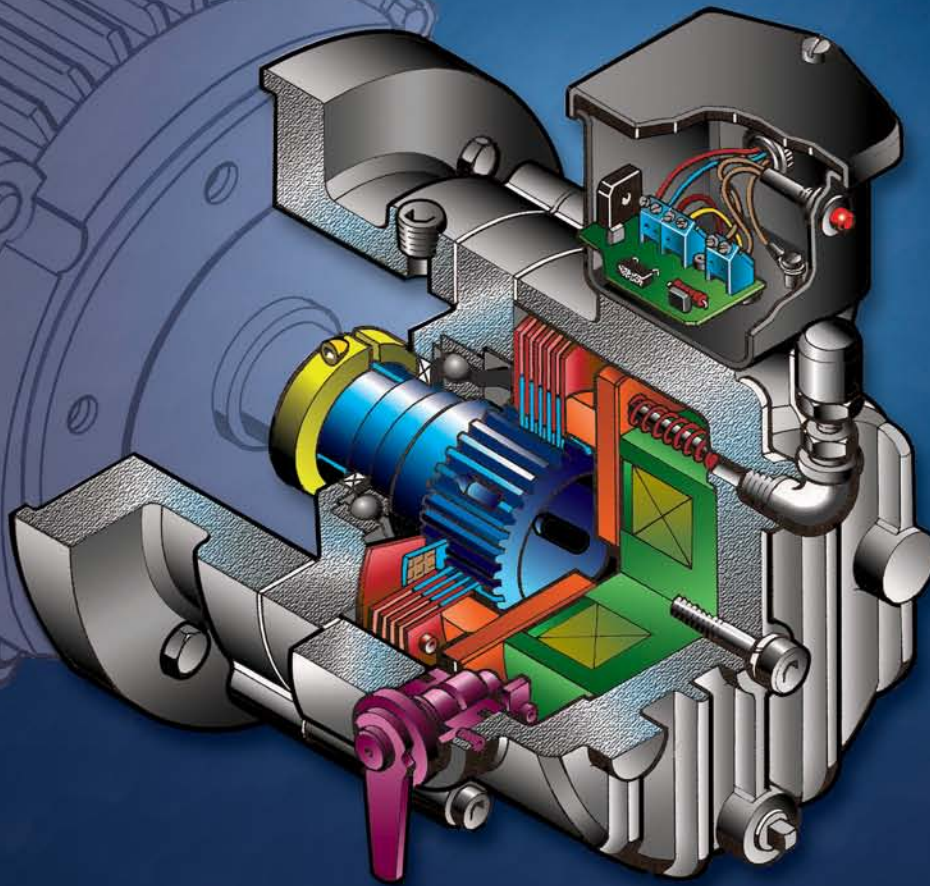
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CERTIFIED



All Products Catalog
APC-2011



Force Control Industries, Inc.
***Oil Shear Clutch &
Brake Drive Systems***



***Worldwide Leader In
Oil Shear Technology***

Welcome to Force Control Industries, Inc.

A leading manufacturer of **Oil Shear** Clutches, Brakes and Drive Systems for over 40 years.



Facilities and Regional Sales Offices

Force Control Industries Inc. headquarters are located in Fairfield, Ohio a few miles north of Cincinnati. To keep pace with the increasing market demand for our products we have undergone several major expansions in recent years. Our current, fully air-conditioned manufacturing facility, which is over 100,000 sq. ft., houses our general administrative offices along with our modern and complete production facilities. The high level of quality and service our customers have come to expect is assured with our sales, engineering, research and development, modern computer controlled machining and turning equipment, inspection, assembly, final testing, inventory and shipping departments, all under one roof for total coordination.

Regional factory sales offices, factory trained representatives throughout the North American continent and, many authorized power transmission distributor locations, form a network to service your local needs.

Our Quality Policy Statement

Force Control Industries, Inc. is committed to providing quality products, services and continuous improvement.

This fact can be born out by the many loyal customers over the years who have used the Force Control Industries oil shear products in more and more applications, in other plants and recommended it to other customers.

Force Control Industries, Inc. is moving forward in the new millennium by providing electronic controls designed to the same exacting standards, and designing and building specialized machine automation.

We look forward to working with you to design or apply products to your application that will improve productivity and reduce cost.



FORCE CONTROL INDUSTRIES, INC.

Main Office and Plant

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Fairfield, Ohio 45014

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Web Site: www.forcecontrol.com

Introducing...



**Force Control
Industries, Inc.**

Worldwide Leader in “Oil Shear” Technology

Providing today's industries with Oil Shear Clutch and Brake Drives that delivers...

- ◆ **Flexibility**
- ◆ **Efficiency**
- ◆ **Dependability**
- ◆ **Endurance**
- ◆ **Performance**

A large selection of standard models are offered on the following pages. If a drive that suits your needs is not found in this catalog or assistance with a drive selection is desired please contact our sales engineering department. We will be pleased to provide our products, technology and over 30 years of application experience to assist you.

“Built to last - Guaranteed to perform”

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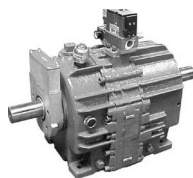
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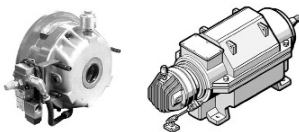


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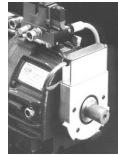
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The Force Control Story...

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

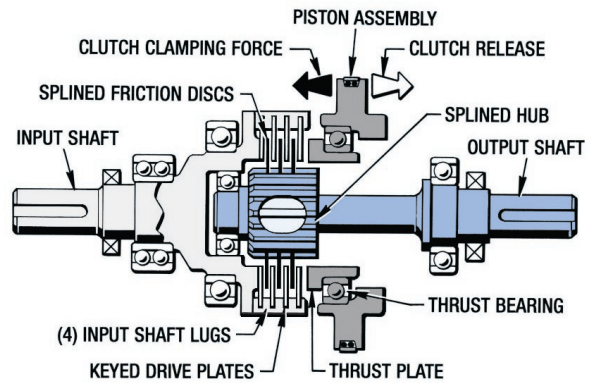
Force Control Industries Inc. headquarters is located in Fairfield, Ohio a few miles north of Cincinnati. Our Current manufacturing campus has three manufacturing facilities with over 100,000 Sq. Ft of manufacturing space along with administrative offices.

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...

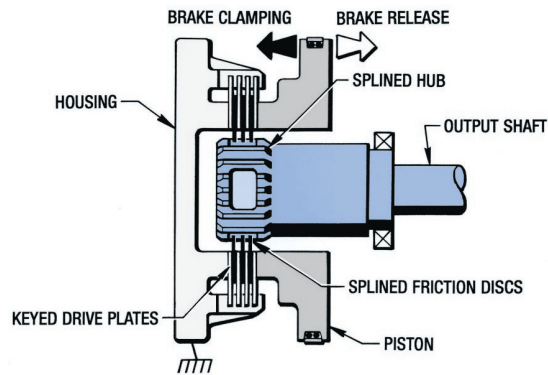
Clutch

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.



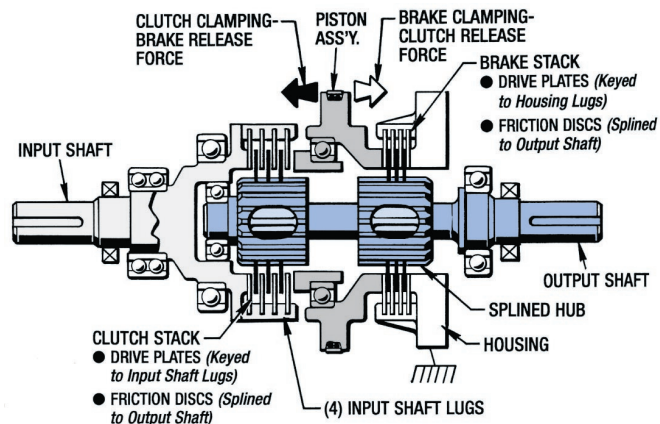
Brake

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.



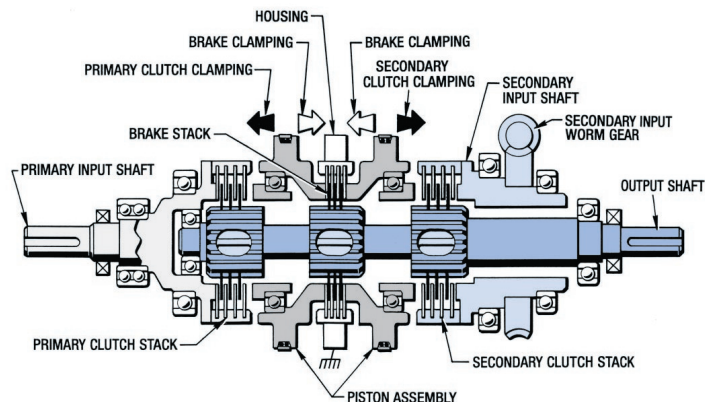
Clutch/Brake

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.



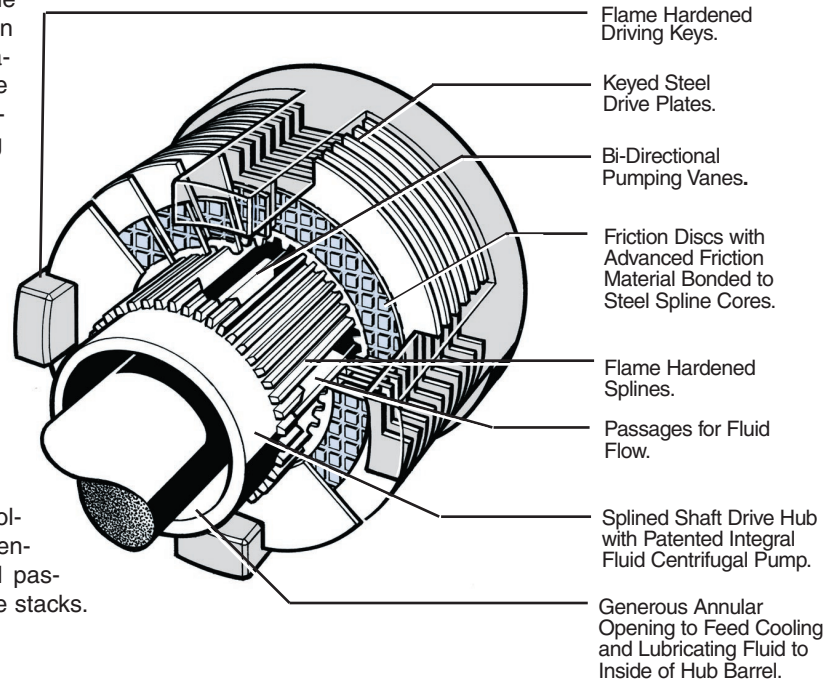
The Heart of Force Control Clutches and Brakes

A Patented Fluid Recirculation System

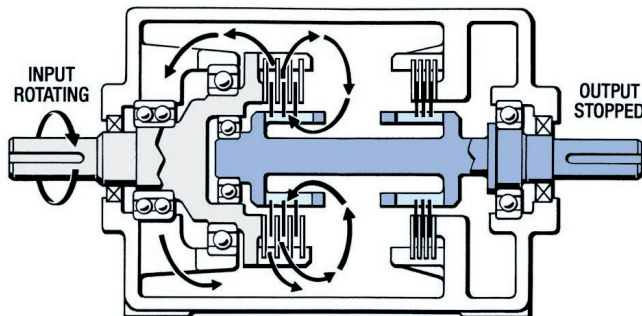
Force Control oil shear clutches and brakes are of the wet or hydroviscous type which transmit torque between lubricated surfaces. Fluid is used to provide both lubrication and cooling to the friction surfaces. Many competitive clutches and brakes depend on friction between dry surfaces surrounded by 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.

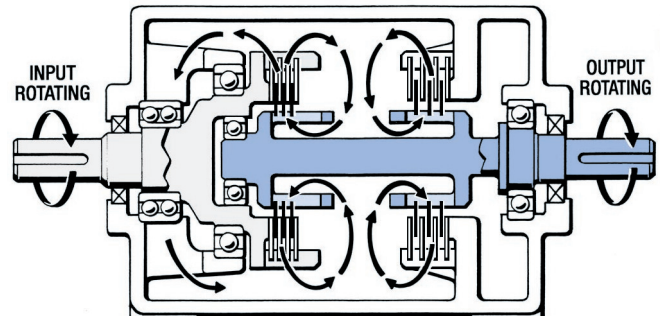


The Force Control Recirculation System puts the Fluid where it's needed - when it's needed.



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.

Section 1

Posidyne® X Class Clutch/Brakes



WASH DOWN

For wash down applications (USDA H-2) in food processing facilities, the optional wash down modification is available. This modification consists of nickel-plated shafts, stainless steel locking collar on the Clamped Split Quill, "Steel-It" epoxy coating, stainless steel fasteners, non-corrosive breather and sight gauge.

Value Engineered for Highest Performance at Lowest Cost per Cycle

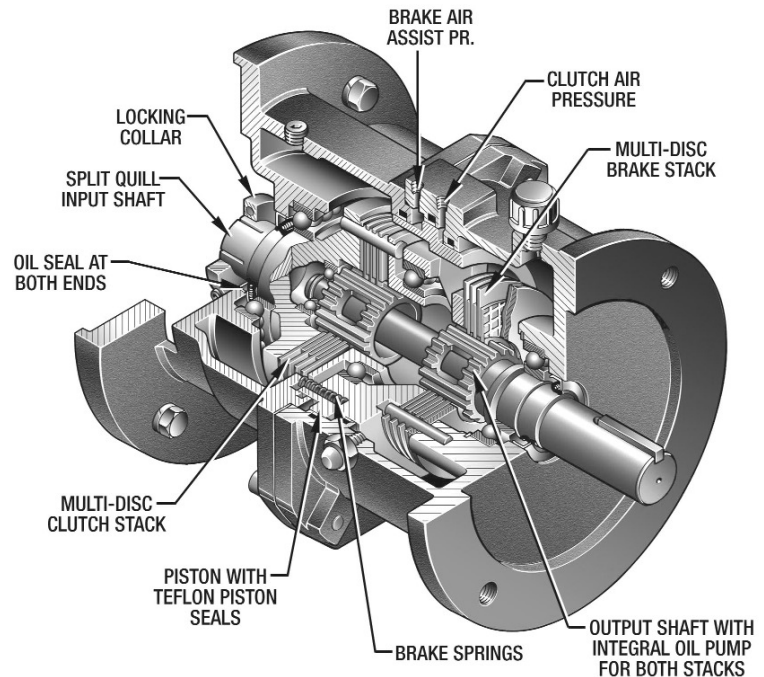
The Posidyne® X Class Clutch/Brakes are designed and tested to operate over 40 million trouble free cycles with only occasional oil changes and no adjustment - ever! This unheard of life expectancy allows the Posidyne® X Class Clutch/Brakes to be used on applications previously thought impossible to do using a clutch/brake. How many cycles do you require to meet your machines design life? Use the total Life Cycle

Calculator shown below to determine expected life for your application.

New Posidyne® X Class Clutch/Brakes let you eliminate the typical line stops, the frequent clutch/brake repairs and replacements. Here's the reliability you need for today's 24/7 manufacturing demands. Here's speed and precision that can let you run at higher cycle rates and quality levels, or design new machines for higher performance.

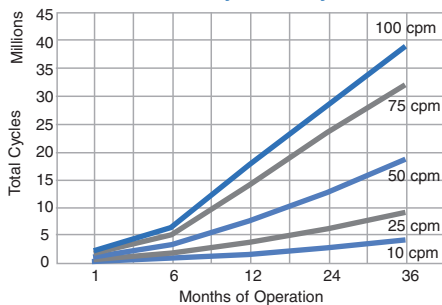
X Class Features:

- Packaged, fully assembled/tested
- Simplified double C-face mounting
- Horizontal or vertical mounting
- Five operating logics: 1. Air-set Clutch/Spring-set Brake; 2. Air-set Clutch/Air-set brake; 3. Clutch only; 4. Air-set Clutch/Light spring-set brake with air assist. 5. Air-set Clutch/Med. spring-set brake with air assist
- Multiple friction discs cooled in recirculating transmission fluid
- Low maintenance: annual oil change
- Hard-coat epoxy finish highly resistant to rust and chipping.
- 2X-10X higher cycle rates – 200 CPM is not unusual
- 10X longer design life – designed & tested for over 40 million cycles
- 4-5X higher thermal rating for fade-free stopping, no burned clutches
- Clamped-Split-Quill reduces key-way problems in aggressive applications

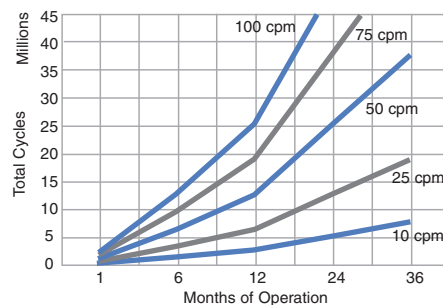


Total Cycle Calculator

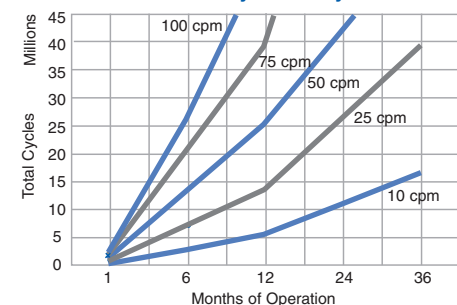
8 Hours/Day • 5 Days/Week



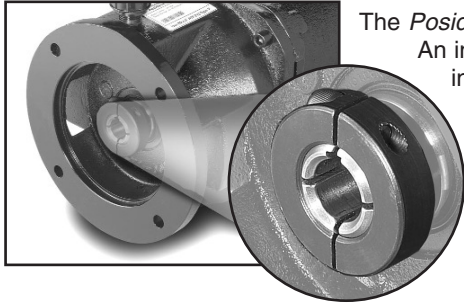
16 Hours/Day • 5 Days/Week



24 Hours/Day • 7 Days/Week



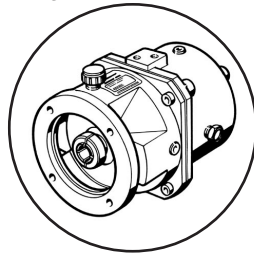
1 Simplified C-Face Mounting System



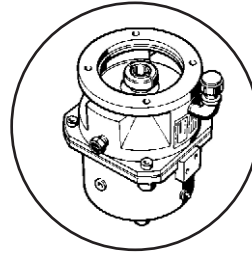
The Posidyne® X Class C-face mount adds a new level of convenience to this classic configuration. An innovative Clamped-Split-Quill absolutely stops play that could deform the key and keyway in high-torque, rapid cycling applications. The new clamp design splits the input quill four ways at 90° intervals. A clamp collar fits over the quill to give 360° clamping effect when tightened down. The keyway is centered in one of the splits in the quill to securely lock the key on both sides.

Mounting Configurations

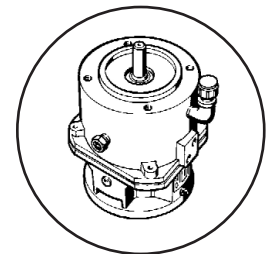
The Posidyne® X Class clutch/brakes may be mounted in three configurations (horizontal, vertical input up and vertical input down) to allow the most flexibility in machine design.



HORIZONTAL



VERTICAL-INPUT UP
(Not available in X4)



VERTICAL-INPUT DOWN
(Not Available in X4)

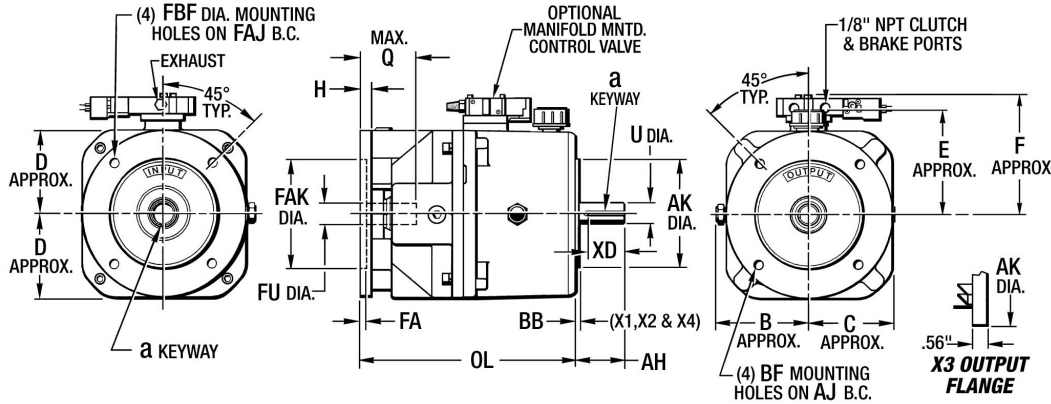
Operating and Technical Specifications

Size	Logic	Clutch Torque			Brake Torque			Max RPM	Max KE per Engmt. (Ft. Lbs.)	Avg. Thermal HP			Cyclic Inertia (Lb. Ft. ²)	Air per Engmt (Cu. In.)	Oil Capacity (Oz)			Overhung Load Cap. (Lbs. Pull)	Weight (Ft. Lbs.)
		Static (Lb. In.)	Dyn. (Lb. In.)	Air Pr. (PSI)	Static (Lb. In.)	Dyn. (Lb. In.)	Air Pr. (PSI)			Horiz.	VIU	VID			Horiz.	VIU	VID		
X1	S	99	85	70	106	90	45	1800	3,765	.40	.40	.40	.005	1.52	37	54	50	167	42
	SA	90	77	80	104	88	30												
	P	110	95	60	110	95	60												
	A	90	77	80	49	42	-----												
	C	99	85	70	-----	-----	-----												
X2	S	198	170	70	213	181	45	1800	7,530	.50	.40	.44	.006	1.52	37	54	50	167	42
	SA	179	154	80	208	177	40												
	P	220	189	60	220	189	60												
	A	179	154	80	98	84	-----												
	C	198	170	70	-----	-----	-----												
X3	S	468	402	80	531	451	60	1800	15,060	.41	.40	.34	.011	1.61	53	59	59	464	57
	SA	359	304	80	480	408	40												
	P	512	440	70	512	440	70												
	A	359	309	80	189	163	-----												
	C	468	402	80	-----	-----	-----												
X4	P	1039	894	60	1039	894	60	1800	21,150	.66	N/A	N/A	.049	2.21	76	N/A	N/A	597	103
	A	777	668	80	444	382	-----												
	C	1000	860	70	-----	-----	-----												

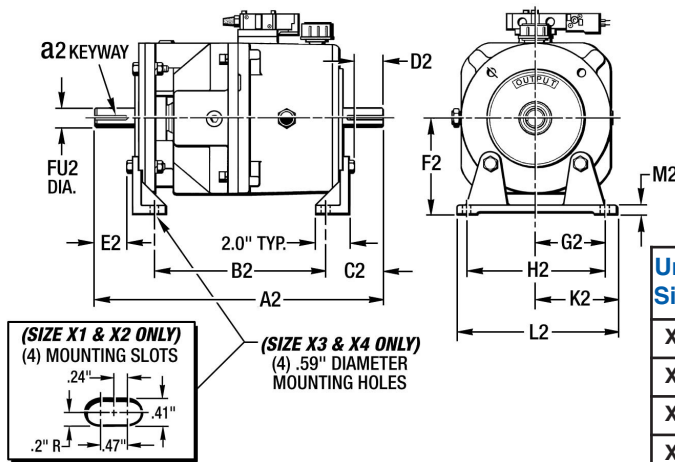
1.2

- VIU = Vertical Input Up • VID = Vertical Input Down
- THP Ratings developed @ 100° F maximum temperature rise and 226° F maximum oil temperature.
- Overhung Load Capacity based on load @ midpoint of output shaft extension.

Dimensional Specifications



Unit Size	Input Dimensions							Keyway a	Output Dimensions					Overall Dimensions							
	FAK	FA	FU	H	Q	FBF	FAJ		AK	BB	U	AH	XD	BF	AJ	B	C	D	E	F	OL
X1	4.500	.28	.625	.50	2.38	.41	5.875	3/16 x 3/32	4.500	.16	.625	2.06	1.50	3/8 x .75	5.875	3.87	3.44	3.44	4.29	4.94	9.00
X2			.875								.875											1.75
X3	8.500	.19	1.125	.80	2.75	.53	7.250	1/4 x 1/8	8.500	---	1.125	2.63	2.12	1/2 x 1.00	7.250	4.44	4.44	4.50	5.09	4.94	11.00
X4	8.500	.19	1.375	.63	3.13	.53	7.250	5/16 x 5/32	8.500	.25	1.375	3.13	2.50	1/2 x 1.00	7.250	5.00	4.50	4.50	5.67	6.00	11.75



Reduced Reaction Time - By mounting the valve directly on the unit, the reaction time is reduced as much as 15 milliseconds. The **Maximum Cycle Rate** is also then increased considerably.

Increased Consistency - This reduction in response time also leads to a more consistent and accurate stopping position in critical applications.

Reduced Cost - Using the manifold mounted valve eliminates the need to purchase a valve, mounting the valve and connecting air lines to the unit.

Unit Size	Dimensions (Inches)												
	A2	B2	C2	D2	E2	F2	G2	H2	K2	L2	M2	FU2	a2
X1	13.69	7.16	3.16	1.50	1.83	4.50	3.19	6.38	3.75	7.50	.15	.6250	3/16 x 3/32
X2	13.75		3.21									.8750	
X3	17.00	9.50	3.63	1.88	2.20	5.25	4.00	8.00	4.75	9.50	.50	1.1250	1/4 x 1/8
X4	18.62	10.50	4.13	2.36	2.62	5.25	4.00	8.00	4.75	9.50	.50	1.375	5/16 x 5/32

Unit Size Selection Chart

The correct size Posidyne X Class Clutch/Brake can generally be selected by the HP and RPM of the motor by using the following Selection Chart. Find the correct motor HP and speed and follow down to the correct X Class Clutch/Brake.

HP	1800 RPM										1200 RPM					
	1/2	3/4	1	1-1/2	2	3	5	7-1/2	10	1/2	3/4	1	1-1/2	2	3	5
X1	X1	X1	X1							X1	X1					
X2			X2	X2	X2						X2	X2	X2			
X3						X3	X3					X3	X3			
X4								X4	X4						X4	X4

When high cycle rates are required (40 cpm +) a thermal HP calculation should be done to assure heat dissipation capability.

Contact Force Control for more information or assistance with your application.

1

Accessories and Kits



To make the X Class Clutch/Brakes adaptable to many applications, several accessories are available.

Mounting Foot Kit

A foot kit is available for those applications where the *Posidyne* X Class clutch/brake may not be mounted on a C-Face motor or reducer. The foot kit includes two feet that bolt onto the clutch/brake. They are made of heavy gauge steel X1 and X2, or cast iron X3 and X4, and hard coat epoxy coated. Note: The *Posidyne* X Class Clutch/Brake cannot be C-Faced mounted to the motor or reducer with feet installed.

Male Input Shaft Assembly

For applications where a belt drive may be required on the input, an input shaft assembly is available to convert the quill input to an extended shaft. It consists of a mounting plate with a bearing and stainless steel shaft that bolts to the C-Face mounting flange. The shaft is then locked into the Split Clamped Quill.

Manifold Mounted Valve

Add the convenience and performance of a Manifold Mounted Valve. Mounting the valve directly on the unit eliminates extra plumbing, improves response time, increases cycle rate, and improves positioning accuracy.

Foot Mounting Kit

X1 & X2 Foot Kit (Pair of feet)	.02-X1-FT-KIT
X1 & X2 Foot Kit Washdown (Steel It Epoxy)	.02-X1-FT-KITW
X3 & X4 Foot Kit (Pair of feet)	.02-X4-FT-KIT
X3 & X4 Foot Kit Washdown (Steel It Epoxy)	.02-X4-FT-KITW

Extended Input Shaft Assembly

Input Shaft Ass'y. X1 5/8" Shaft	.02-X1-IA-KIT
Input Shaft Ass'y. X1 5/8" Shaft, Washdown	.02-X1-IA-KITW
Input Shaft Ass'y. X2 7/8" Shaft	.02-X2-IA-KIT
Input Shaft Ass'y. X2 7/8" Shaft, Washdown	.02-X2-IA-KITW
Input Shaft Ass'y. X3 1-1/8" Shaft	.02-X3-IA-KIT
Input Shaft Ass'y. X3 1-1/8" Shaft, Washdown	.02-X3-IA-KITW

Extended Input Shaft Assembly, Cont.

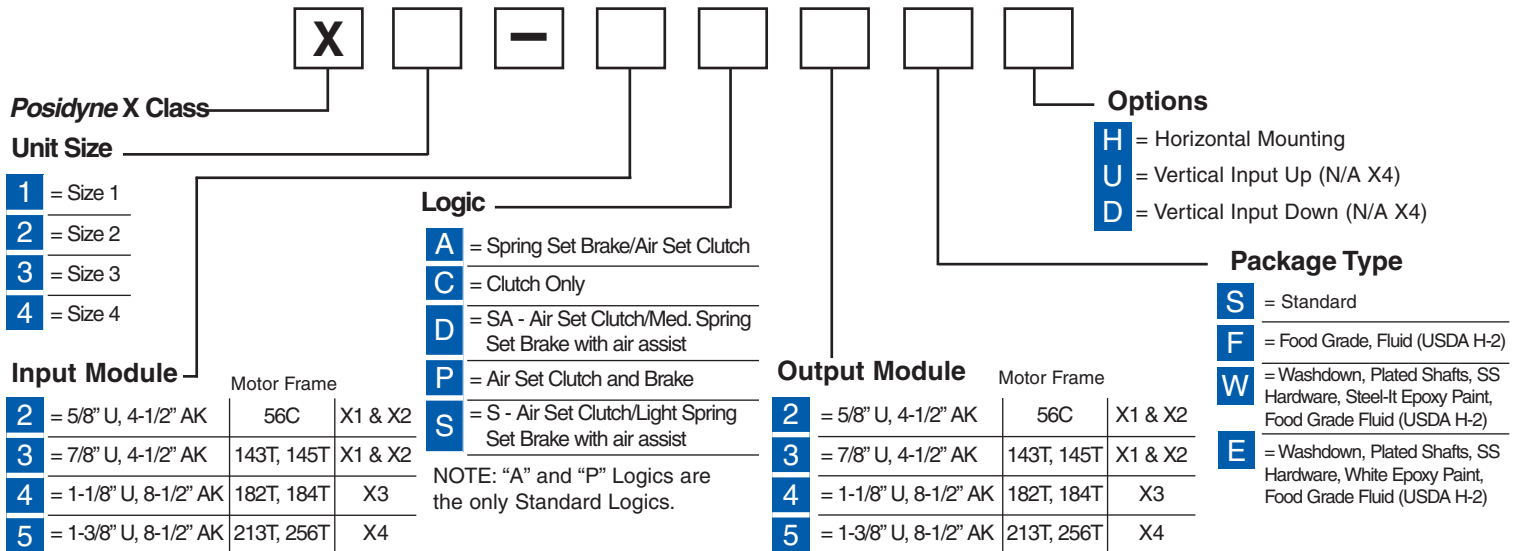
Input Shaft Ass'y. X4 1-3/8" Shaft	.02-X4-IA-KIT
Input Shaft Ass'y. X4 1-3/8" Shaft, Washdown	.02-X4-IA-KITW

Pneumatic Control Valves

Control Valve, 434A Series, Manifold Mounted 120 VAC/60Hz, 1.0 Cv	.09-56-A3NN-00
Control Valve, 434A Series, Manifold Mounted 24 VDC, 1.0 Cv	.09-56-A1NN-00
Control Valve, 35A Series, A logic, 120 VAC/60Hz, .25 Cv, Ship Loose	.01-56-147-08
Control Valve, 35A Series, A logic, 7.3 watt 24 VDC, .21 Cv, Ship Loose	.01-56-148-08

Note: All valves are washdown duty, explosion proof available.

How To Order Your Posidyne X Class Clutch/Brake



Section 2

Posidyne® Clutch/Brakes

Major Advantages of a Posidyne...

2

Today's **Posidyne** is a modern motion control device capable of rapid and precise stopping, starting, reversing, speed changing and positioning. The **Posidyne Clutch/Brake** being designed to handle the energy of rapid acceleration and deceleration has a field proven history under normal use demonstrating its ability to reduce maintenance normally associated with cycling applications. Use of a **Posidyne** also reduces stress on motors and other components in the machine.

1. Higher Production Rates

a. Higher cycle rates - because the **Posidyne** can cycle at rates faster than most prime movers, machine speeds can be increased for higher production levels.

b. Reduced downtime - The **Posidyne's** patented fluid recirculation system, and quality components, enables a long life with a minimum of maintenance. The reduced loads and stress on other components can also reduce maintenance on those items. This reduced downtime means more production time, increasing overall production.

2. Energy Savings

a. By reducing the high starting inrush currents and associated power factor imbalance, energy costs can be reduced.

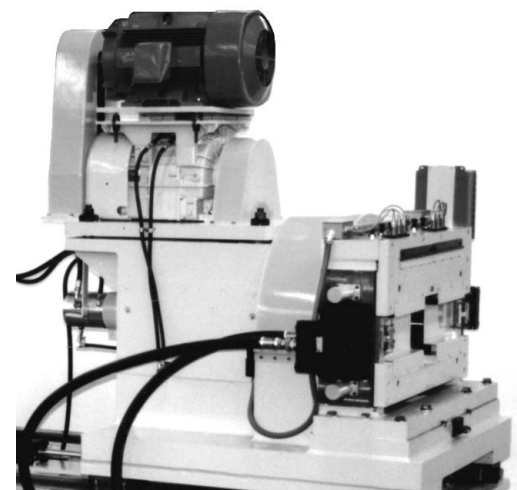
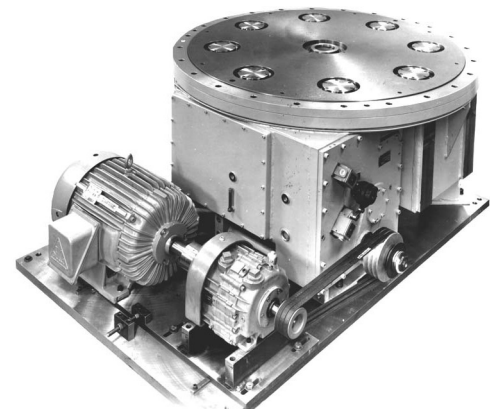
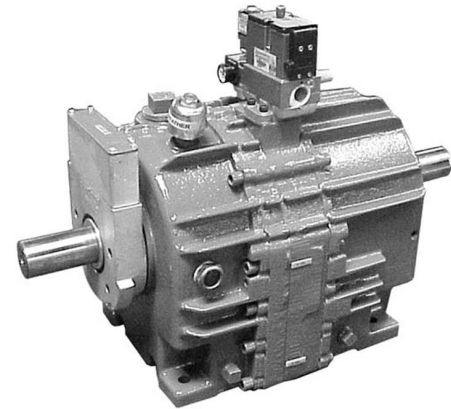
3. Hostile Environments

a. The totally enclosed sealed unit prevents contamination by chips, dust, dirt, chemicals, coolant, caustic washdown, weather, etc.

b. The enclosed unit also prevents contamination of the surrounding environment.

4. High Torque - Small Package

a. The multiple disc design provides a small package with high torque capacity. Because inertia increases by the fourth power of the diameter as torque increases proportional to the diameter or number of surfaces the **Posidyne's** multiple disc design increases torque capacity with a minimum increase in inertia.



b. The recirculating fluid efficiently removes the heat of engagement from the working surfaces for increased capacity.

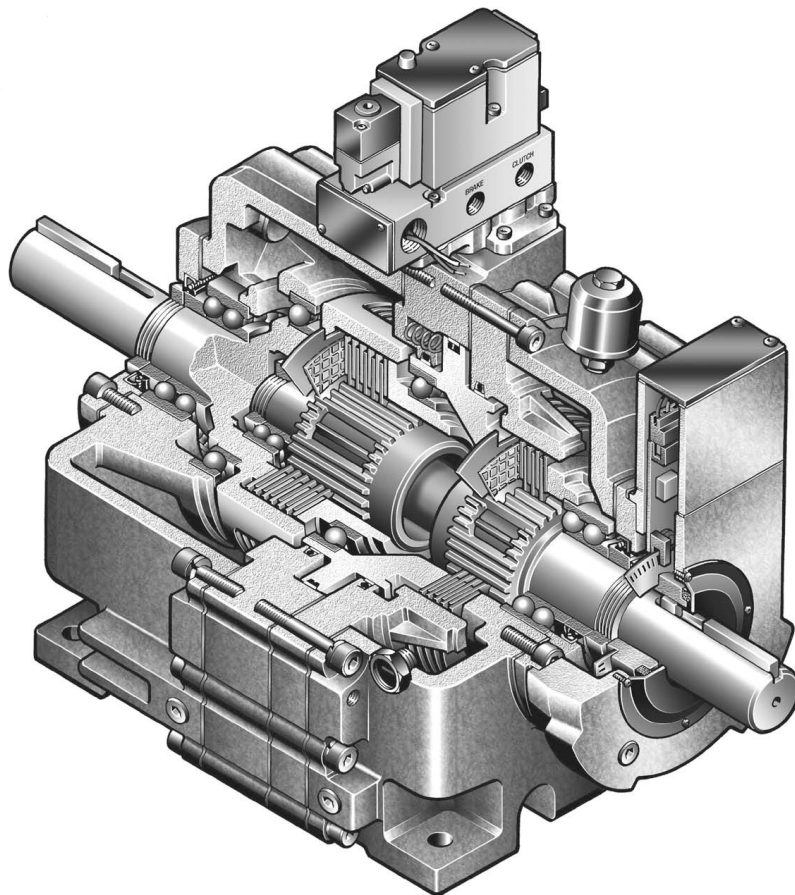
5. Precision Control

a. Due to the simple actuation system, torque in the clutch and brake can be precisely controlled. Adjustment for rapid or soft starts and stops is simple with a *Posidyne*.

b. Advanced friction materials provide consistent and repeatable output torque for controlled starts and stops especially important for positioning applications.

c. Many different standard control logic options are available, ranging from fully adjustable torque control to fixed settings and combinations of both.

d. Encoders provided for CLPC (*Closed Loop Position Control*) option.



Size 03 Posidyne Clutch/Brake shown with an Optical Encoder for Precision Positioning Control and a Manifold Mounted Control Valve for Ultra-Quick Response Time.

6. Ultra-Quick Response

a. Manifold mounted control valves reduce response time by eliminating hoses and fittings.

b. New lightweight pistons in the 1.5 *Posidyne* for a faster response time.

c. DC valve solenoid for further improvement of control response and consistency.

7. Ease of Installation

a. Totally self contained and ready to use. Installation requires only mounting to a base and coupling to the prime mover and load. Normal care in alignment such as that used when installing a motor or gear reducer is all that is required.

b. NEMA C-Face and piggyback mounting options are available for many of the sizes.

8. Flexibility

a. **9-Basic Unit Sizes** - 1/2 to 250 HP to cover the majority of applications including high horsepower.

b. **7-Control Logic Options** - for flexibility in type of control required.

c. **4-Cooling Systems** - Standard, fan cooled, water cooled and forced lube for any degree of thermal load.

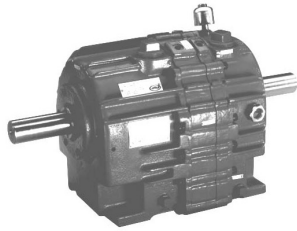
d. **8-Mounting Arrangements** - Basic, C-Face input, C-Face output, piggyback, vertical up, vertical down and 2 wall mounts to fit even the most difficult applications.

9. Easy Maintenance

a. Normal maintenance of the *Posidyne* requires only periodic checking and maintaining the oil level. A simple method of checking stack wear is also provided to predict and schedule maintenance. Since wear is minimal in normal applications, out of service time is greatly reduced.

We at Force Control Industries strive to make our Clutch/Brake Products as reliable and maintenance free as other components in the drive system. In many cases this has been done so well that the *Posidyne* may actually outlast many other components.

Posidyne Clutch/Brake Drives

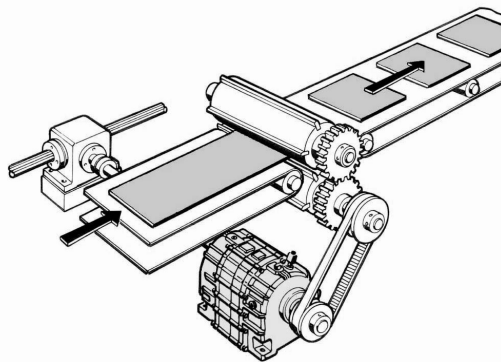


Typical Applications

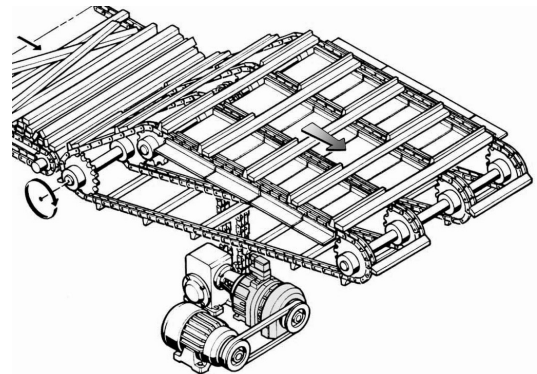
2

Posidyne clutch and brake drives may be found on a large variety of applications serving many industries world wide. Their uses vary from indexing and positioning of simple conveyors, hoists and tables to cycle on demand control for cam type devices. A few sample applications are shown for your reference.

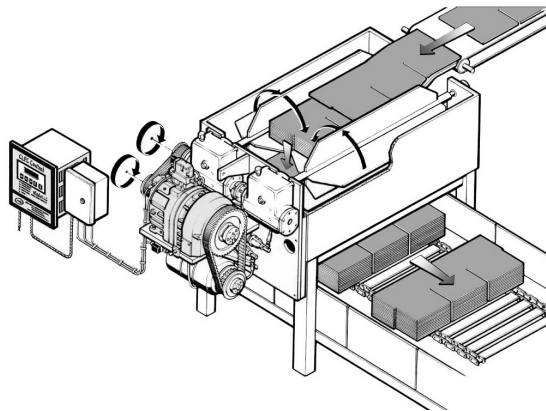
ROTARY CUT-OFF



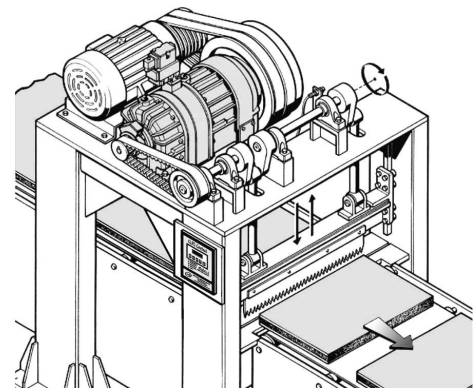
UNSCRAMBLER CONVEYOR



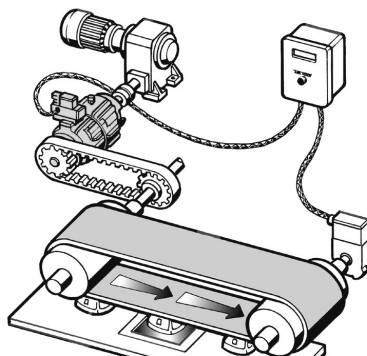
CATCHING ROOFING SHINGLES



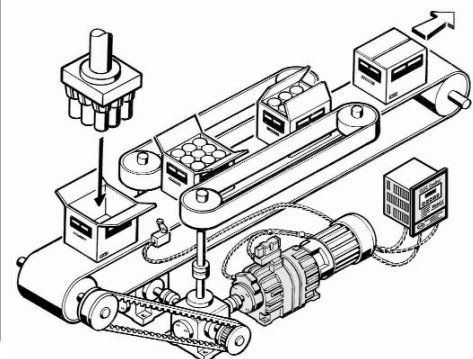
GUILLOTINE SHEAR



HEADLAMP INSPECTION



CASE PACKER



2



Posidyne Clutch/Brake

Size 1.5

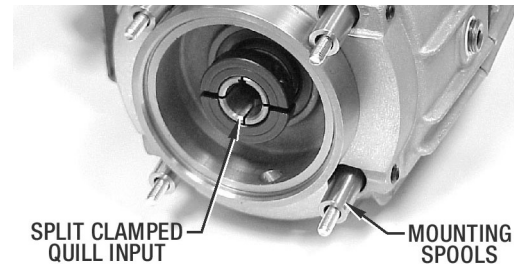
World renowned oil shear clutch/brakes are now available for fractional to 3 HP applications.

Posidyne Clutch/Brakes are the standard for performance and durability where there is no time for downtime. Now this performance is available for your smaller 1/2 to 3 HP drives for conveyors, packaging machines, food processing applications and extruder cut-offs.

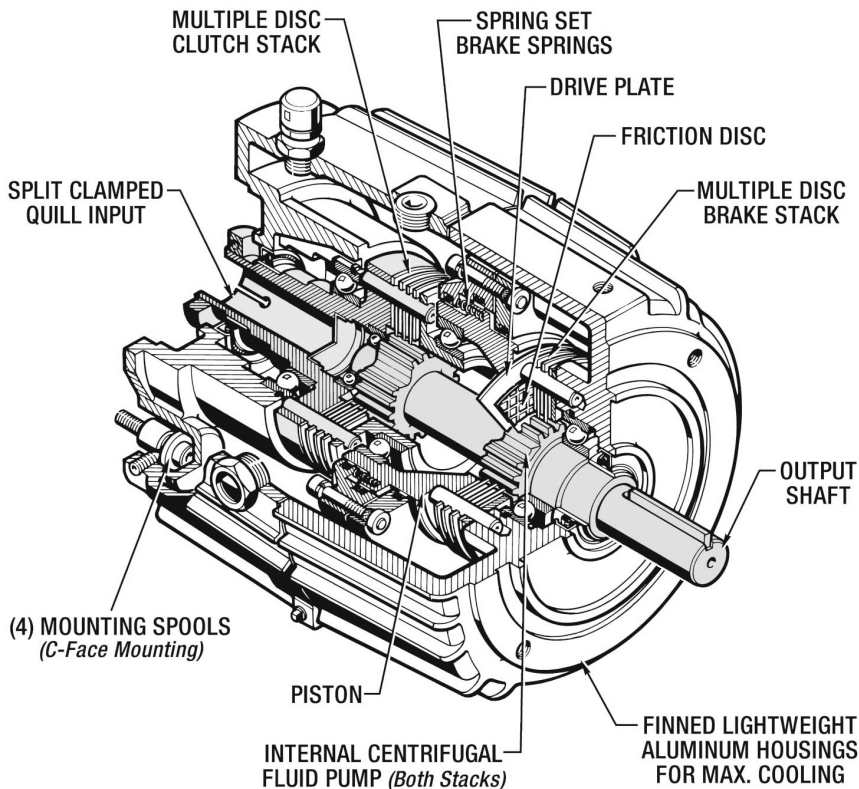
The 1.5 *Posidyne* boosts the cycle rate, accuracy and life of your fractional to 3 HP drives. They bring oil shear durability to a new level of performance and convenience in a compact, lightweight, double C-Face mounted package.

- The new split clamped quill input eliminates key and keyway problems associated with competitive clutch/brakes. By splitting the quill shaft and using a locking collar the quill is **clamped tightly 360°** on the motor shaft.
- The minimal inertia of cyclic parts, combined with high torque handling capability, puts more usable horsepower into your drive - **quicker**.
- The 1.5 *Posidyne* can cycle up to 600 times per minute, and with oil shear technology can last for years, making them perfect for those high cycle applications that may have required more expensive alternative drives in the past.

- High heat dissipation capability ensures long life and consistent accuracy in 24 hour operations.
- Convenient options such as foot mounting kits, manifold mounted valves and optical encoders are available to fit most any application.



SPLIT CLAMPED QUILL INPUT MOUNTING SPOOLS



FEATURES...

- Rapid-fire cycle rates of 600 cpm and more capability with the manifold mounted valve.
- Consistent accuracy with virtually no fade.
- Ideal in hostile or washdown environments. Nickel-plated shafts and anodized housings available.
- Low cyclic inertia of only .012 Lb.Ft.² for ultra-quick acceleration with maximum usable horsepower.
- Pneumatic actuation for easy control of acceleration/deceleration rates by simply adjusting the air pressure. (See Section 6)
- Smooth and quiet engagements with Oil Shear Technology.
- Usable with the **CLPC-LC™** Closed Loop Positioning Control with an Optical Encoder for optimal positioning accuracy.
- Easy access C-Face mounting spool design.

Larger Sizes - Page 2.9
 Selection Procedure - Section 15
 Pressure vs. Torque Specifications - Section 15, Page 15.6
 Engineering Information - Section 16

Specifications - Posidyne Clutch/Brake

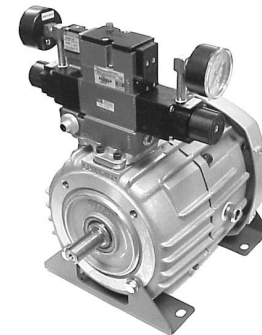
Size 1.5

Size	Logic	Max. Clutch Torque (Lb. In.)			Max. Brake Torque (Lb. In.)					Max RPM	Max KE per Engmt. (Ft. Lbs.)	Avg. Therm. H.P.		Air Vol. per Engmt. (Cu. In.)	Oil Cap. (Qts.)		Inertia of Cyclic Parts (Lb. Ft. ²)
		Static	Dyn.	Max Air Pr.	Springs Only		With Air Assist					Cooling			Horiz	Vert	
					Static	Dyn.	Static	Dyn.	Max Air Pr.			Basic	Fan				
1.5	S	427	367	60 psi	32	27	484	416	60 psi	3600	11,230	Horiz. .25 | .55 ----- Vert. --- | ---	.50	2.0	2.5	.012	
	SA	387	333	70 psi	110	95	492	423	70 psi								
	A	387	333	70 psi	110	95	---	---	---								
	B	240	206	70 psi	220	189	---	---	---								
	C	427	367	60 psi	---	---	---	---	---								
	P	464	399	70 psi	---	---	464	399	70 psi								

NOTES:

Thermal HP ratings based on 1800 RPM, 80° F ambient, 220° F max. oil temp.

Air pressures are at maximum. Operating pressures are generally much lower. Refer to Section 15 "Pressure vs. Static Torque" charts on page 15.7 for proper pressure settings.



1.5 Posidyne shown with Manifold Mounted Control Valve.

Mounting the control valve directly on the Posidyne improves response time with the shortest possible air circuit. It also makes installation quick and easy.

OVERHUNG LOAD CAPACITY (Lbs. Pull)**

Size	Male Input Shaft				Output Shaft							
	300 RPM	1200 RPM*	1800 RPM	3600 RPM	300 RPM		1200 RPM		1800 RPM		3600 RPM	
					Without Encoder	With Encoder	Without Encoder	With Encoder	Without Encoder	With Encoder	Without Encoder	With Encoder
1.5	275	175	150	120	360	245	360	245	335	235	265	186

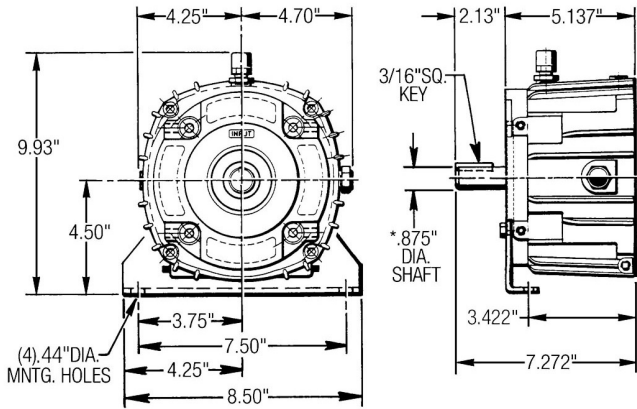
** - At midpoint of shaft extension.

Input Module Dimensions - 1.5 Posidyne® Clutch/Brake (Inches)

2

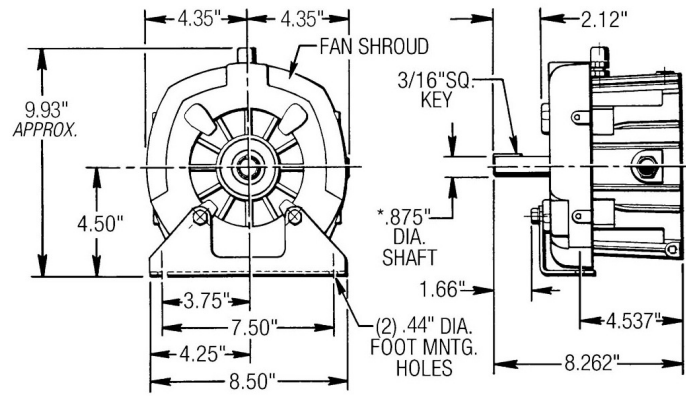
INPUT MODULE #1

7/8" DIA. MALE EXTENDED INPUT SHAFT & FOOT MOUNT



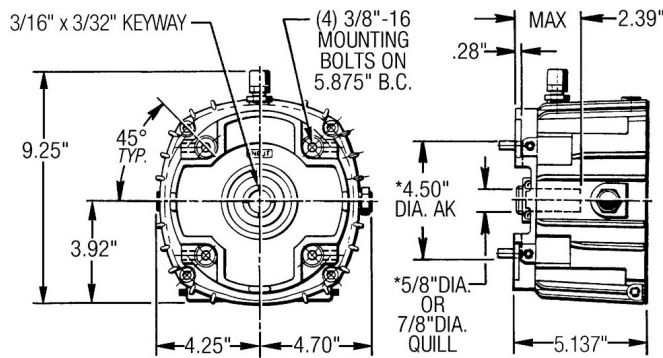
INPUT MODULE #1 WITH FAN COOLING

7/8" DIA. MALE EXTENDED INPUT SHAFT & FOOT MOUNT



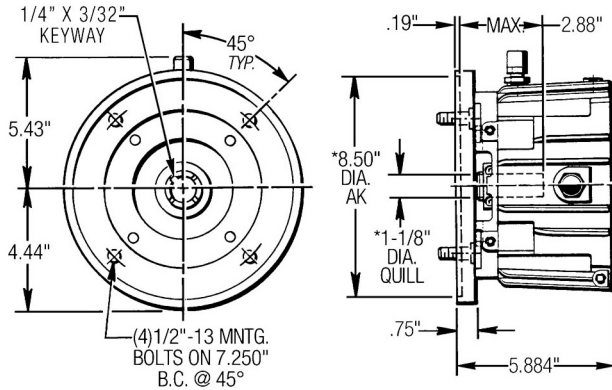
INPUT MODULE #2 & #3 (C-Face)

5/8" OR 7/8" DIA. FU, 4.50" DIA. AK, SPLIT CLAMPED QUILL (56/143TC/145TC Frame)



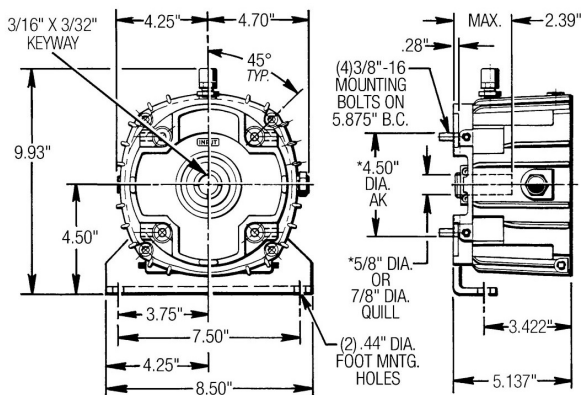
INPUT MODULE #4 (C-Face)

1-1/8" DIA. FU, 8.50" DIA. AK, SPLIT CLAMPED QUILL (182TC/184TC Frame)



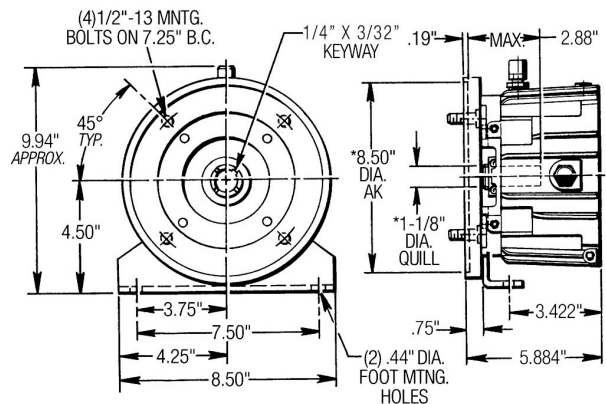
INPUT MODULE "A" & "B" (C-Face)

5/8" OR 7/8" DIA. FU, 4.50" DIA. AK, SPLIT CLAMPED QUILL & FOOT MOUNTED (56/143TC/145TC Frame)



INPUT MODULE "C" (C-Face)

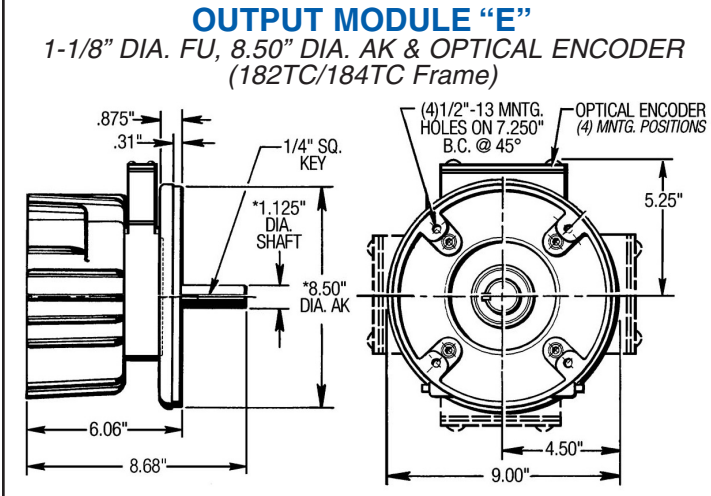
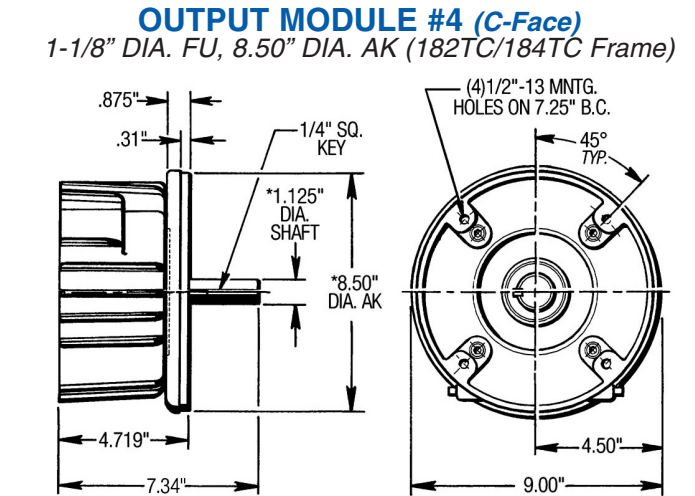
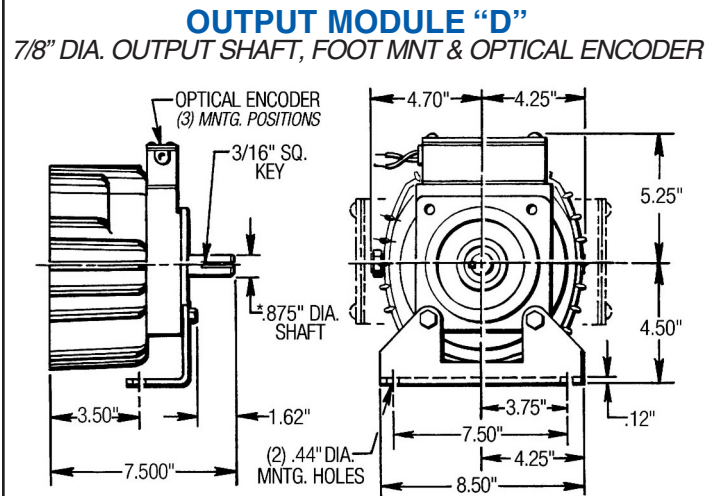
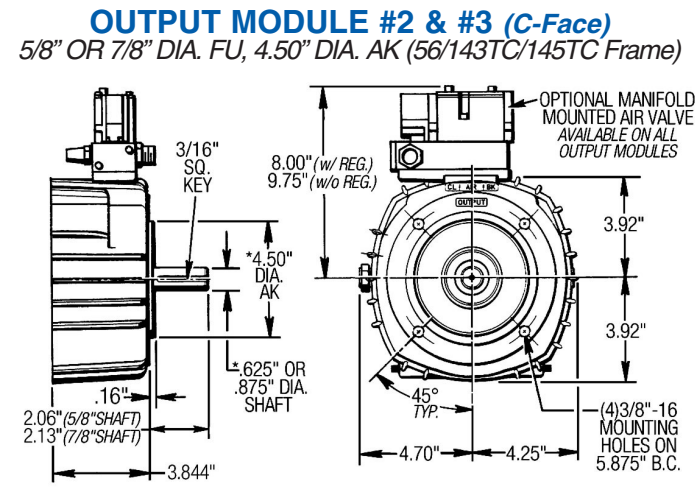
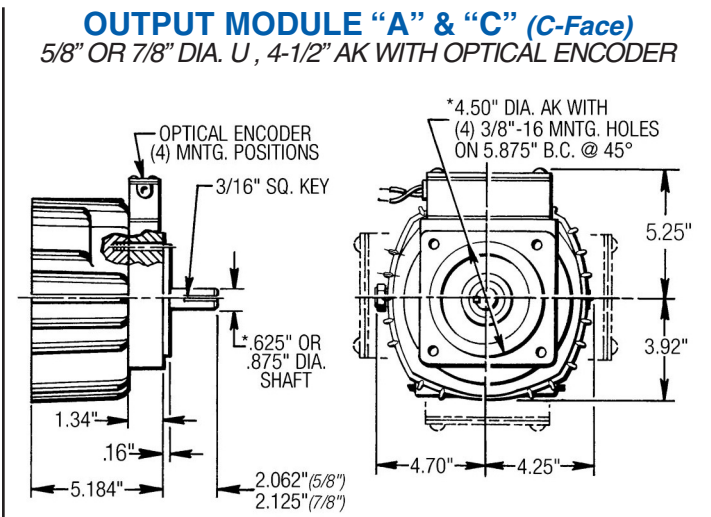
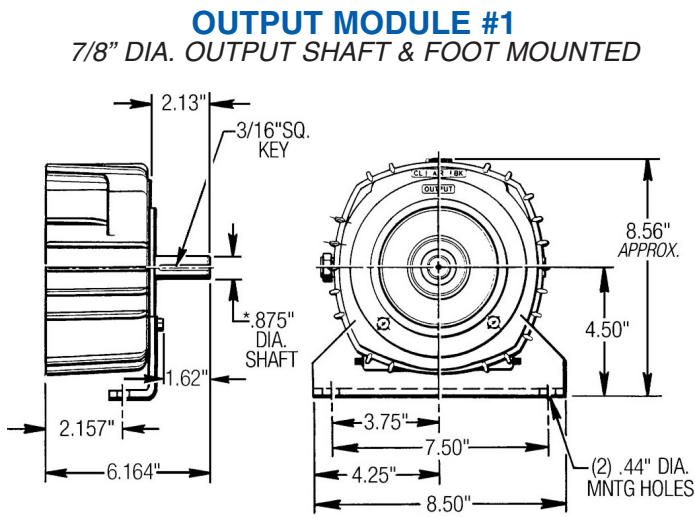
1-1/8" DIA. FU, 8.50" DIA. AK, SPLIT CLAMPED QUILL & FOOT MOUNTING (182TC/184TC Frame)



Choose the appropriate Input Module and Output Module to get the complete envelope dimensions.

Output Module Dimensions - 1.5 Posidyne® Clutch/Brake (Inches)

2



Choose the appropriate Input Module and Output Module to get the complete envelope dimensions.

How to order your Posidyne Size 1.5 Clutch/Brake

2

Ordering System Chart

Example: 15-1D3-H7T / _____ / _____



SIZE (1,2)

1 5 = 1.5

INPUT (3)

- 1** = 7/8" FU Extended Shaft. (With Mounting Foot)
- 2** = 4-1/2" FAK, 5/8" FU with Clamped Split Quill Input Shaft. (56C Frame)
- 3** = 4-1/2" FAK, 7/8" FU with Clamped Split Quill Input Shaft. (143TC / 145TC Frame)
- 4** = 8-1/2" FAK, 1-1/8" FU with Clamped Split Quill Input Shaft (182TC / 184TC Frame)
- A** = 4-1/2" FAK, 5/8" FU with Clamped Split Quill Input Shaft and Foot Mounting. (56C Frame)
- B** = 4-1/2" FAK, 7/8" FU with Clamped Split Quill Input Shaft and Foot Mounting (143TC/145TC Frame)
- C** = 8-1/2" FAK, 1-1/8" FU with Clamped Split Quill Input Shaft and Foot Mounting. (182TC / 184TC Frame)

C-Face

OUTPUT (5)

- 1** = 7/8" U Male Shaft (With Mntg. Foot)
- 2** = 4-1/2" FAK, 5/8" FU. (56C Frame)
- 3** = 4-1/2" FAK, 7/8" FU. (143TC / 145TC Frame)
- 4** = 8-1/2" FAK, 1-1/8" FU. (1.5 Only) (182TC / 184TC Frame)
- A** = Optical Encoder* 4-1/2" AK, 5/8" U.
- C** = Optical Encoder* 4-1/2" AK, 7/8" U.
- D** = Optical Encoder* 7/8" U and Foot Mounting
- E** = Optical Encoder* 8-1/2" AK, 1-1/8" U

C-Face

C-Face

* Machined to accept an Encoder. See Section 11.7 for Ordering Encoder.

LOGIC (4)

- S** = S - Air set clutch / light spring set brake with air assist, 95/5.
- A** = A - Air set clutch / medium spring set brake, 75/25.
- B** = B - Air set clutch / heavy spring set brake, 50/50.
- C** = C - Air set clutch / no brake.
- D** = SA - Air set clutch / medium spring set brake with air assist, 75/25
- P** = P - Air set clutch / Air set brake, without springs.

MOUNTING POSITION (6)

- H** = Horizontal.
- D** = VID - Vertical, Input Down.
- U** = VIU - Vertical, Input Up.
- L** = Wall on Left Viewing Input Shaft.
- R** = Wall on Right Viewing Input Shaft.

COOLING (7)

- 1** = Basic (Radiant)
- 5** = Fan Cooled.
- 6** = Basic, (Manifold Mntd. Valve)
- 7** = Fan Cooled, (Manifold Mntd. Valve)

9 ENCODER

See Section 11 for Ordering Number. Use **N** if no Encoder is to be ordered.

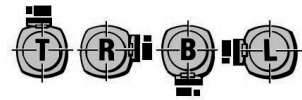
CONTROL VALVE 10

See Section 10 for Ordering Number. Use **N** if no Valve is to be ordered.

PORTING/VALVE LOCATION (8)
(Viewing Input Shaft) See Below

- T** = Top
- B** = Bottom
- R** = Right
- L** = Left

PORTING/VALVE LOCATION
(Viewing Input Shaft)



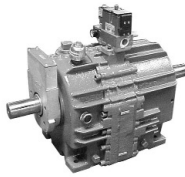
ASSEMBLY OPTIONS

Location	Std.	C-Face	Foot Mntd.	Piggy Back
T	X	X	X	---
R	X	X	X	X
B	X	X	---	X
L	X	X	X	X

Posidyne Clutch/Brakes with Optical Encoder and Manifold Mounted Valve

The **Posidyne Clutch/Brake** size 02 through 20 can be furnished with a Manifold Mounted Valve, which mounts directly on a machined surface on the unit. This feature eliminates hoses to the clutch and brake ports, reduces assembly time and improves response time.

An Encoder can also be furnished for improved positioning, when used with one of the CLPC Series Closed Loop Positioning Controls. The Encoder mounts on the output shaft, and includes a home position for single revolution applications.



Posidyne C-Face Clutch/Brakes

Posidyne C-Face Clutch / Brakes are available for up to 10 HP - 256UC Frame applications. Sizes 02, 2.5 and 03 can be equipped with provisions for NEMA C-Face input mounting, NEMA C-Face output mounting, or both. All units incorporate the Force Control Oil Shear Drive principle. Basic or Water Cooled Options are available with the C-Face input option. Fan Cooling is not available.



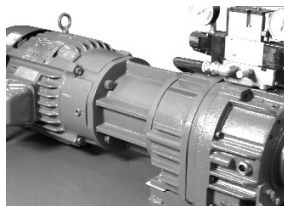
2.5 Posidyne with C-Face Input



2.5 Posidyne with C-Face Output

Posidyne Clutch/Brake with C-Face Long Coupled Input

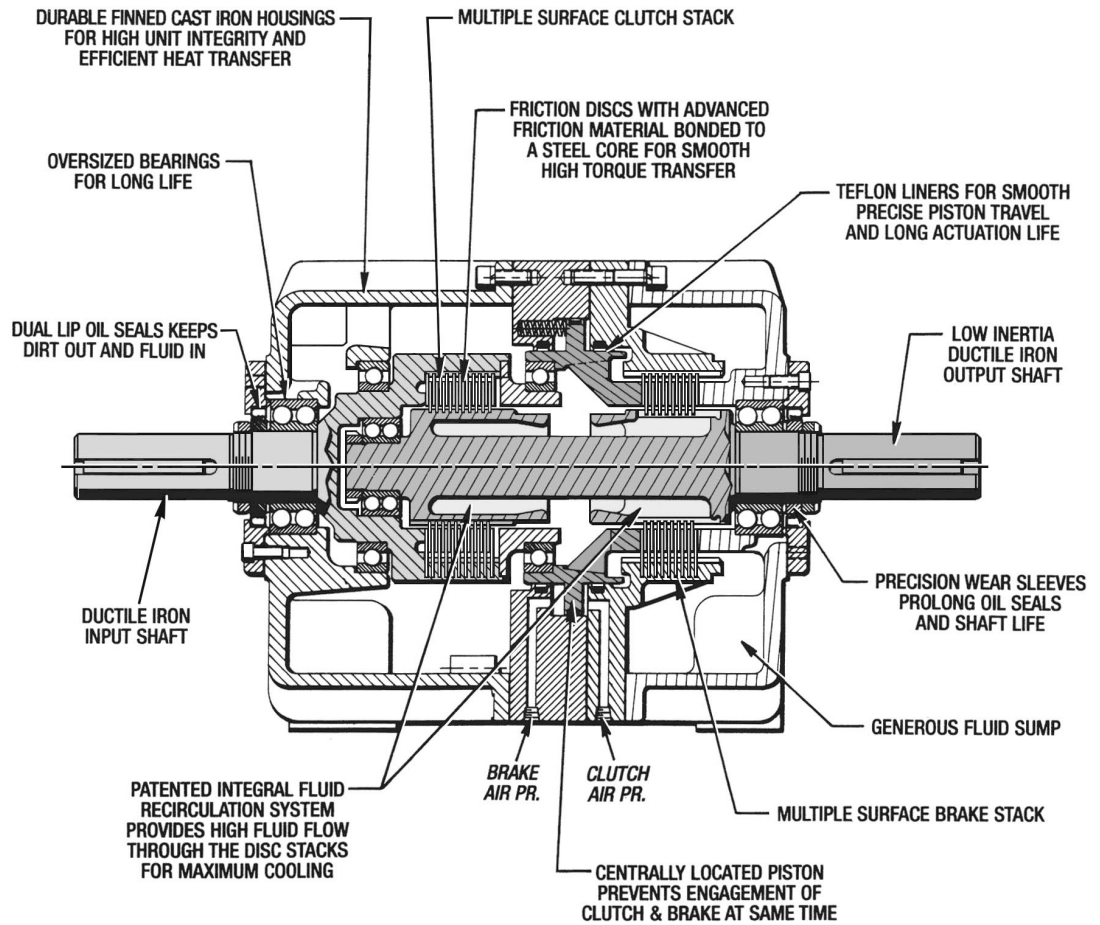
Sizes 02, 2.5 and 03 is available with a C-Face Long Coupled Input for NEMA motor frame sizes 143T to 256T and 182U to 256U. Fan cooling is not available



Posidyne Clutch/Brake

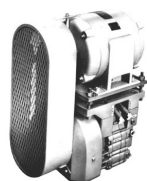
Sizes 02 to 30

The **Posidyne** is the backbone of the **Force Control** line of Clutch/Brake products. Constant development of new designs and materials has enabled the **Posidyne** to become a work-horse on today's modern high production machinery. The basic **Posidyne** is a combination of a clutch and brake in a single unit. The multiple stacks enclosed in a cast iron housing, cooled and lubricated by recirculating fluid are unaffected by outside contaminants and have a tremendous ability to dissipate heat. With their built in mechanical strength this makes the **Posidyne** an excellent choice for applications of heavy loads and high cycle rates.



Piggyback Posidyne

Posidyne sizes 02 thru 10 are available with a piggyback mounting frame that will accept NEMA motor sizes from 56 through 356U depending on the drive size.



Fan Cooled Units

Fan cooled **Posidyne** clutch/brake units may be required for those applications where thermal requirements are somewhat above average. The fan and shroud may be easily added in the field to any standard unit when required.



Water Cooled Units

For applications with extremely high inertia loads or cyclic requirements, the water cooled **Posidyne** clutch/brake unit may be required. The internal Heat Exchanger and necessary fittings may easily be installed in the field to most standard units when increased duty cycles are required.

View showing the coiled tube heat exchanger mounted in the input housing. The oil lubricating the clutch stack is cooled prior to returning to the sump. (Water Flow Requirements in GPM = 0.01 x calculated thermal HP)



2

Specifications - Posidyne Clutch/Brake

Sizes 02 to 10

Size	Logic	Max Clutch Torque (Lb. In.)			Max Brake Torque (Lb. In.)						Max. (RPM)		Max. KE per Engmt. (Ft Lbs)	Average Thermal HP			Air Vol. Per Engmt. (In ³)	Oil Cap. (Qts)	Inertia of Cyclic Parts (Lb. Ft ²)
		Static	Dyn.	Max. Air Pr.	Springs Only		With Max Air Assist			Basic & Fan Cool	Water Cool	Basic		Fan	Water				
					Static	Dyn.	Static	Dyn.	Max. Air Pr.										
02	S	518	439	60 psi	48	41	553	468	60 psi	1800	3600	11,230	Horizontal .80 | 2.00 | 4.00 ----- Vertical .40 | 1.50 | 6.00	1	Horz 2 ----- Vert 3	.04			
	SA	542	458	80 psi	164	139	501	424	40 psi										
	A	503	426	80 psi	126	107	---	---	---										
	B	336	284	80 psi	252	214	---	---	---										
	C	335	284	60 psi	---	---	---	---	---										
	P	590	499	60 psi	---	---	505	428	60 psi										
2.5	S	1,331	1,126	60 psi	113	96	1,396	1,181	60 psi	1800	3600	15,865	Horizontal .70 | 2.00 | 4.00 ----- Vertical .35 | 1.00 | 2.00	5	Horz 2.5 ----- Vert 4	.20			
	SA	1,482	1,227	80 psi	512	433	1,663	1,399	40 psi										
	A	1,451	1,254	80 psi	476	403	---	---	---										
	B	968	819	80 psi	952	806	---	---	---										
	C	1,270	1,074	60 psi	---	---	---	---	---										
	SCP	1,234	1,061	60 psi	---	---	1,051	904	60 psi										
	P	1,497	1,267	60 psi	---	---	1,283	1086	60 psi										
03	S	2,574	2,178	60 psi	144	122	2,049	1,734	60 psi	1800	3600	21,494	Horizontal .75 | 2.80 | 8.00 ----- Vertical .38 | 1.40 | 4.00	8	Horz 3.5 ----- Vert 4.5	.20			
	SA	2,790	2,361	80 psi	651	551	2,238	1,894	40 psi										
	A	2,852	2,413	80 psi	602	509	---	---	---										
	B	1,895	1,603	80 psi	1,203	1,018	---	---	---										
	C	2,474	2,093	60 psi	---	---	---	---	---										
	SCP	2,668	2,258	60 psi	---	---	1,833	1,551	60 psi										
	P	2,857	2,417	60 psi	---	---	1,905	1,612	60 psi										
05	S	4,325	3,659	60 psi	212	179	4,021	3,402	60 psi	1800	3600	42,988	Horizontal 1.0 | 4.50 | 12.0 ----- Vertical .50 | 2.25 | 6.00	8	Horz 8 ----- Vert 10	.30			
	SA	4,889	4,137	80 psi	789	668	3,645	3,085	40 psi										
	A	4,487	3,797	80 psi	1,136	962	---	---	---										
	B	2,626	2,222	80 psi	2,273	1,923	---	---	---										
	C	4,017	3,399	60 psi	---	---	---	---	---										
	SCP	4,362	3,691	60 psi	---	---	3,518	2,977	60 psi										
	P	4,761	4,029	60 psi	---	---	3,809	3,223	60 psi										
10	S	9,832	8,320	60 psi	691	585	10,489	8,875	60 psi	1800	3600	68,035	Horizontal 1.0 | 6.00 | 15.0 ----- Vertical .50 | 3.00 | 7.50	12	Horz 10 ----- Vert 13	.69			
	SA	9,471	8,014	80 psi	2,766	2,340	9,297	7,867	40 psi										
	A	10,013	8,472	80 psi	2,797	2,366	---	---	---										
	B	5,097	4,313	80 psi	5,593	4,733	---	---	---										
	C	9,228	7,808	60 psi	---	---	---	---	---										
	SCP	9,936	8,407	60 psi	---	---	8,612	7,287	60 psi										
	P	11,197	9,474	60 psi	---	---	9,797	8,290	60 psi										

NOTES:

Thermal HP ratings based on 1800 RPM and 70° ambient temperature. Higher thermal ratings available with forced lubrication. Consult factory with application details.

For Water cooled Units Cooling water flow requirements in GPM equals .10 x thermal horsepower

Oil Capacity is only approximate. Always fill unit to center of sight gauge.

Air pressures are at maximum torque. Operating pressures are generally much lower. Refer to Section 15 "Pressure vs. Static Torque" charts on pages 15.7 & 15.8 for proper pressure settings.

Specifications - Posidyne Clutch/Brake

Sizes 11 to 30

2

Size	Logic	Max Clutch Torque (Lb. In.)			Max Brake Torque (Lb. In.)					Max. (RPM)		Max. KE per Engmt. (Ft Lbs)	Average Thermal HP			Air Vol. Per Engmt. (In ³)	Oil Cap. (Qts)	Inertia of Cyclic Parts (Lb. Ft ²)
		Static	Dyn.	Max. Air Pr.	Springs Only		With Max Air Assist			Basic & Fan Cool	Water Cool		Basic	Fan	Water			
					Static	Dyn.	Static	Dyn.	Max. Air Pr.									
11	S	18,045	15,269	80 psi	888	751	14,926	12,630	80 psi	** 1200	N/A	108,501	Horizontal 4.00			15	Horz 10 ----- Vert 13	1.60
	SA	13,358	11,303	80 psi	2,961	2,505	9,980	8,445	40 psi									
	A	14,036	11,877	80 psi	2,661	2,252	---	---	---									
	B	8,019	6,785	80 psi	5,322	4,504	---	---	---									
	C	18,045	15,269	80 psi	---	---	---	---	---									
	SCP	17,833	15,090	80 psi	---	---	17,833	15,090	80 psi									
P	20,054	16,969	80 psi	---	---	14,038	11,878	80 psi										
14	S	22,989	19,453	80 psi	1,681	1,410	23,737	20,085	80 psi	** 1200	N/A	170,532	Horizontal 4.00			15	Horz 10 ----- Vert 13	1.75
	SA	16,484	13,948	80 psi	5,237	4,431	16,264	13,762	40 psi									
	A	17,576	14,872	80 psi	4,660	3,926	---	---	---									
	B	10,783	9,124	80 psi	8,352	7,067	---	---	---									
	C	23,453	19,844	80 psi	---	---	---	---	---									
	SCP	23,183	19,617	80 psi	---	---	20,793	17,594	80 psi									
P	26,066	22,056	80 psi	---	---	22,056	18,662	80 psi										
20	S	31,082	26,300	80 psi	2,018	1,707	32,274	27,308	80 psi	600 (Basic) 1800 (Fan)	1800	137,221	Horizontal 1.5 | 8.00 | 25.0			23	Horz 25 ----- Vert 30	4.37
	SA	25,837	21,862	80 psi	5,045	4,269	20,173	17,069	40 psi									
	A	26,332	22,281	80 psi	4,759	4,027	---	---	---									
	B	18,087	15,304	80 psi	9,518	8,054	---	---	---									
	C	30,455	25,770	80 psi	---	---	---	---	---									
	SCP	32,737	27,700	80 psi	---	---	28,115	23,789	80 psi									
P	34,578	29,258	80 psi	---	---	30,256	25,601	80 psi										
30	S	78,857	67,028	50 psi	8,010	6,808	72,185	61,357	40 psi	1200	1200	322,062	CF			97	CF	61.0
	SA	75,478	64,156	60 psi	20,026	17,200	68,157	57,933	30 psi									
	A	75,478	64,156	60 psi	20,026	17,200	---	---	---									
	C	78,857	67,028	50 psi	---	---	---	---	---									
	SCP	76,600	65,110	45 psi	---	---	65,657	55,808	45 psi									
	P	74,871	63,640	40 psi	---	---	64,175	54,548	40 psi									

NOTES:

Thermal HP ratings based on 1800 RPM and 70° ambient temperature. Higher thermal ratings available with forced lubrication. Consult factory with application details.

For Water cooled Units Cooling water flow requirements in GPM equals .10 x thermal horsepower

Oil Capacity is only approximate. **Always fill unit to center of sight gauge.**

Air pressures are at maximum torque . Operating pressures are generally much lower. Refer to **Section 15 "Pressure vs. Static Torque"** charts on pages 15.7 & 15.8 for proper pressure settings.

Size 11 and 14 Posidyne rated @ 1200 RPM. Fan cooled only. These sizes can run up to 1800 RPM with the External Cooling System shown below.

CF- Consult Factory

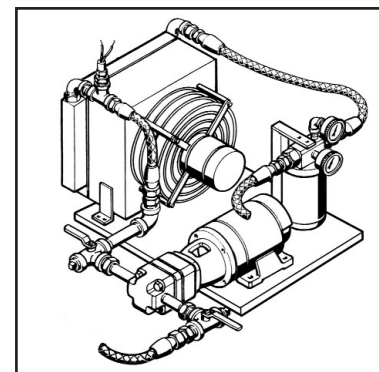
EXTERNAL COOLING SYSTEM - "Oil to Air" Shown

This External Cooling System is available for all sizes of *Posidyne* Clutch/Brakes. The typical cooling configuration is "Oil to Air" as shown, but "Oil to Water" is also available.

The External Cooling System filters the oil so the life of the Clutch/Brake is in turn increased.

The Thermal Capacity is increased so in some applications the max. operating RPM can also be increased.

Consult the Force Control Factory for additional information.

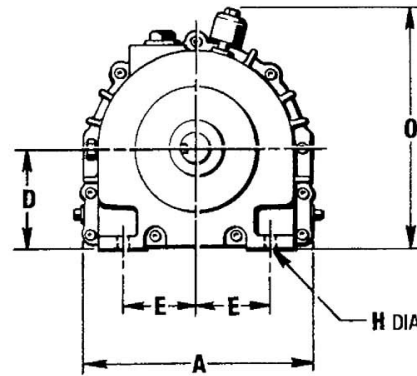
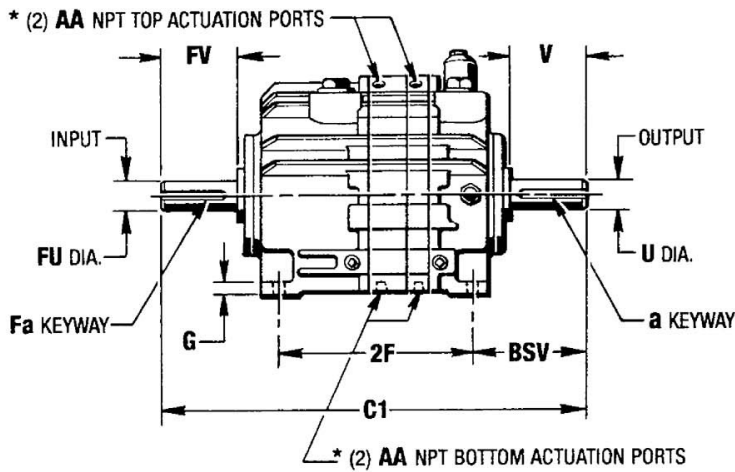


Dimensions - Posidyne Clutch/Brake (Inches)

Basic Posidyne

Sizes 02 to 30

2



STANDARD SHAFT DIAMETER TOLERANCES
 UP TO & INCLUDING 1.500" DIA. +.0000" -.0005"
 OVER 1.500" DIA..... +.000" -.001"

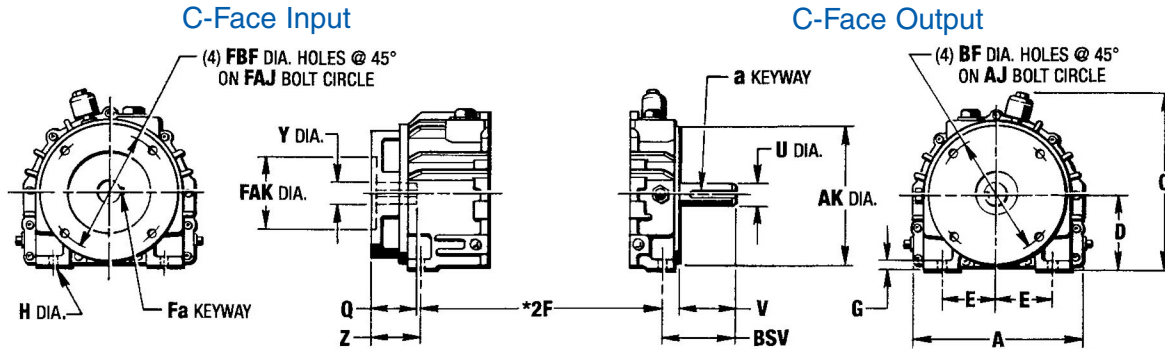
Size	Drive Dim.									Shaft Dim.					Porting - AA		
	A	D	E	2F	G	H	O	BSV	C1	a Keyway	Fa Keyway	U	FU	V	FV	(Bot.)	(Top)
02	9.00	4.00	3.50	7.00	0.59	0.44	9.25	3.5	14.62	1/4 X 1/8	1/4 X 1/8	1.125	1.125	2.00	2.00	1/8-27	1/8-27
2.5	9.50	4.37	3.31	8.75	0.50	0.44	10.0	4.62	18.25	5/16 X 5/32	5/16 X 5/32	1.375	1.375	3.00	3.25	1/4-18	1/4-18
03	10.25	4.50	3.31	8.77	0.50	0.44	10.69	5.16	19.25	5/16 X 5/32	5/16 X 5/32	1.375	1.375	3.50	3.50	1/4-18	1/4-18
05	10.25	6.50	3.50	10.25	0.75	0.56	12.69	5.75	22.75	3/8 x 3/16	3/8 x 3/16	1.625	1.625	4.00	4.00	1/4-18	1/4-18
10	12.50	6.50	3.50	15.38	1.00	0.75	14.0	5.61	27.50	3/8 x 3/16	3/8 x 3/16	1.750	1.750	3.75	3.75	1/4-18	1/4-18
11	12.63	6.50	4.75	15.38	1.00	0.75	14.56	6.75	31.56	5/8 x 5/16	5/8 x 5/16	2.375	2.375	5.00	5.62	1/4-18	1/4-18
14	12.63	6.50	4.75	15.38	1.13	0.75	15.21	6.75	32.04	5/8 x 5/16	5/8 x 5/16	2.375	2.375	4.43	5.56	1/4-18	1/4-18
20	17.50	9.00	5.75	19.63	1.25	0.88	19.0	7.38	35.5	5/8 x 5/16	5/8 x 5/16	2.750	2.750	4.75	4.75	3/8-18	1/2-14
30	22.50	13.00	8.00	29.25	1.50	1.06	24.37	9.88	49.00	1 x 1/2	1 x 1/2	4.000	4.000	6.58	6.58	1/2-14	1/2-14

* - Top porting and bottom porting are both supplied. The use of bottom porting is recommended to purge contaminants out of the pistons when they are exhausted. The use of top porting will not purge the pistons.

Dimensions - Posidyne Clutch/Brake (Inches)

C-Face Mounting Options Sizes 02, 2.5 and 03

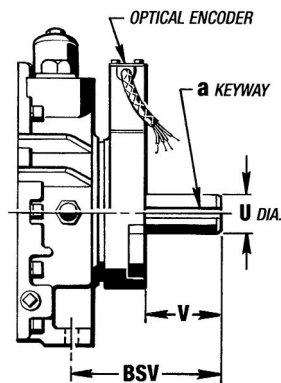
2



Size	Input Module	Input Dimensions							Output Module	Output Dimensions						Foot Mounting Dimensions						
		FAJ	FAK	Fa	FBF	Q	Y	Z		AJ	AK	a	BF	BSV	U	V	A	D	E	G	H	O
02	3	5.88	4.5	3/16 x 3/32	0.41	2.62	7/8	3.44	3**	5.88	4.5	3/16 x 3/32	3/8-16 x .75	2.94	7/8	2.06	9.0	4.0	3.5	.59	.44	9.25
	4	7.25	8.5	1/4 x 1/8	0.53	2.75	1-1/8	3.25	4	7.25	8.5	1/4 x 1/8	1/2-13 x 1	4.56	1-1/8	2.69						
2.5	3	5.88	4.5	3/16 x 3/32	0.41	3.50	7/8	2.56	3	5.88	4.5	3/16 x 3/32	3/8-16 x .75	4.62	7/8	2.12	9.5	4.37	3.31	.50	.44	10.0
	4	7.25	8.5	1/4 x 1/8	0.53	3.50	1-1/8	2.81	4	7.25	8.5	1/4 x 1/8	1/2-13 x 1	4.13	1-1/8	2.62						
	5	7.25	8.5	5/16 x 5/32	0.53	3.50	1-3/8	2.81	5	7.25	8.5	5/16 x 5/32	1/2-13 x 1	4.62	1-3/8	3.00						
03	4	7.25	8.5	1/4 x 1/8	0.53	3.50	1-1/8	2.91	4	7.25	8.5	1/4 x 1/8	1/2-13 x 1	4.22	1-1/8	2.62	10.2	4.5	3.31	.50	.44	10.5
	5	7.25	8.5	5/16 x 5/32	0.53	3.50	1-3/8	2.91	5	7.25	8.5	5/16 x 5/32	1/2-13 x 1	5.16	1-3/8	3.50						

* - See Basic Posidyne Dimensions on previous page.
 ** - Spacer may be required to keep Output Housing from interfering with mating C-Face.

Optical Encoder Dimensions Sizes 02 to 30



Size	Output Module	U	V	BSV	a
02	C	1.125	2.17	4.57	3/16 X 3/32
2.5	C	1.375	1.79	4.62	5/16 X 5/32
03	C	2.50	5.16		
05	C	1.625	3.00	5.75	3/8 X 3/16
10	C	1.750	2.81	5.50	
11	C	2.375	3.91	6.75	5/8 X 5/16
14	C	2.375	3.34	6.75	
20	C	2.750	4.37	8.19	
30	----	-----	-----	-----	-----

See Section 11 for additional information on Optical Encoders.

Dimensions - Posidyne Clutch/Brake (Inches)

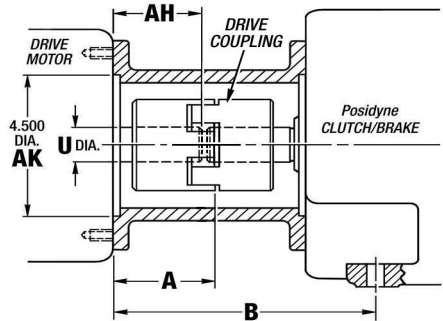
Sizes 02 to 30

2

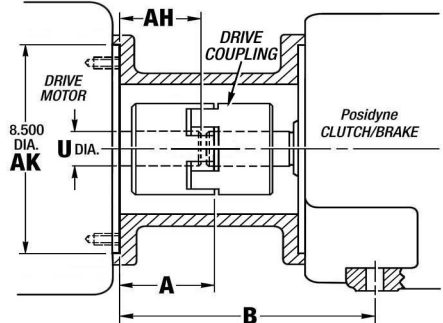
C-Face Long Coupled Input Dimensions (Inches)

Sizes 02, 2.5 and 03 Only

4.500" AK MOTOR REGISTER



8.500" AK MOTOR REGISTER



Posidyne SIZE	MOTOR FRAME	DIMENSION (Inches)				
		AH	AK DIA.	U DIA.	A	B
02	143T, 145T	2.290	4.500	.875	2.63	6.62
	182, 184				3.17	
	182T, 184T	2.630	8.500	1.125	3.23	7.37
	213, 215	2.750				
2.5	182T, 184T	2.630	8.500	1.125	3.46	8.69
	213, 215	2.750			3.52	
	213T, 215T	3.130			3.71	
	254, 256	3.500			3.89	
	254T, 256T	3.750			4.60	
03	182T, 184T	2.630	8.500	1.125	3.50	8.78
	213, 215	2.750			3.51	
	213T, 215T	3.130		1.375	3.76	9.47
	254, 256	3.500			4.22	
	254T, 256T	3.750		1.625	4.52	

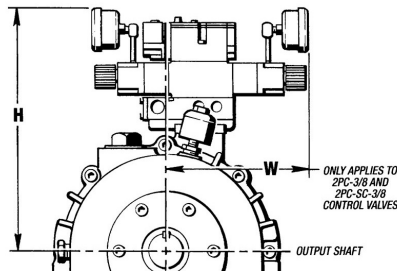
Manifold Mounted Control Valve Envelope Dimensions

Sizes 02 to 30

Size	Without Regulators		With Regulators	
	H	W	H	W
02	8.16	---	10.47	6.13
2.5	8.82	---	10.92	6.70
03	9.44	---	11.75	6.70
05	9.32	---	11.63	6.70
10	10.57	---	12.89	6.70
11	12.77	9.63	---	---
14	12.77	9.63	---	---
20	14.05	11.75	---	---
30	18.05	11.75	---	---

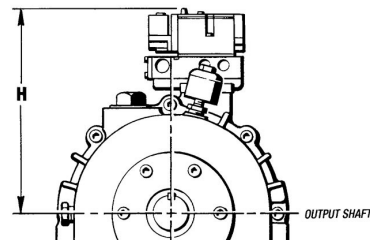
See Section 10 for additional information on Pneumatic Control Valves.

(With Regulators and Gauges)



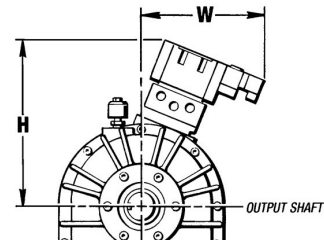
02, 2.5, 03, 05 and 10 Posidyne Clutch/Brakes (1PC-3/8, 2PC-3/8 and 2PC-SC-3/8 Manifold Mntd. Control Valves)

(Without Regulators and Gauges)



02, 2.5, 03, 05 and 10 Posidyne Clutch/Brakes (2 Pr. Inlet-3/8 Manifold Mounted Control Valve)

(Without Regulators and Gauges)

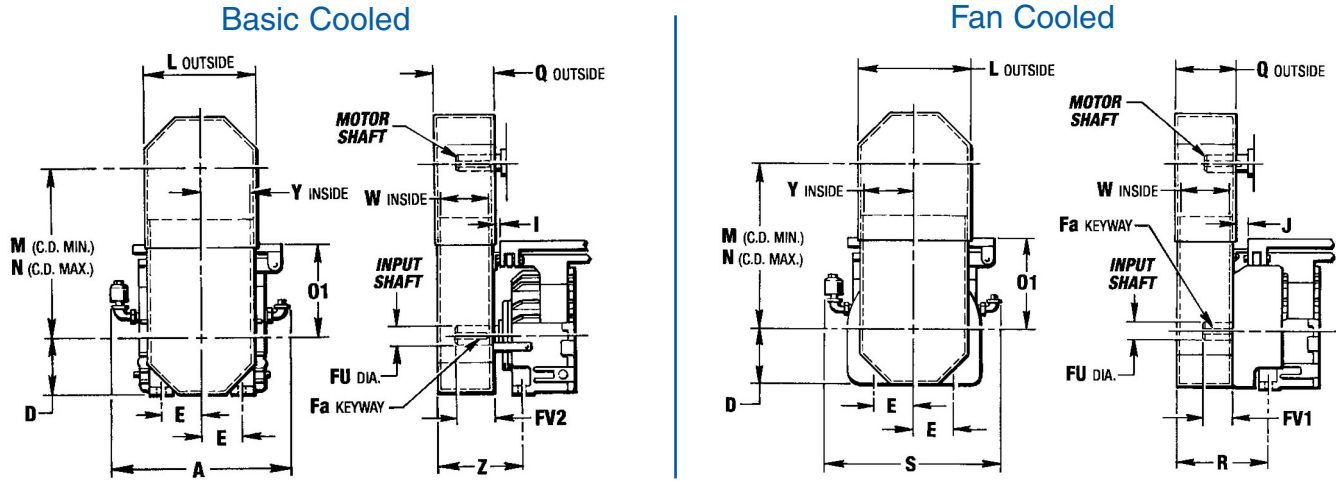


11 and 14 Posidyne Clutch/Brake (2PI-5/8 Manifold Mntd. Control Valve)
20 and 30 Posidyne Clutch/Brake (2PI-3/4 Manifold Mntd. Control Valve)

Dimensions - Posidyne Clutch/Brake (Inches)

Piggyback Mounting Options Sizes 02 to 10

2

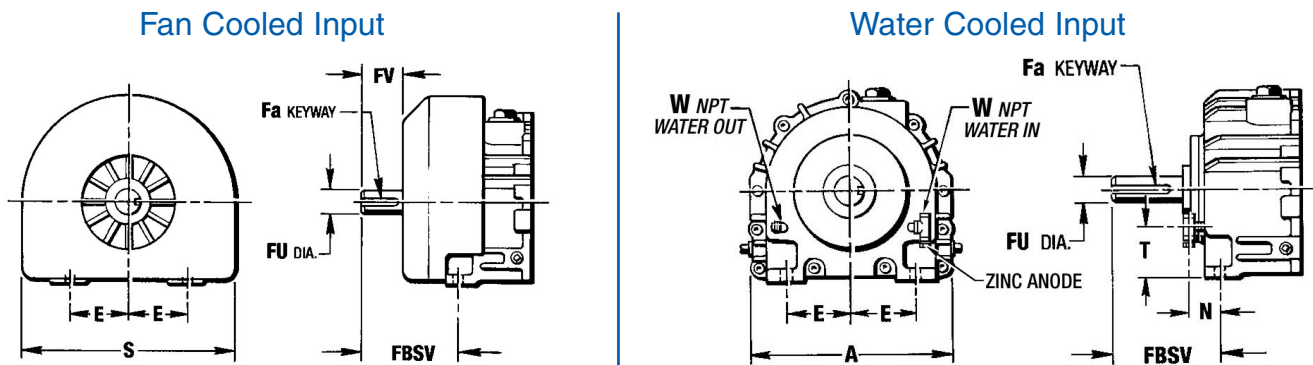


Size	Drive Dimensions								Piggyback Dimensions										Max Pulley Size		
	A	D	E	Fa	FU	FV1	FV2	S	I	J	L	M	N	O1	Q	R	W	Y	Z	Dia.	Width
02	---	4.0	3.5	1/4 x 1/8	1-1/8	1.0	1.0	---	---	---	7.31	12.31	13.31	7.12	3.16	5.38	2.50	3.12	5.38	6.00	2.00
2.5	---	4.37	3.31	5/16 x 5/32	1-3/8	2.13	2.13	---	1.25	1.25	7.62	11.5	15.19	8.44	4.31	4.75	4.19	3.69	4.75	5.39	3.00
03	11.5	4.5	3.31	5/16 x 5/32	1-3/8	2.38	3.5	11.5	.38	1.5	9.12	12.5	16.50	7.94*	4.68	6.62	4.38	4.44	5.5	6.84	3.25
05	11.5	6.5	3.5	3/8 x 3/16	1-5/8	2.94	4.0	11.5	1.5	2.56	9.12	12.5	16.50	7.94*	4.68	8.38	4.38	4.44	7.31	6.84	3.25
10	---	6.5	3.5	3/8 x 3/16	1-3/4	2.62	3.75	---	1.56	2.94	12.12	16.12	19.12	9.62	5.18	8.88	4.88	5.94	7.5	9.00	3.75

* This dimension changes to 8.44 with 254 thru 286 Frame Motors.
 Manifold Mounted Valve not available with Piggyback Mounting.

Dimensions are subject to change without notice. Certified Installation Drawings are available upon request.

Cooling Options Sizes 02 to 30



Size	Dimensions									
	A	E	Fa	FBSV	FU	FV	N	S	T	W
02	9.00	3.50	1/4 x 1/8	4.12	1.125	1.38	---	9.0	---	---
2.5	9.50	3.31	5/16 x 5/32	4.88	1.375	2.25	2.0	10.50	2.50	.38
03	10.25	3.31	5/16 x 5/32	5.31	1.375	2.31	2.0	11.5	2.50	.38
05	10.25	3.50	3/8 x 3/16	6.75	1.625	2.72	1.5	11.5	4.75	.38
10	12.50	3.50	3/8 x 3/16	6.62	1.750	2.88	2.0	14.0	4.00	.38
11	12.63	4.75	5/8 x 5/16	9.43	2.375	5.50	---	14.0	---	---
14	12.63	4.75	5/8 x 5/16	9.43	2.375	5.50	---	14.0	---	---
20	17.50	5.75	5/8 x 5/16	8.50	2.750	3.75	4.0	19.0	7.25	.50

2

OVERHUNG LOAD CAPACITY (Lbs. Pull)

Size	Input Shaft			Output Shaft					
	900 RPM	1200 RPM*	1800 RPM	900 RPM		1200 RPM		1800 RPM	
				Without Encoder	With Encoder	Without Encoder	With Encoder	Without Encoder	With Encoder
02	700	600	500	765	550	680	490	595	430
2.5	900	800	700	1020	805	935	740	850	670
03	1400	1350	1150	1785	1410	1700	1340	1490	1180
05	1400	1350	1150	1785	1410	1700	1340	1490	1180
10	1800	1700	1500	2550	2140	2380	2000	1960	1650
11	2200	2000	-----	3910	3280	3570	3000	-----	-----
14	2200	2000	-----	3910	3280	3570	3000	-----	-----
20	4100	3000	1800	4500	3780	4080	3430	3530	2970
30	9400	8500	-----	11900	-----	10900	-----	-----	-----

Overhung Loads are based on:

Bearing life L₁₀ 25,000 hrs. @ 20% duty.

At midpoint of shaft extension.

Standard male shaft diameters. (Not applicable to C-Face.)

CAUTION - Excessive overhung load will shorten bearing life and may exceed the capacity of the shaft to the point of failure.

Posidyne Available Options

(3) INPUT MODULE

	02	2.5	03	05	10	11	14	20	30
1	X	X	X	X	X	X	X	X	X
3	X	X	---	---	---	---	---	---	---
4	X	X	X	---	---	---	---	---	---
5	---	X	X	---	---	---	---	---	---
7	X	X	X	X	X	---	---	---	---
9	X	X	X	---	---	---	---	---	---
A	X	X	X	---	---	---	---	---	---
B	---	X	X	---	---	---	---	---	---

(5) OUTPUT MODULE

	02	2.5	03	05	10	11	14	20	30
1	X	X	X	X	X	X	X	X	X
3	X	X	---	---	---	---	---	---	---
4	X	X	X	---	---	---	---	---	---
5	---	X	X	---	---	---	---	---	---
7	X	X	X	X	X	---	---	---	---
C	X	X	X	X	X	X	X	X	X
E	X	---	---	---	---	---	---	---	---

Posidyne Piggyback

Motor Option Availabilities

To limit the torque delivered to a drive and the physical size of the motor mounted on our piggyback drives, please use the following chart.

U-Fr	T-Fr	02	2.5	03	05	10
56	143T	X	---	---	---	---
56	145T	X	---	---	---	---
182	182T	X	X	X	---	---
184	184T	X	X	X	---	---
213	213T	---	X	X	X	---
215	215T	---	X	X	X	---
254U	254T	---	---	X	X	---
256U	256T	---	---	X	X	---
284U	284T	---	---	---	X	X
286U	324T	---	---	---	X	X
324U	326T	---	---	---	---	X
326U	326T	---	---	---	---	X
364U	364T	---	---	---	---	X
365U	365T	---	---	---	---	X

(4) CONTROL LOGIC

	02	2.5	03	05	10	11	14	20	30
S	X	X	X	X	X	X	X	X	X
A	X	X	X	X	X	X	X	X	X
B	X	X	X	X	X	X	X	X	---
C	X	X	X	X	X	X	X	X	X
D	X	X	X	X	X	X	X	X	X
E	---	X	X	X	X	X	X	X	X
F	---	X	X	X	---	---	---	---	---
G	---	X	X	X	---	---	---	---	---
P	X	X	X	X	X	X	X	X	X
J	---	X	X	X	---	---	---	---	---

(6) MOUNTING POSITION

All options available in all sizes.

(7) COOLING*

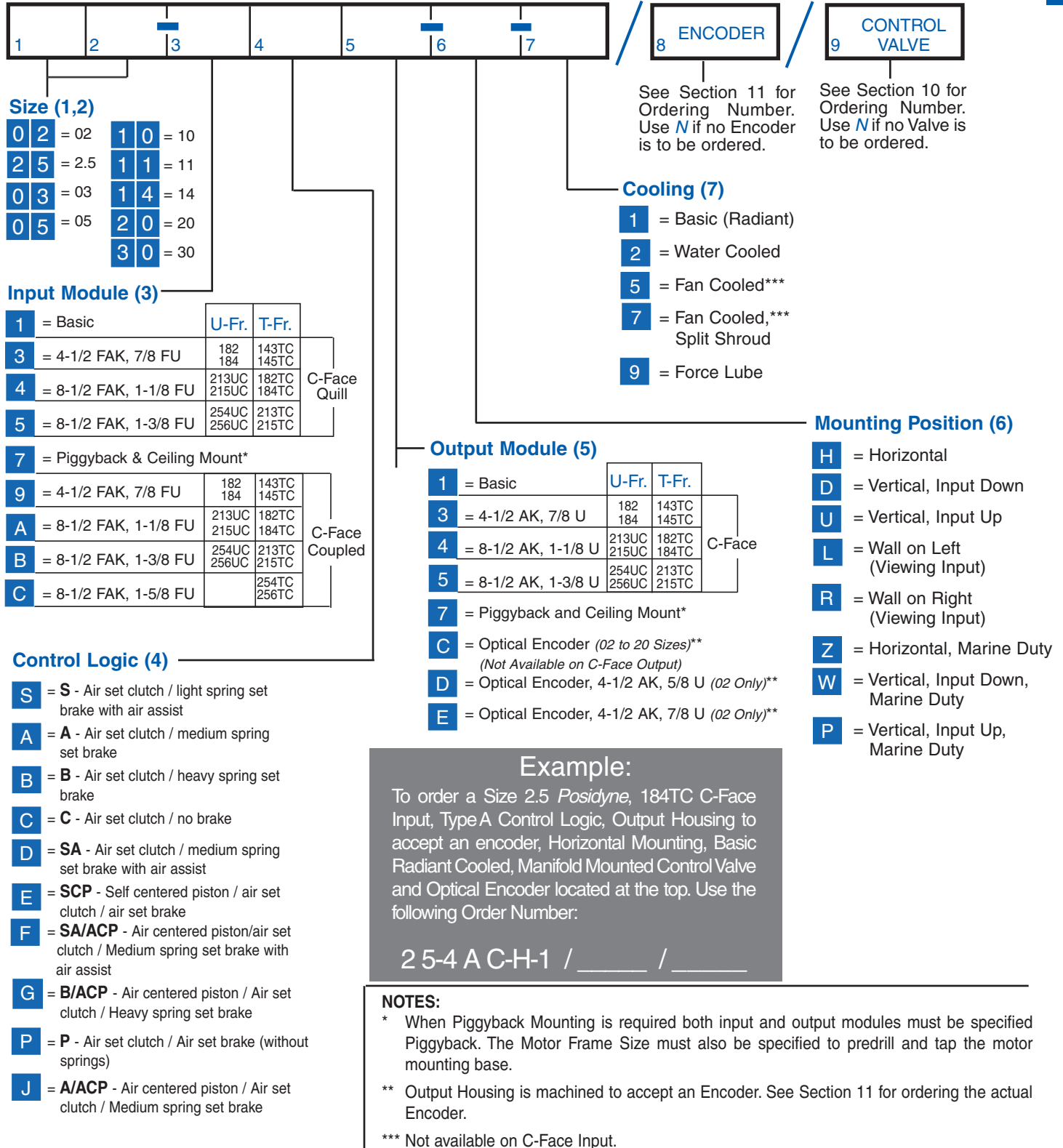
	02	2.5	03	05	10	11	14	20	30
1	X	X	X	X	X	---	---	X	X
2	---	X	X	X	X	---	---	X	---
5	X	X	X	X	X	X	X	X	X
7	---	X	X	X	X	X	X	X	X

* Fan cooling not available with C-Face input.

How to order your Posidyne Size 02-30 Clutch/Brake

Ordering System Chart

2



Section 3

Posistop X Class Brake



WASH DOWN

For wash down applications (USDA H-2) in food processing facilities, the optional wash down modification is available. This modification consists of nickel-plated shafts, stainless steel locking collar on the Clamped Split Quill, "Steel-It" epoxy coating, stainless steel fasteners, non-corrosive breather and sight gauge.

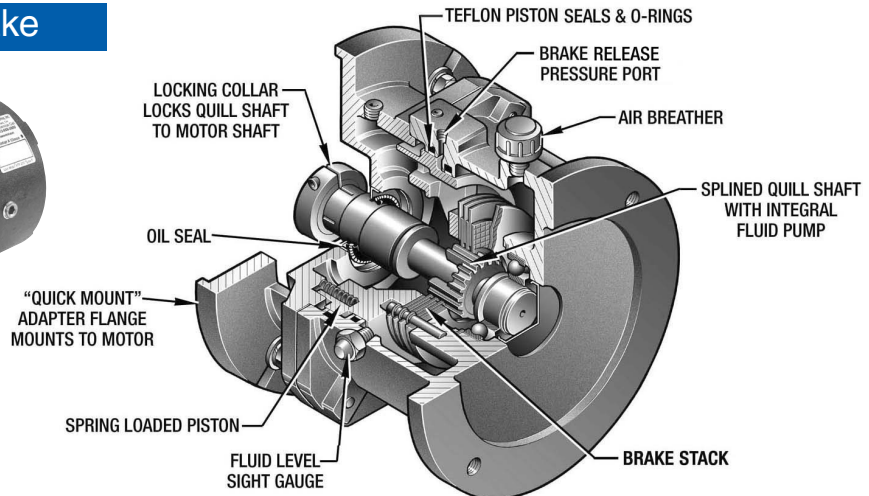
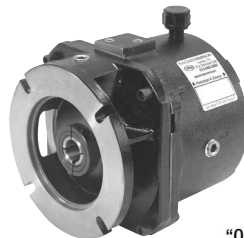
X-treme Performance - Now Value-Engineered

The *Posistop*® X Class Oil Shear Motor and Coupler Brakes are designed and tested to operate over 6 million trouble free cycles with only occasional oil changes and no adjustment - ever! This unheard of life expectancy allows the *Posistop*® X Class Motor and Coupler Brakes to be used on applications previously thought impossible to do using a brake.

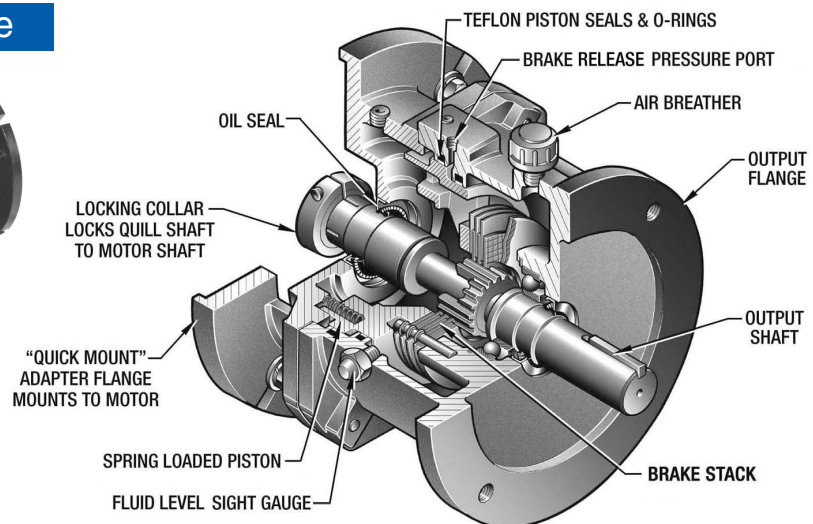
New *Posistop*® X Class Brakes let you eliminate the typical line stops, the frequent brake repairs and replacements. Here's the reliability you need for today's 24/7 manufacturing demands. Here's speed and precision that can let you run at higher cycle rates and quality levels, or design new machines for higher performance.

3

Motor Brake



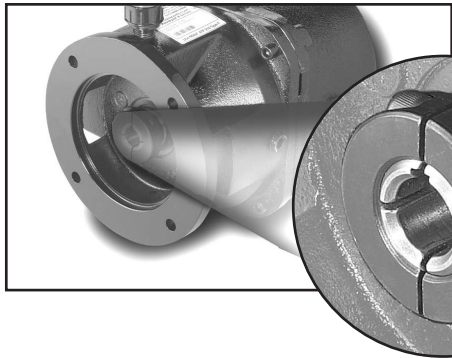
Coupler Brake



X Class Features:

- Packaged, fully assembled/tested
- Simplified double C-face or brake mounting
- Horizontal or vertical mounting
- Spring set, Air Release
- Multiple friction discs cooled in recirculating transmission fluid
- Low maintenance: annual oil change
- Hard-coat epoxy finish highly resistant to rust and chipping.
- 10X longer design life – designed & tested for over 6 million cycles
- Clamped-Split-Quill reduces keyway problems in aggressive applications

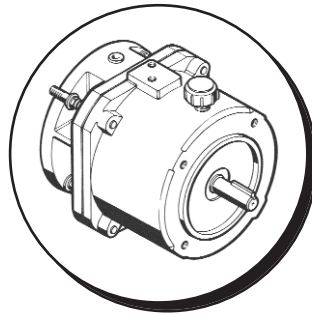
Simplified C-Face Mounting System



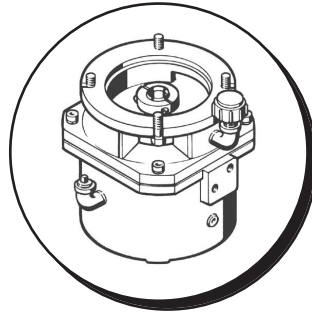
The *Posistop*® X Class C-face mount adds a new level of convenience to this classic configuration. An innovative Clamped-Split-Quill absolutely stops play that could deform the key and keyway in high-torque, rapid cycling applications. The new clamp design splits the input quill four ways at 90° intervals. A clamp collar fits over the quill to give 360° clamping effect when tightened down. The keyway is centered in one of the splits in the quill to securely lock the key on both sides.

Mounting Configurations

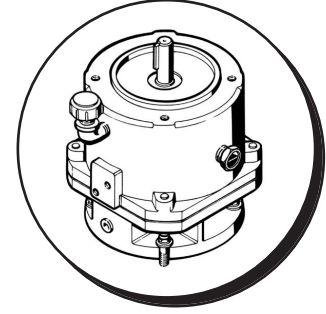
The *Posistop*® X Class brakes may be mounted in three configurations (horizontal, vertical input up and vertical input down) to allow the most flexibility in machine design.



HORIZONTAL



VERTICAL-INPUT UP



VERTICAL-INPUT DOWN

Unit Selection

The correct size X Class brakes can be selected using motor frame size and required brake torque. The following tables indicate the proper size X Class brake based on various motor frame sizes. Torque can be determined for moderate inertial loads using the formula:

$$\text{TORQUE (Lb. Ft.)} = \frac{\text{motor Hp} \times 5250 \times 1.5}{\text{RPM at Brake}}$$

Select a brake with a rating equal to or greater than the torque calculated. Several torque ratings are available in each brake size. Use the following tables to select the appropriate torque. Please contact your local distributor, rep or the factory for application assistance.

BRAKE SIZE	MOTOR FRAME SIZE										
	56	143T	145T	182T	184T	213T	215T	254T	256T	284T	286T
XB1	X	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
XB2	-----	X	X	-----	-----	-----	-----	-----	-----	-----	-----
XB3	-----	-----	-----	X	X	-----	-----	-----	-----	-----	-----
XB5	-----	-----	-----	-----	-----	X	X	X	X	-----	-----
XB6	-----	-----	-----	-----	-----	-----	-----	-----	-----	X	X

STATIC TORQUE (Lb. Ft.)

XB1		Spring Qty. (Light)			(2) Drive Plates	
		3	6	9		
(2) Friction Discs	4	8	12	(2) Drive Plates		
	10	20	30			
	Pr. to Release (PSI)					
XB2		Spring Qty. (Light)			(3) Drive Plates	
		3	6	9		
(3) Friction Discs	6	12	18	(3) Drive Plates		
	15	30	46			
	Pr. to Release (PSI)					

XB1 & XB2 TECHNICAL SPECIFICATIONS

	Thermal Rating (HP Sec/Min)	Max. KE per Engagement (Ft. Lbs.)	Piston Volume (Cu. In.)	Inertia WK ² (Lb. Ft. ²)	Max. Speed (RPM)	Weight (Lbs.)	Oil Capacity (Ounces)
XB1	21	7530	.9	0.0130	1800	31	28
XB2	39	11295					

3

XB3 TECHNICAL SPECIFICATIONS

XB3 STATIC TORQUE (Lb. Ft.)

		No. of Springs (Heavy)				
		3	6	9		
No. of Friction Discs	3	7	15	23	6	No. of Drive Plates
	4	10	20	30	8	
	5	12	25	38	6	
	17			34	50	
		Pressure to Release (PSI)				

	Thermal Rating (HP Sec/Min)	Max. KE per Engagement (Ft. Lbs.)	Piston Volume (Cu. In.)	Inertia WK ² (Lb. Ft. ²)	Max. Speed (RPM)	Weight (Lbs.)	Oil Capacity (Ounces)
42		11295	.9	.0174	1800	45	30
		15060		.0181			
		18825		.0189			

XB5 & XB6 STATIC TORQUE (Lb. Ft.)

		No. of Springs				
		3	6	9		
No. of Friction Discs	4	50	100	150	11	No. of Drive Plates
	5	65	130	185	10	
	6	80	160	240*	9	
	7	100	200	300*	8	
		16			32	48
		Pressure to Release (PSI)				

XB5 & XB6 TECHNICAL SPECIFICATIONS

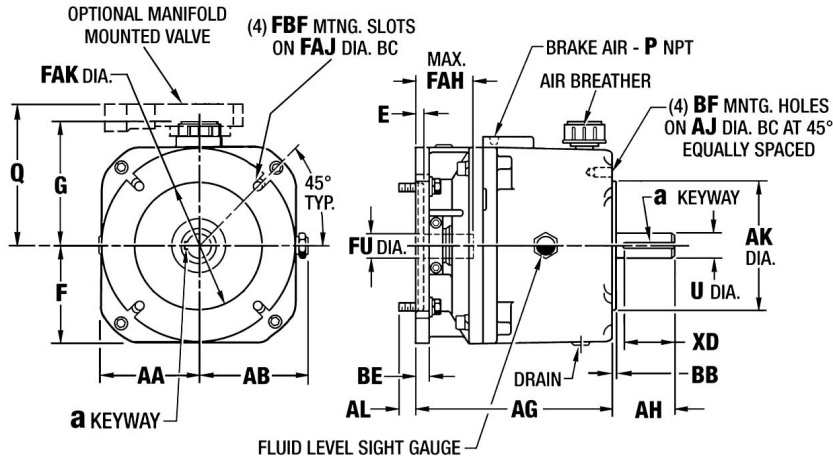
	Thermal Rating (HP Sec/Min)	Max. KE per Engagement (Ft. Lbs.)	Piston Volume (Cu. In.)	Inertia WK ² (Lb. Ft. ²)	Max. Speed (RPM)	Weight (Lbs.)	Oil Capacity (Ounces)
CF		29103	3.92	0.2011	1800	140	110
		36378					
		43654		0.2215			
		50930					

* These Torques only available with 1-5/8" & 1-7/8" Dia. Shafts.

CF = Consult Factory

3

Coupler Brake Dimensions



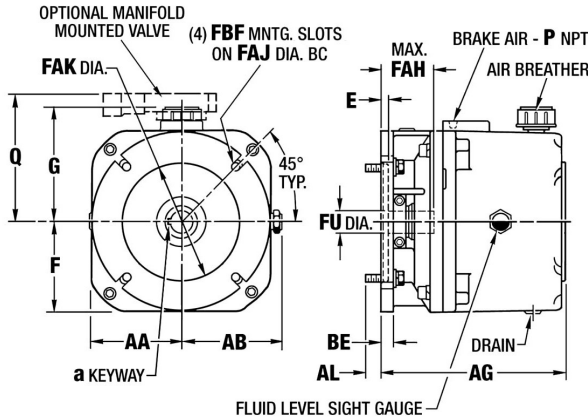
Brake Size	Coupler Brake Overall Dimensions (Inches)						
	AA	AB	AG	F	G	P	Q
XB1	3.51	3.77	7.00	3.44	4.50	1/8 NPT	4.94
XB2	4.44	4.44	8.46	4.44	5.08	1/8 NPT	4.94
XB5	5.00	5.00	11.45	5.50	6.64	1/4 NPT	-----
XB6	5.50	5.50					

Brake Size	Coupler Brake Input Dimensions (Inches)						
	AL	BE	E	FAH	FAJ	FAK	FU
XB1	.63	.50	.28	2.38	5.88	4.502	5/8
XB2						4.500	7/8
XB3	.57	.73	.19	2.94	7.25	8.502	1-1/8
XB5	.71	.69	-----	3.88	7.25	-----	*
XB6			-----	4.88	9.00	-----	*

* Available Input Bores XB5: 1-1/8, 1-3/8 & 1-5/8
XB6: 1-5/8 & 1-7/8

Brake Size	Coupler Brake Output Dimensions (Inches)							
	a	AH	AJ	AK	BB	BF	U	XD
XB1	3/16 x 3/32	2.06	5.875	4.50	.16	3/8-16	5/8	1.50
XB2		2.12					7/8	1.73
XB3	1/4 x 1/8	2.63	7.250	8.50	.25	1/2-13	1-1/8	2.00
XB5	1/4 x 1/8	2.75	7.250	8.50	.25	1/2-13	1-1/8	2.65
	5/16 x 5/32	3.12					1-3/8	3.00
	3/8 x 3/16	3.75					1-5/8	3.63
XB6	3/8 x 3/16	4.62	9.000	10.50			1-5/8	3.69
	1/2 x 1/4	4.37					1-7/8	3.62

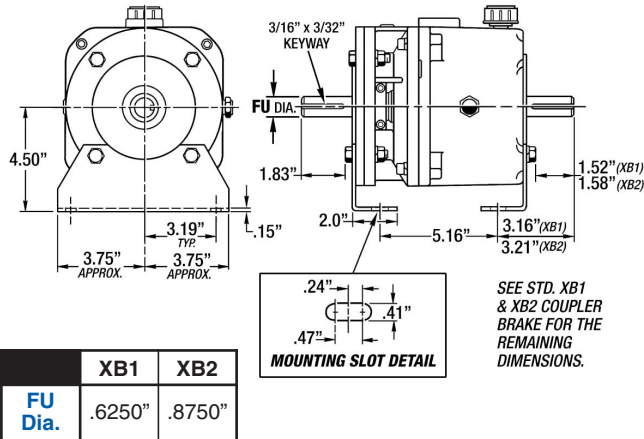
Motor Brake Dimensions



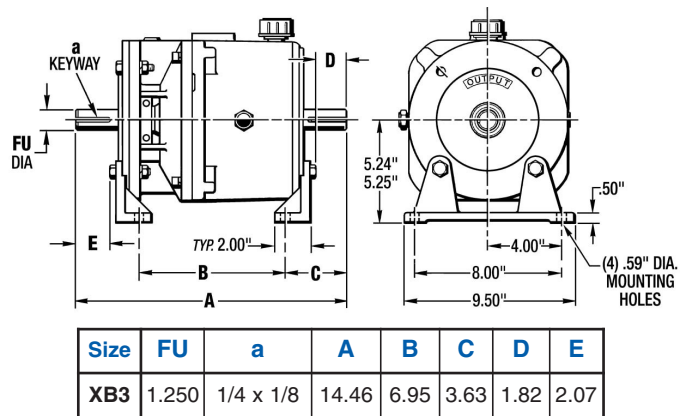
Brake Size	Motor Brake Dimensions (Inches)																			
	AA	AB	AG	AL	BE	E	F	G	FAH	FAK	FU	a	FBF	FAJ	P	Q				
XB1	3.51	3.77	7.00	.63	.50	.28	3.44	4.50	2.38	4.50	5/8	3/16 x 3/32	7/16	5.875	1/8 NPT	4.94				
XB2	4.44	4.44	8.46	.57	.56	.73	4.44	4.50	2.94	8.50	7/8	1-1/8	1/4 x 1/8	9/16	7.250	1/8 NPT	4.94			
XB5	5.50	5.50	11.70	.71	.69	---	5.50	6.64	3.88	-----	1-1/8	1/4 x 1/8	1-3/8	5/16 x 5/32	9/16	7.250	1/4 NPT	-----		
																			1-5/8	3/8 x 3/16
																			1-5/8	3/8 x 3/16
XB6	5.50	5.50	---	---	---	---	---	---	4.88	-----	1-7/8	1/2 x 1/4			9.000	1/4 NPT	-----			

XB1, XB2, & XB3 Coupler Brake Dimensions (With Mounting Feet and Male Input Shaft)

Sizes XB1 and XB2



Sizes XB3



Accessories and Kits

3



To make the X Class Brakes adaptable to many applications, several accessories are available.

Mounting Foot Kit

A foot kit is available for the Coupler Brake. The foot kit includes two feet that bolt onto the brake. They are made of heavy gauge steel XB1 and XB2, or cast iron XB3, and hard coat epoxy coated.

Male Input Shaft Assembly

For applications where a belt drive may be required on the input, an input shaft assembly is available to convert the quill input to an extended shaft. It consists of a mounting plate with a bearing and stainless steel shaft that bolts to the C-Face mounting flange. The shaft is then locked into the Split Clamped Quill.

Manifold Mounted Valve

Add the convenience and performance of a Manifold Mounted Valve. Mounting the valve directly on the unit eliminates extra plumbing, improves response time, increases cycle rate, and improves positioning accuracy.

Foot Mounting Kit

XB1 & XB2 Foot Kit (Pair of feet) . . . . .	.02-X1-FFKIT
XB1 & XB2 Foot Kit Washdown . . . . .	.02-X1-FFKITW (Steel It Epoxy)
XB3 Foot Kit (Pair of feet) . . . . .	.02-X4-FFKIT
XB3 Foot Kit Washdown . . . . .	.02-X4-FFKITW (Steel It Epoxy)

Extended Input Shaft Assembly

Input Shaft Ass'y. XB1 5/8" shaft . . . . .	.02-X1-IA-KIT
Input Shaft Ass'y. XB1 5/8" Shaft, Washdown . . . . .	.02-X1-IA-KITW
Input Shaft Ass'y. XB2 7/8" Shaft . . . . .	.02-X2-IA-KIT
Input Shaft Ass'y. XB2 7/8" Shaft, Washdown . . . . .	.02-X2-IA-KITW
Input Shaft Ass'y. XB3 1-1/8" Shaft . . . . .	.02-X3-IA-KIT
Input Shaft Ass'y. XB3 1-1/8" Shaft, Washdown . . . . .	.02-X3-IA-KITW

Pneumatic Control Valves

Control Valve, 434A Series, Manifold Mounted 120 VAC/60Hz, 1.0 Cv . . . . .	.09-56-A3NN-00
Control Valve, 434A Series, Manifold Mounted 24 VDC, 1.0 Cv . . . . .	.09-56-A1NN-00
Control Valve, 35A Series, A logic, 120 VAC/60Hz, .25 Cv, Ship Loose . . . . .	.01-56-147-08
Control Valve, 35A Series, A logic, 7.3 watt 24 VDC, .21 Cv, Ship Loose . . . . .	.01-56-148-08

Note: All valves are washdown duty

How To Order Your Posistop X Class Motor or Coupler Brake

Posistop X Class Brake

Unit Size (1)

- 1 = Size 1
- 2 = Size 2
- 3 = Size 3
- 5 = Size 5
- 6 = Size 6

Input Module (2)

	Motor Frame	
2 = 5/8" U, 4-1/2" AK	56C	XB1 & XB2
3 = 7/8" U, 4-1/2" AK	143TC, 145TC	XB1 & XB2
4 = 1-1/8" U, 8-1/2" AK	182TC, 184TC	XB3, XB5
5 = 1-3/8" U, 8-1/2" AK	213TC, 215TC	XB5
6 = 1-5/8" U, 8-1/2" AK	254TC, 256TC	XB5
7 = 1-5/8" U, 10-1/2" AK	284C, 286C	XB6
8 = 1-7/8" U, 10-1/2" AK	284TC, 286TC	XB6

Spring Set Brake (3)

Torque (5,6,7) Lb. Ft.
Example:
6 Lb. Ft. = **006**
12 Lb. Ft. = **012**

Output Module (4)

	Motor Frame	
0 = Motor Brake		
2 = 5/8" U, 4-1/2" AK	56C	XB1 & XB2
3 = 7/8" U, 4-1/2" AK	143TC, 145TC	XB1 & XB2
4 = 1-1/8" U, 8-1/2" AK	182TC, 184TC	XB3, XB5
5 = 1-3/8" U, 8-1/2" AK	213TC, 215CT	XB5
6 = 1-5/8" U, 8-1/2" AK	254TC, 256TC	XB5
7 = 1-5/8" U, 10-1/2" AK	254TC, 256TC	XB6
8 = 1-7/8" U, 10-1/2" AK	284TC, 286TC	XB6

Options (9)

- N = None**
- * D = Vert. Input Down
- * U = Vert. Input Up

** N is Horizontal mounting for XB5 & XB6
* Req'd. for XB5 & XB6. All others use N

Package Type (8)

- S = Standard
- F = Food Grade, Fluid (USDA H-2)
- W = Washdown, Plated Shafts, SS Hardware, Steel-It Epoxy Paint, Food Grade Fluid (USDA H-2)
- E = Washdown, Plated Shafts, SS Hardware, White Epoxy Paint, Food Grade Fluid (USDA H-2)

NOTE: Accessories and Kits shown above must be ordered separately.

Section 4 Posistop Motor & Coupler Brakes

The Problem and the Solution...

The Problem - Heat Buildup

Heat buildup, the mortal enemy of electric motors can destroy conventional motor brakes. Although heat is the natural product of the braking process, increased starts and stops of the electric motor creates intense heat in conventional brake devices. Often heat buildup damages the brake as well as the electric motor - and frequently causes failure of the entire system. This can mean increased downtime - as well as higher maintenance costs.

Conventional brake devices can take the heat from industrial motors, but they sacrifice friction material with each stop. They deteriorate with repeated use. Even though the motor is spared the stress of excessive braking heat, the brakes require routine maintenance such as coil and friction material replacement .

The result of heat buildup - Breakdowns.

Dry brakes have a short life, suffer from increased wear and may cause downtime losses that come from frequent maintenance and replacement.

The Solution - Posistop Brakes

Posistop Oil Shear Brakes are designed to dissipate the heat buildup that destroy conventional braking devices. The **Posistop** absorbs the energy generated by the braking action and controls the heat buildup - thus providing greater reliability and repeatability, as well as heat dissipation.

Unlike conventional motor brakes, the **Posistop** is a multiple surface device that operates on a spring activated, pressure release system. Its' multiple disc stack and internal oil pump helps to eliminate the need to replace coils and friction material - and reduce the heat on any one friction surface.



Benefits...

- Long Service Life.
- Low Noise Level.
- Low Maintenance.
- Easy Service.
- Self Adjusting - No Linkages
- Energy Efficient.

Features...

- Totally Enclosed.
- High Heat Dissipation with Rugged Cast-Finned Housing.
- Multiple Spring Set Brake with Multiple Friction Surfaces.
- NEMA C-Face Mounting.
- Integral Oil Pump for Positive Oil Circulation.
- Air or Hydraulic Release.
- Low Cyclic Inertia

Standard Design Configurations...

The **Posistop** series of **Force Control** products is a Brake designed for stopping and holding. Many different configurations are available to fit a wide variety of applications. The **Posistop Brake** is available with air actuation. See **Section 5 - Magna Shear Motor Brakes** for electric actuated motor brakes.

4

Motor Brakes (MB Series)

The **Posistop Motor Brake** is designed to mount directly onto the back of a NEMA or IEC Frame Brakeless Brake Motor. They come in (8) eight basic sizes from 56 Frame through a 449T Frame size.

They range from 3 Lb. Ft. to 2030 Lb. Ft. Braking Torque.

The **MB Series Posistop Brakes** are spring set, air release units used on various applications requiring a spring-set brake.

(See Page 4.3)



These **Posistop "Oil Shear" Motor Brakes** are certified by the **American Bureau of Shipping (ABS)** under ABS Product Design Assessment (PDA) Certificate # 02-HS310430-PDA and Manufacturing Assessment # 02JE305084-X.

They are ideal for a wide variety of heavy-duty and high-torque applications, which are common in the Shipping Industry, such as **Winches, Windlasses, Cranes and Conveyors for Docks and Shipboard Applications.**



Assembled Brake Motor (ABM)

The same unit as above already mounted on a Drive Motor, ready to use, is called the **Assembled Brake Motor**. The **ABM** is available in horsepower ranging from 1/4 HP up to 400 HP and Torque Values from 3 Lb. Ft. to 2030 Lb. Ft. A large variety of motor types and styles can be furnished in U and T frames.

(See Page 4.7)

Posistop Coupler Brakes (Double C-Face)

The **Posistop Coupler Brake** has a C-Face mounting on both ends. This allows the brake to be mounted on the drive end of a C-Face motor, which then can be connected to a C-Face Input Reducer.

Using the **Posistop Coupler Brake** allows the use of a standard C-Face Drive Motor rather than an expensive and often difficult to find brakeless brake motor.

Posistop Coupler Brakes are available in sizes for 56 Frame through 365TS Frame Drive Motors. They have Torque Ranges from 3 Ft.Lbs. to 450 Ft. Lbs.

(See Page 4.13)

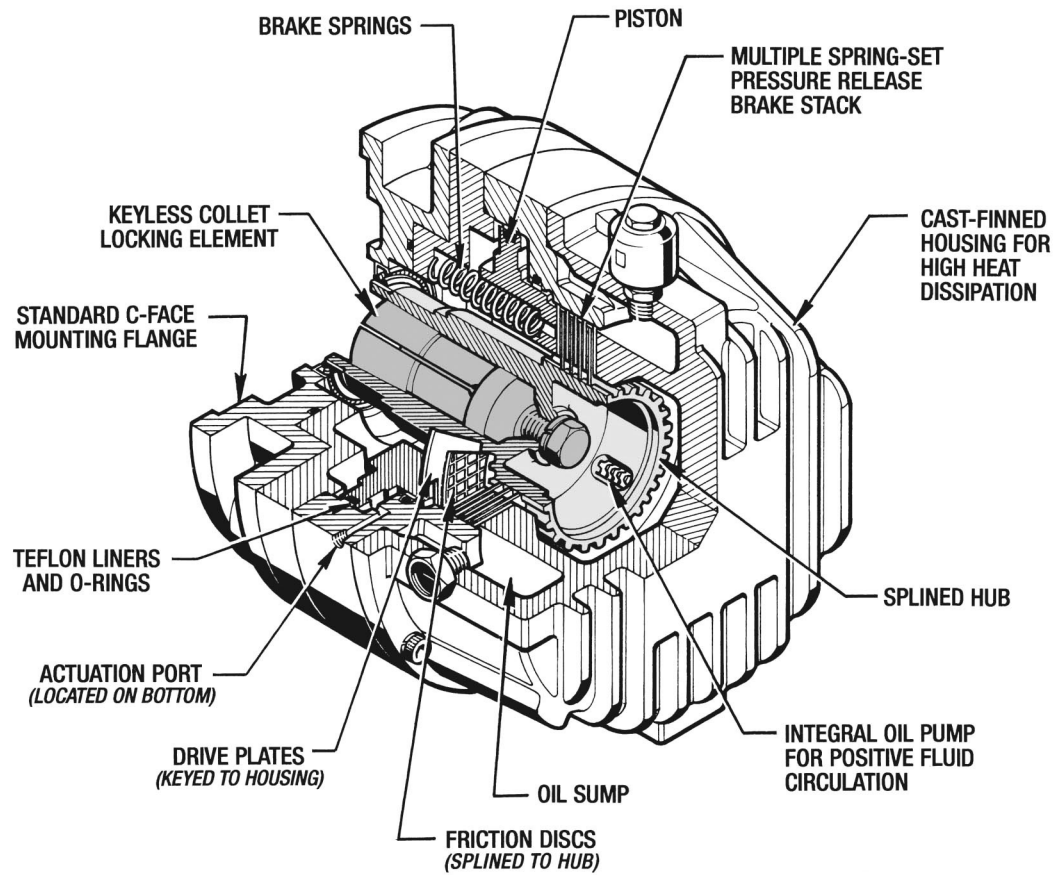




Posistop Motor Brake (MB Series)

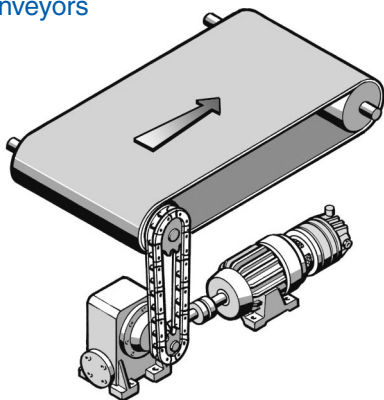
The **Posistop Motor Brake** is available as a motor mounted unit. This Motor Brake is designed to fit brakeless brake motor frame sizes 56 to 449T. It also comes complete with the motor. (See ABM - Assembled Brake Motor) The **Posistop Motor Brake** is designed with the same proven oil shear technology which includes the patented fluid recirculation system used in the **Posidyne Clutch/Brake Units** for smooth precise stops and long service life. The rugged cast iron and aluminum, totally enclosed, housings provide high heat dissipation and protects the multiple friction surfaces from hostile environments.

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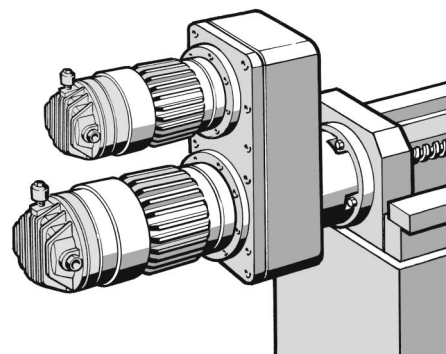


Typical Applications

Conveyors

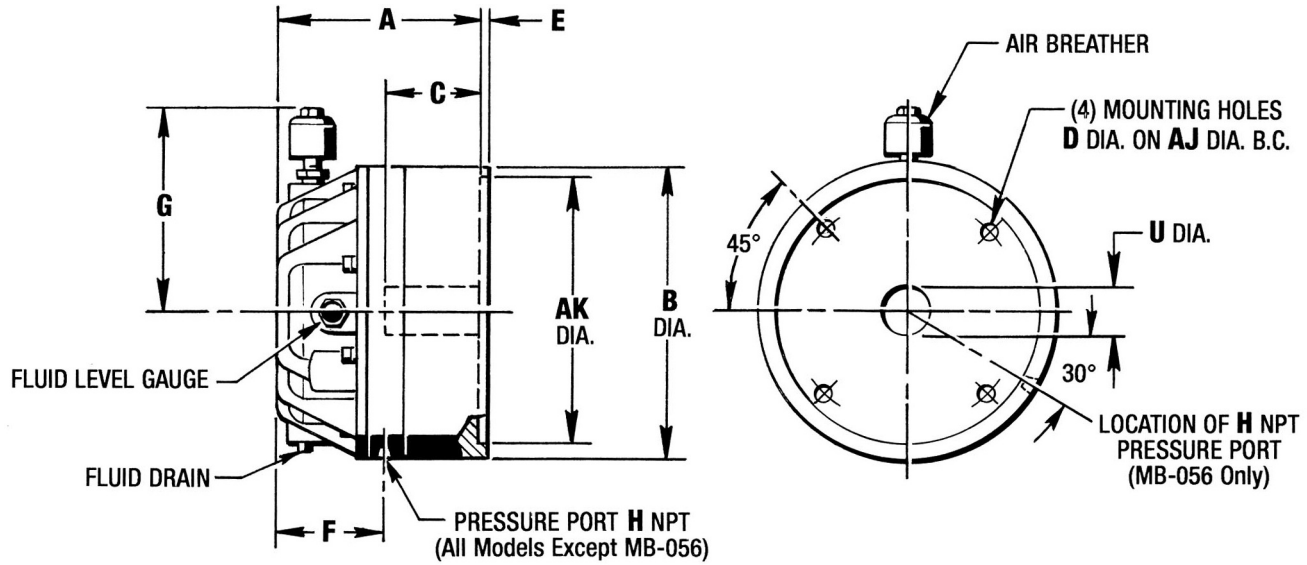


Ball Screw Feed & Traverse Drives



Posistop Motor Brake Dimensions (Inches)

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BRAKE SIZE	DIMENSIONS (Inches)											FLUID CAP.	WEIGHT (Lbs.)	
	A	B	C		D Dia.	E	F	G	H (NPT)	U* Dia.	AJ Dia.			AK Dia.
			Min.	Max.										
MB-056	4.81	6.63	1.38	2.13	.41	.25	1.88	4.63	1/8	.625	5.88	4.500	6 Oz.	15
MB-180	6.13	8.81	1.75	2.75			3.38	5.75		.875				
MB-210	6.13	8.81	1.75	2.62	.53	.19	3.38	5.75	1/8	.875	7.25	8.500	1 Qt.	45
MB-210L	6.88		2.50	3.50						1.125					1.375
MB-250	10.00	10.88	2.00	4.13	.53	.19	5.38	6.25	1/4	1.125	7.25	8.500	2 Qt.	100
MB-280							5.44			1.375					1.625	1.875	1.375	1.625	1.875	9.00	10.500	108
MB-320	10.63	12.88	2.50	4.63	.66	.19	6.06	7.25	1/4	1.375	11.00	12.500	5 Qt.	160
MB-440	17.61	16.75	4.00	5.00	.66	.22	4.54	9.76	3/4	2.125	14.00	16.000	5.5 Qt.	370
										2.375				
										2.875				
										3.375				

* Consult Factory for non-standard bore sizes and thru-shaft configurations.

Posistop Brake Operating Specifications

Posistop Motor Brakes (MB Series) may be assembled to obtain a broad range of torque ratings. The multiple disc and multiple spring design makes the **Posistop** a very flexible brake. How the stack is assembled determines the braking torque developed.

The following charts give an overview of all the combinations possible. **Standard Static Torque Ratings** are shown in bold blue numbers. Optional non-standard ratings are also shown in the Static Torque Rating Option Charts.

Static Torque (Lb. Ft.)	Dynamic Torque (Lb. Ft.)	Thermal Rating ($\frac{HP \text{ Sec.}}{Min.}$)	Max. KE per Engmt. w/Full Stack (Ft. Lbs.)	Piston Volume (In. ³)	Inertia WK ² (Lb.Ft. ²)
----------------------------	-----------------------------	--	--	--------------------------------------	--

Size 056

6	5.2	30	4650	.5	.009
9	7.8				
12	10.4				
18	15.6				

Sizes 180, 210 and 210L

20	17	25	6425	3	.034
30	26				
45	39				
60	52				
90	78				

* Torque not available with 7/8" dia. collet.

Sizes 250 and 280

75	65	50	18,500	5	.215
150	130				
225	194				
300	259				

* Torque not available with 1-1/8" or 1-3/8" dia. collet.

Size 320

120	104	70	18,500	6	.215
150	130				
200	173				
300	259				
450	388				

* Min.shaft diameter - 1-5/8" Δ Min. shaft dia. - 1-7/8"

Size 440

990	842	CF	CF	47.4	2.1
1340	1139				
1690	1437				
2030	1726				

NOTE: Maximum Speed - 1800 RPM, except Sizes 180 and 210 which is 3600 RPM in horiz. and vertical brake down position.

CF - Consult Factory

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Static Torque Rating Options

		No. of Discs			20	30	40	60	Min. PSI to Rel.
		1	2	3					
Qty. of Springs	2	2	4	6					
	3	3	6	9					
	4	4	8	12					
	6	6	12	18					
		No. of Plates							
		8	6	4					

Static Torque Rating Options

		No. of Discs			20	28	35	51	Min. PSI to Rel.
		1	2	3					
Qty. of Springs	2	10	20	30					
	3	15	30	45					
	4	20	40	*60					
	6	30	60	*90					
		No. of Plates							
		7	6	4					

Static Torque Rating Options

		No. of Discs					20	28	35	51	Min. PSI to Rel.
		1	2	3	4	5					
Qty. of Springs	2	15	30	45	60	75					
	4	30	60	90	120	150					
	6	45	90	135	180	225					
	8	60	120	180	*240	*300					
		No. of Plates									
		11	10	8	7	6					

Static Torque Rating Options

		No. of Discs					20	28	35	51	Min. PSI to Rel.
		1	2	3	4	5					
Qty. of Springs	3	30	60	90	120	150					
	4	40	80	120	160	200					
	6	60	120	180	*240	*300					
	9	90	180	270	*360	Δ450					
		No. of Plates									
		11	10	8	7	6					

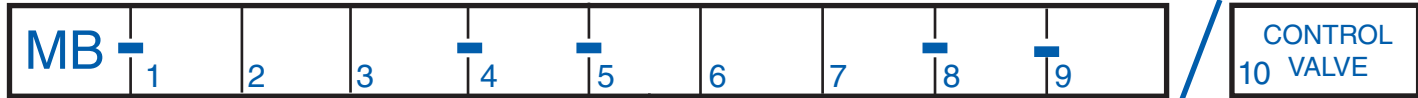
Static Torque Rating Options

		No. of Discs		20	30	40	60	Min. PSI to Rel.
		4	9					
Qty. of Springs	6	440	990					
	8	590	1340					
	10	750	1690					
	12	900	2030					
		No. of Plates						
		17	10					

How to order your Posistop Motor Brake

Ordering System Chart

Example: MB-210-S-090-1-E / _____



4

Posistop Size (1, 2 and 3)

0	5	6	= 056
1	8	0	= 180
2	1	0	= 210
* 2	1	L	= 210L
2	5	0	= 250
2	8	0	= 280
3	2	0	= 320
4	4	0	= 440

* 21L = 210 Long, for use on 254 and 256 Frames when torque requirements are 90 Lb.Ft. static torque or less.

Type (4)

Horizontal

Vertical

S = Std.	1 = Std.-Brake Up
T = Thru-Shaft **	2 = Std.-Brake Down
	3 = Thru Shaft-Brake Up
	4 = Thru Shaft-Brake Down

** Thru Shaft - Not available on MB-056 size.

Static Torque (Lb.Ft.) (5, 6 and 7)

0	0	2	= 2
0	0	3	= 3
0	0	4	= 4
0	0	6	= 6
0	0	8	= 8
0	0	9	= 9
0	1	0	= 10
0	1	2	= 12
0	1	5	= 15
0	1	8	= 18
0	2	0	= 20
0	3	0	= 30
0	4	0	= 40
0	4	5	= 45
0	6	0	= 60
0	7	5	= 75
0	8	0	= 80
0	9	0	= 90
1	2	0	= 120
1	3	5	= 135
1	5	0	= 150
1	6	0	= 160
1	8	0	= 180
2	0	0	= 200
2	2	5	= 225
2	4	0	= 240
2	7	0	= 270
3	0	0	= 300
3	6	0	= 360
4	4	0	= 440
4	5	0	= 450
5	9	0	= 590
7	5	0	= 750
9	0	0	= 900
9	9	0	= 990
D	4	0	= 1340
G	9	0	= 1690
L	3	0	= 2030

CONTROL VALVE

See Section 10 for Ordering Number. Use N if no Valve is to be ordered.

Encoder/Tach. (9)

E = Encoder
T = Tachometer
N = None

Shaft Dia. (8)

A = 5/8"
0 = 7/8"
1 = 1-1/8"
2 = 1-1/4"
3 = 1-3/8"
5 = 1-5/8"
7 = 1-7/8"
C = 2-1/8"
D = 2-1/4"
E = 2-3/8"
J = 71/80*
K = 90/100*
L = 112/132S*
M = 132M/160M*
N = 160L/225*

* Sew Eurodrive Metric Frame Motors.

Posistop Type & Shaft Dia. Availabilities

Type (4)

	056	180	210	210L	250	280	320	440
S	X	X	X	X	X	X	X	X
T	----	X	X	X	X	X	X	X
1	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X
3	----	X	X	X	X	X	X	X
4	----	X	X	X	X	X	X	X

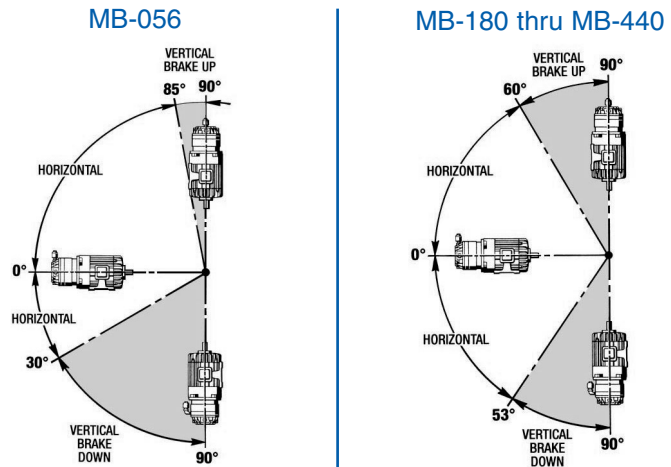
Shaft Diameter (8); FU

FU	056	180	210	210L	250	280	320	440
5/8	X ¹	----	----	----	----	----	----	----
7/8	X ¹	X ³	X ³	X ³	----	----	----	----
1-1/8	----	X	X	X	X	X	----	----
1-3/8	----	X ²	X ²	X ²	X	X	X	----
1-5/8	----	----	----	----	X ²	X ²	X	----
1-7/8	----	----	----	----	X ²	X ²	X	----
2-1/8	----	----	----	----	----	----	----	X ²
2-3/8	----	----	----	----	----	----	----	X ²

NOTES: 1 - Not available with thru-shaft configuration.
 2 - Consult factory for thru-shaft configuration.
 3 - Must be 45 Ft.Lbs. or less.

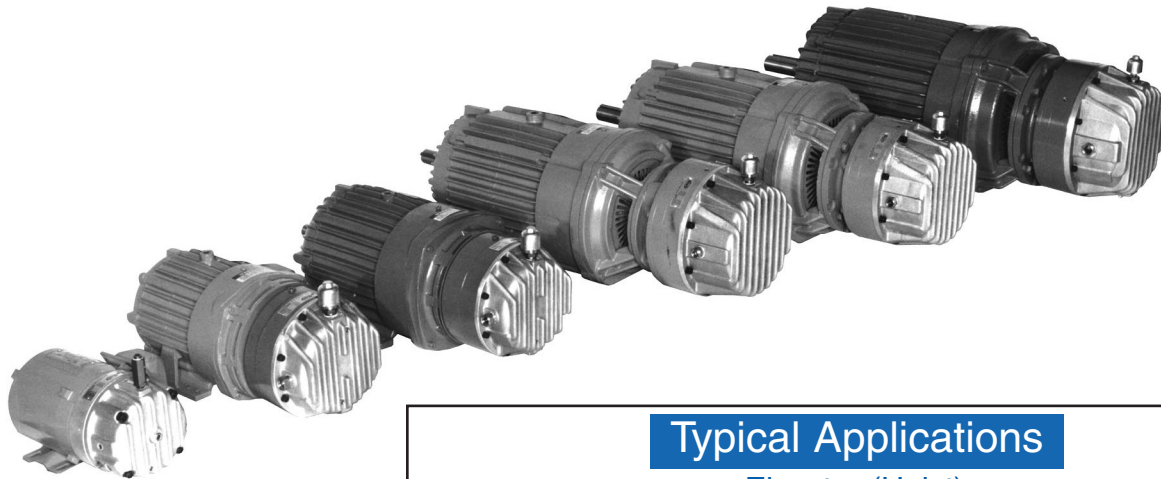
Horizontal / Vertical Mounting

The illustration below shows when it is necessary to specify **Vertical Mounting** when you know the mounting angle of the **Posistop Brake**.



Assembled Brake Motor (ABM)

The **ABM** consists of a motor with a **Posistop Motor Brake** assembled and ready to use. The **ABM** is available in many sizes, types and torque ranges up to 2030 Lb.Ft. By specifying the **Posistop ABM**, complete motor and brake assembly, installation time is reduced to simply mounting the motor and connecting the air supply.



4

Standard Features:

- 13 Different Std. HP Ratings
- 1800 & 1200 RPM Motors
- 8 *Posistop* Brake Sizes
- 38 Torque Ratings
- 12 Assembly Configurations
- 43 Motor Frame Sizes



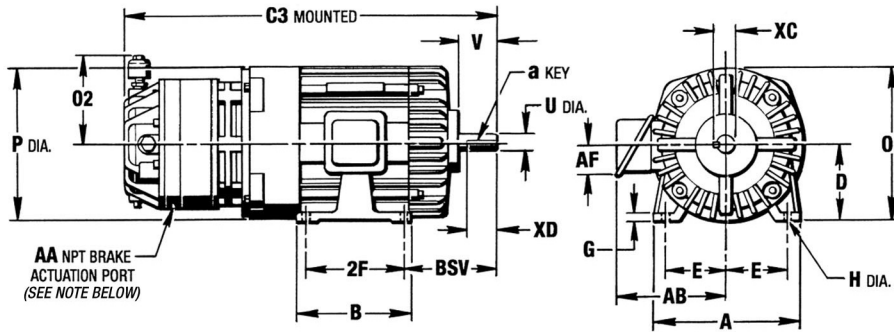
ABM units are pre-assembled to your specified torque ratings and configuration, filled with the proper amount of fluid and cycle tested ready for quick installation.

Typical Applications

Elevator (Hoist)

Tap Heads

Posistop ABM Brake Dimensions (Inches)



4

Dimensions are subject to change without notice. Certified Installation Drawings are available upon request.

Frame Size	Brake Size	Overall Dimensions							Foot Mounting Dimensions							Shaft Dimensions					
		AB	AF	BSV	C3	O1	P	O2	A	B	D	E	2F	G	H	a	U	V	XC	XD	
56	056	5.94	1.80	4.62	16.25	6.81	6.53	4.62	6.5	4	3.5	2.06	3	.16	.34	3/16 x 3/32	5/8	1.94	.70	1.25	
56Z				4.75	16.50		6.88										7/8	2.19	.96	1.38	
U - F R A M E D R I V E M O T O R S																					
182U	056	7.19	2.06	5.0	20.94	9.25	9.0	4.62	9.0	6.62	4.5	3.75	4.5	.44	.41	3/16 x 3/32	7/8	2.06	.96	1.38	
184U													5.5								
182U	180	7.19	2.06	5.0	22.95	9.25	9.0	5.75	9.0	6.62	4.5	3.75	4.5	.44	.41	3/16 x 3/32	7/8	2.06	.96	1.38	
184U													5.5								
213U	210	9.41	2.62	6.5	26.44	10.62	10.5	5.75	10.5	8.12	5.25	4.25	5.5	.50	.41	1/4 x 1/8	1-1/8	2.81	1.24	2.00	
215U													7.0								
254U	210L	10.28	2.62	8.0	34.06	12.56	12.62	5.75	12.5	11.38	6.25	5.0	8.25	.68	.53	5/16 x 5/32	1-3/8	3.56	1.51	2.75	
256U													10.0								
254U	250	10.28	2.62	8.0	37.19	12.56	12.62	6.75	12.5	11.38	6.25	5.0	8.25	.68	.53	5/16 x 5/32	1-3/8	3.56	1.51	2.75	
256U													10.0								
284U	280	10.97	2.62	9.62	39.62	14.0	14.0	6.75	14.0	12.5	7.0	5.5	9.5	.75	.53	3/8 x 3/16	1-5/8	4.69	1.51	3.75	
286U													11.0								
324U	320	13.03	3.44	10.88	43.25	16.0	16.0	7.75	15.94	14.0	8.0	6.25	10.5	.88	.66	1/2 x 1/4	1-7/8	5.44	2.09	4.25	
326U													12.0								
364U	320	14.16	3.44	12.25	46.75	18.25	18.0	7.75	17.38	14.5	9.0	7.0	11.25	1.0	.66	1/2 x 1/4	2-1/8	6.19	2.34	5.0	
365U													12.25								
T - F R A M E D R I V E M O T O R S																					
143T	056	7.03	2.06	4.50	19.56	7.34	7.69	4.62	7.0	5.94	3.5	2.75	4.0	.38	.34	3/16 x 3/32	7/8	2.06	.96	1.38	
145T													5.0								
143T	180	7.03	2.06	4.50	20.88	7.34	7.69	5.75	7.0	5.94	3.5	2.75	4.0	.38	.34	3/16 x 3/32	7/8	2.06	.96	1.38	
145T													5.0								
182T	056	7.19	2.06	5.50	21.56	9.25	9.0	4.62	9.0	6.62	4.50	3.75	4.5	.44	.41	1/4 x 1/8	1-1/8	2.62	1.24	1.75	
180	22.88				5.75																
210	22.88				5.75																
184T	210	7.19	2.06	5.50	22.88	9.25	9.0	5.75	9.0	6.62	4.50	3.75	5.5	.44	.41	1/4 x 1/8	1-1/8	2.62	1.24	1.75	
213T	210	9.41	2.62	6.88	26.81	10.62	10.5	5.75	10.5	8.12	5.25	4.25	5.5	.50	.41	5/16 x 5/32	1-3/8	3.25	1.51	2.38	
210L	27.56				5.75																
250	30.69				6.75																
215T	210L	9.41	2.62	6.88	27.56	10.62	10.5	5.75	10.5	8.12	5.25	4.25	7.0	.50	.41	5/16 x 5/32	1-3/8	3.25	1.51	2.38	
250	30.69				6.75																
254T	210L	10.28	2.62	8.25	34.31	12.56	12.62	5.75	12.5	11.38	6.25	5.0	8.25	.69	.53	3/8 x 3/16	1-5/8	3.81	1.79	2.88	
250	37.44				6.75																
254T	250	10.28	2.62	8.25	37.44	12.56	12.62	6.75	12.5	11.38	6.25	5.0	8.25	.69	.53	3/8 x 3/16	1-5/8	3.81	1.79	2.88	
256T	250	10.28	2.62	8.25	37.44	12.56	12.62	6.75	12.5	11.38	6.25	5.0	10.0	.69	.53	3/8 x 3/16	1-5/8	3.81	1.79	2.88	
284T	280	12.03	3.06	9.38	40.00	14.0	14.0	6.75	14.0	12.50	7.0	5.5	9.5	.75	.53	1/2 x 1/4	1-7/8	4.44	2.09	3.25	
286T													11.0								
324T	320	13.03	3.50	10.5	42.88	16.0	16.0	7.50	15.94	14.0	8.0	6.25	10.5	.88	.66	1/2 x 1/4	2-1/8	5.06	2.34	3.88	
326T													12.0								
364T	320	15	4.12	11.75	46.25	18.25	18.0	7.50	17.38	14.50	9.0	7.00	11.25	1.0	.66	5/8 x 5/16	2-3/8	5.69		2.65	
365T													12.25								

NOTE:
 AA Actuation Port - Size 056, 180, 210 and 210L (1/8" NPT) ; Size 250, 280 and 320 (1/4" NPT)
 Dimensions can vary on motor mfg.

Posistop ABM Brake Dimensions (Continued) (Inches)

Frame Size	Brake Size	Overall Dimensions							Foot Mounting Dimensions							Shaft Dimensions					
		AB	AF	BSV	C3	01	P	02	A	B	D	E	2F	G	H	a	U	V	XC	XD	
U - F R A M E D R I V E M O T O R S																					
404U	440	16	4.12	13.75	58	20.5	20	9.76	19.38	16	10	8	12.25	1.25	0.81	5/8 x 5/16	2-3/8	6.94	2.646	5.50	
405U				13.75																	
404US				10.87	55								12.25								
405US				5	13.75																
444U		17	4.12	16.12	42	22.25	22	9.76	21.38	18.5	11	9	14.5	1.25	0.81	3/4 x 3/8	2-7/8	8.44	3.200	7.00	
445U				5	16.5																
444US				11.75	60								14.5								
445US				11.75	60								16.5								
T - F R A M E D R I V E M O T O R S																					
404T	440	16	4.12	13.88	58	20.5	20	9.76	19.38	16	10	8	12.25	1.25	0.81	3/4 x 3/8	2-7/8	7.06	3.200	5.62	
405T				13.75																	
404TS				10.88	55								12.25								
405TS				10.88	55								13.75								
444T		19.8	5.5	16	64.25	22.25	22	9.76	21.38	18.5	11	9	14.5	1.25	0.81	7/8 x 7/16	3-3/8	8.31	3.755	6.88	
445T				1	16								64.25								16.5
444TS				1	12.25								60.5								14.5
445TS				1	12.25								60.5								16.5
447T	25.7	6.94	16	66.36	24.22	26.28	9.76	21.5	28.25	11	9	20	1.25	0.81	7/8 x 7/16	3-3/8	8.50	3.755	6.88		
449T												1								20	25

4

Posistop ABM Brake Operating Specifications

Posistop Motor Brakes (ABM Series) may be assembled to obtain a broad range of torque ratings. The multiple disc and multiple spring design makes the **Posistop** a very flexible brake. How the stack is assembled determines the braking torque developed.

The following charts give an overview of all the combinations possible. **Standard Static Torque Ratings** are shown in bold blue numbers. Optional non-standard ratings are also shown in the Static Torque Rating Option Charts.

4

Static Torque (Lb. Ft.)	Dynamic Torque (Lb. Ft.)	Thermal Rating ($\frac{HP \text{ Sec.}}{Min.}$)	Max. KE per Engmt. w/Full Stack (Ft. Lbs.)	Piston Volume (In. ³)	Inertia WK ² (Lb.Ft. ²)
----------------------------	-----------------------------	--	--	--------------------------------------	--

Size 056

6	5.2	30	4650	.5	.009
9	7.8				
12	10.4				
18	15.6				

Sizes 180, 210 and 210L

20	17	25	6425	3	.034
30	26				
45	39				
60	52				
90	78				

* Torque not available with 7/8" dia. collet.

Sizes 250 and 280

75	65	50	18,500	5	.215
150	130				
225	194				
300	259				

* Torque not available with 1-1/8" or 1-3/8" dia. collet.

Size 320

120	104	70	18,500	6	.215
150	130				
200	173				
300	259				
450	388				

* Min.shaft diameter - 1-5/8" Δ Min. shaft dia. - 1-7/8"

Size 440

990	842	CF	CF	47.4	2.1
1340	1139				
1690	1437				
2030	1726				

NOTE: Maximum Speed - 1800 RPM, except Sizes 180 and 210 which is 3600 RPM in horiz. and vertical brake down position.

CF - Consult Factory

Static Torque Rating Options

		No. of Discs			20	30	40	60	Min. PSI to Rel.
		1	2	3					
Qty. of Springs	2	2	4	6					
	3	3	6	9					
	4	4	8	12					
	6	6	12	18					
		8	6	4					
		No. of Plates							

Static Torque Rating Options

		No. of Discs			20	28	35	51	Min. PSI to Rel.
		1	2	3					
Qty. of Springs	2	10	20	30					
	3	15	30	45					
	4	20	40	*60					
	6	30	60	*90					
		7	6	4					
		No. of Plates							

Static Torque Rating Options

		No. of Discs					20	28	35	51	Min. PSI to Rel.
		1	2	3	4	5					
Qty. of Springs	2	15	30	45	60	75					
	4	30	60	90	120	150					
	6	45	90	135	180	225					
	8	60	120	180	*240	*300					
		11	10	8	7	6					
		No. of Plates									

Static Torque Rating Options

		No. of Discs					20	28	35	51	Min. PSI to Rel.
		1	2	3	4	5					
Qty. of Springs	3	30	60	90	120	150					
	4	40	80	120	160	200					
	6	60	120	180	*240	*300					
	9	90	180	270	*360	Δ450					
		11	10	8	7	6					
		No. of Plates									

Static Torque Rating Options

		No. of Discs		20	30	40	60	Min. PSI to Rel.
		4	9					
Qty. of Springs	6	440	990					
	8	590	1340					
	10	750	1690					
	12	900	2030					
		17	10					
		No. of Plates						

Posistop ABM Size Specifications

Motor HP	Motor RPM	Frame Size			Posistop Size	Motor HP	Motor RPM	Frame Size			Posistop Size
		T	U	IEC				T	U	IEC	
1/4	1800	56	56	DT71K4	MB-056	40	1800	324T	364U	DV200L4	MB-320
	1200										
1/3	1800	56	56	DT71C4	MB-056	50	1800	326T	365U		MB-320
	1200										
1/2	1800	56	56	DT71D4	MB-056	60	1800	364T	405U		MB-320, MB-440
	1200										
3/4	1800	56	56	DT80K4	MB-056	75	1800	365T	444U		MB-440
	1200										
1	1800	143T	184U	DT80N4	MB-056, MB-180	100	1800	405T	445U		MB-440
	1200										
	1200			145T							
1-1/2	1800	145T	184U	DT90S4	MB-056, MB-180	125	1800	444T	445U		MB-440
	1200	182T									
2	1800	145T	184U	DT90L4	MB-056, MB-180	150	1800	445T			MB-440
	1200	184T	213U	DT100L6	MB-210						
3	1800	182T	213U	DT100LS4	MB-056, MB-210	200	1800	445T			MB-440
	1200	213T	215U	DV112M6	MB-210			1200	447T		
5	1800	184T	215U	DT100L4	MB-210	250	1800	445T			MB-440
	1200	215T	254U	DV132M6	MB-210, MB-210L, MB-250			1800	447T		
7-1/2	1800	213T	254U	DV132S4	MB-210, MB-210L, MB-250	300	1800	449T			MB-440
	1200	254T	256U	DV132ML6	MB-210L, MB-250			1200	447T		
10	1800	215T	256U	DV132M4	MB-210, MB-210L, MB-250	350	1800	445T			MB-440
	1200										
12-1/2	1800			DV132ML4	MB-210	400	1800	447T			MB-440
15	1800	254T	284U	DV160M4	MB-210, MB-250, MB-280			1800	449T		
	1200	284T	324U	DV160L6	MB-280, MB-320		1200	447T			
20	1800	256T	286U	DV160L4	MB-250, MB-280	350	1800	447T			MB-440
	1200	286T	326U	DV180L6	MB-280, MB-320			1800	449T		
25	1800	284T	324U	DV180M4	MB-280, MB-320	400	1800	447T			MB-440
	1200	324T	364U	DV200LS6							
30	1800	286T	326U	DV180L4	MB-320	400	1800	447T			MB-440
	1200	326T	365U	DV200L6							

4

NOTE: All IEC frame motors are TENV, 50% maximum duty.

Selection...

Selecting your ABM for your application may be accomplished by following five easy steps as you use the Ordering System Chart on page (4.12).

Many custom options are available. Please contact your local authorized distributor, area representative or the factory for any special needs and applications.

1. Determine the motor HP and RPM your specific application requires.
2. Determine the brake torque requirement of your application. (See Section 15 for procedure.)
3. Select the correct size of *Posistop* and torque setting from the Specification Tables on this page.
4. Determine the correct motor specification.
5. Determine the ABM mounting position.

How to order your Posistop ABM

Ordering System Chart

Example: ABM-5/1200-215T-210-045-T-F1 / _____

4



Posistop Size (3, 4 and 5)

0	5	6	= 056
1	8	0	= 180
2	1	0	= 210
2	1	L	= 210L
2	5	0	= 250
2	8	0	= 280
3	2	0	= 320
4	4	0	= 440

Static Torque (Lb.Ft.) (6, 7 and 8)

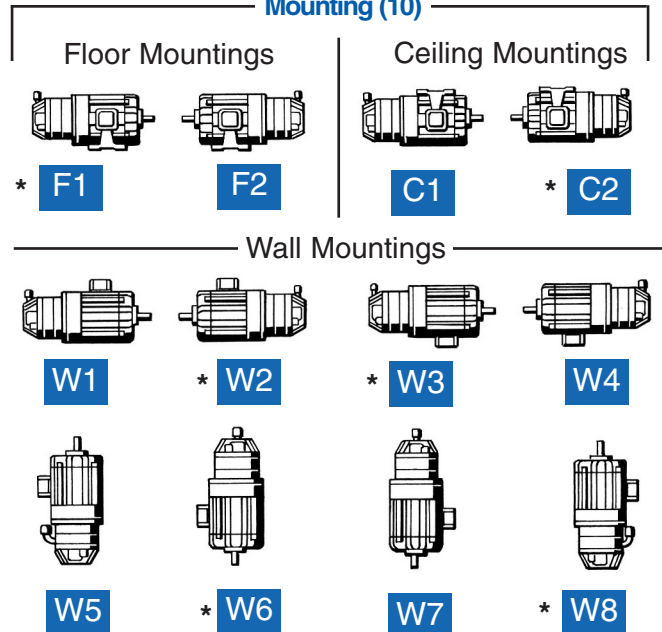
0	0	2	= 2
0	0	3	= 3
0	0	4	= 4
0	0	6	= 6
0	0	8	= 8
0	0	9	= 9
0	1	0	= 10
0	1	2	= 12
0	1	5	= 15
0	1	8	= 18
0	2	0	= 20
0	3	0	= 30
0	4	0	= 40
0	4	5	= 45
0	6	0	= 60
0	7	5	= 75
0	8	0	= 80
0	9	0	= 90
1	2	0	= 120
1	3	5	= 135
1	5	0	= 150
1	6	0	= 160
1	8	0	= 180
2	0	0	= 200
2	2	5	= 225
2	4	0	= 240
2	7	0	= 270
3	0	0	= 300
3	6	0	= 360
4	4	0	= 440
4	5	0	= 450
5	9	0	= 590
7	5	0	= 750
9	0	0	= 900
9	9	0	= 990
D	4	0	= 1340
G	9	0	= 1690
L	3	0	= 2030

Motor Specifications (9)

- 7EQ** = GM Std. Efficiency (U Frame)
- 7EH** = GM High Efficiency (U Frame)
- EM1** = Ford (U Frame)
- NPEM100** = Chrysler (U Frame)
- T** = T Frame
- IEC** = IEC Frame

See Section 10 for Ordering Number. Use **N** if no valve is ordered

Mounting (10)



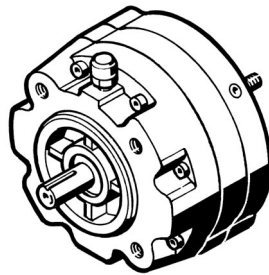
***NOTE:** Motors are standard in these arrangements and should be ordered with these conduit box locations whenever possible.



Posistop Coupler Brakes (Double C-Face)

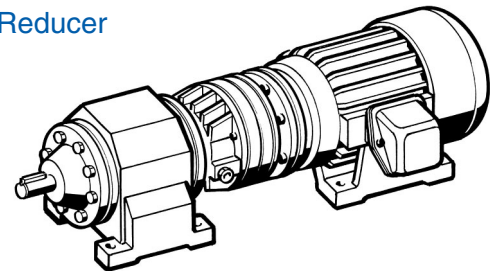
The **Coupler Motor Brake** is designed for indexing applications where cycle rates are too low to justify a clutch/brake (roughly less than 10 CPM) or in applications where the motor must reverse. The **Coupler Brake** utilizes a standard Nema C-Face motor driving through a durable, keyless collet connection. Common applications include palletizers, indexing conveyors, shrink wrappers package and general material handling equipment. The **Coupler Brakes** are rated from 6 Ft. Lbs. to 450 Ft. Lbs. of torque.

Standard Posistop Coupler Brakes



The Standard **Posistop Coupler Brake** has a C-Face register on both ends. This enables mounting the brake between a C-Face Motor and C-Face Reducer.

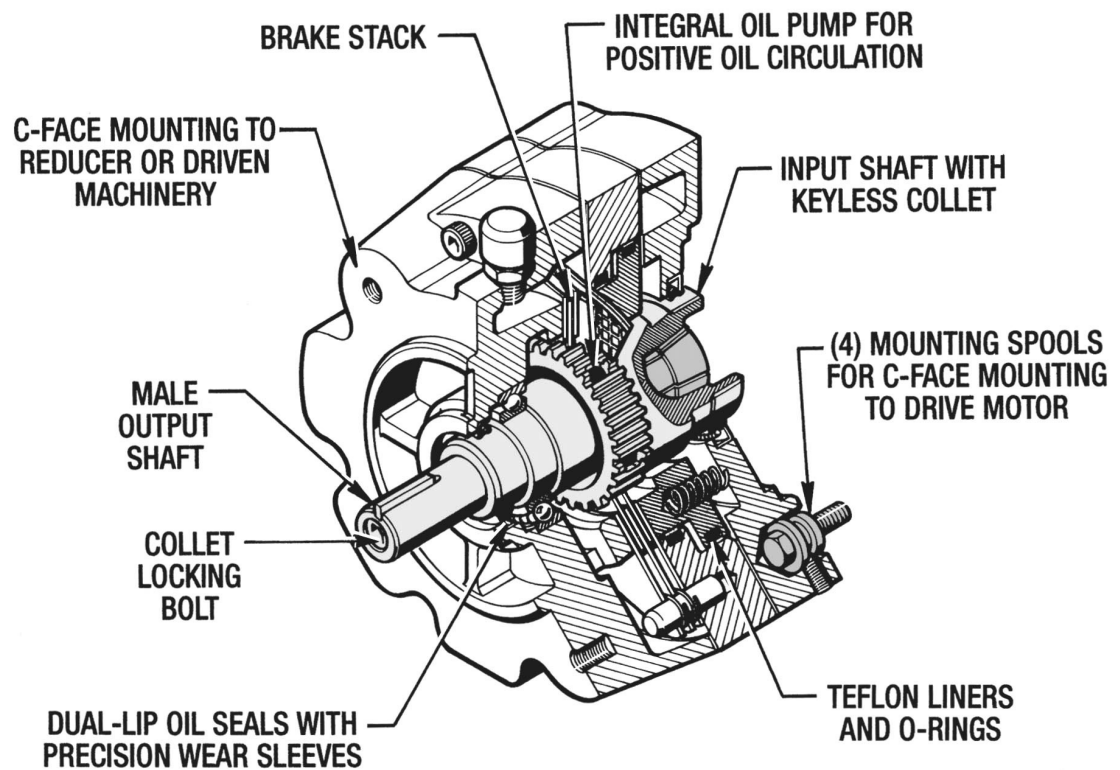
Posistop Coupler Brakes with Drive Motor and Gear Reducer



A complete package can be furnished including the gear reducer and motor. Force Control's application engineers will be glad to select the proper size components for a long service life in cycling applications.

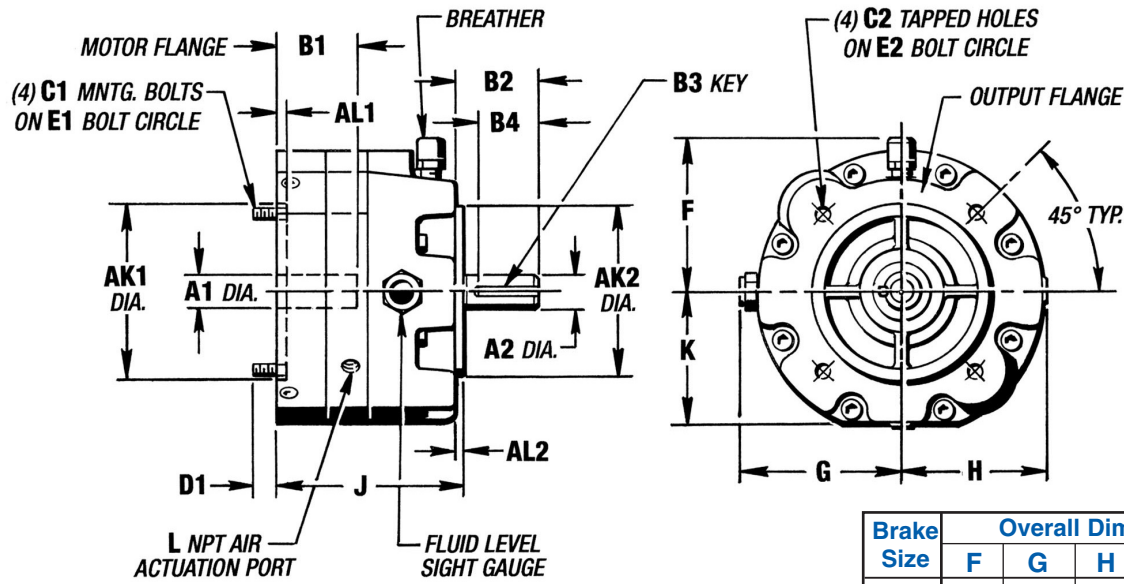
4

Posistop Coupler Brake Features



Standard Coupler Brake Dimensions (Inches)

4



	Brake Size					
	056	210	210L	250	280	320
Fluid Capacity	1 Pt.	1 Qt.	1 Qt.	2 Qts.	2 Qts.	5 Qts.
Weight (Lbs.)	15	45	45	100	108	160

Brake Size	Overall Dimensions					NPT L
	F	G	H	J	K	
056	4.12	4.38	3.84	5.00	3.38	1/8
210	5.80	4.50	4.50	6.52	4.78	1/8
210L	5.80	4.50	4.50	7.28	4.78	1/8
250	7.00	5.50	5.50	10.00	5.50	1/4
280	5.50	5.50	5.50	10.37	5.50	1/4
320	7.75	6.00	5.63	10.50	6.44	1/4

Brake Size	Motor Mounting Flange								Output Flange							
	A1	B1		C1	D1	E1	AK1	AL1	A2	B2	B3	B4	C2	E2	AK2	AL2
		Min.	Max.													
056	.625	1.44	2.00	3/8-16	.62	5.88	4.50	.25	.875	2.13	3/16	1.70	3/8-16	5.88	4.50	.18
	.875	1.38	2.13													
210	.875	1.75	2.75	1/2-13	.86	7.25	8.50	.19	.875	2.13	3/16	1.41	1/2-13	7.25	8.50	.25
	1.125								2.63	1/4	1.78					
	1.375								3.13	5/16	2.41					
210L	.875	2.50	3.50	1/2-13	.86	7.25	8.50	.19	.875	2.13	3/16	1.41	1/2-13	7.25	8.50	.25
	1.125								2.63	1/4	1.78					
	1.375								3.13	5/16	2.41					
	1.375								3.13	5/16	2.41					
250	1.125	1.63	3.88	1/2-13	.75	7.25	8.50	.19	1.125	2.63	1/4	1.75	1/2-13	7.25	8.50	.25
	1.375	1.88	4.00						1.375	3.50	5/16	2.75				
	1.625	2.00	4.00						1.625	4.00	3/8	3.25				
280	1.625	2.00	4.00	1/2-13	.75	9.00	10.50	.19	1.625	4.00	3/8	3.25	1/2-13	9.00	10.50	.25
	1.875	2.25	4.63						1.875	4.00	3/8	3.25				
320	1.625	2.50	4.88	5/8-11	.88	11.00	12.50	.19	1.625	3.00	3/8	1.88	5/8-11	11.00	12.50	.25
	1.875	2.88	4.88						1.875	5.12	1/2	3.50				

Posistop Coupler Brake Specifications

Posistop Coupler Brakes may be assembled to obtain a broad range of torque ratings. The multiple disc and multiple spring design makes the **Posistop Coupler Brake** a very flexible brake. How the stack is assembled determines the braking torque developed.

The following charts give an overview of all the combinations possible. Standard static torque ratings are shown in bold blue numbers. Optional non-standard ratings are also shown in the **Static Torque Rating Option Charts**.

Static Torque (Lb. Ft.)	Dynamic Torque (Lb. Ft.)	Thermal Rating (HP Sec./Min.)	Max. KE per Engmt. w/Full Stack (Ft. Lbs.)	Piston Volume (In. ³)	Inertia WK ² (Lb. Ft. ²)
----------------------------	-----------------------------	----------------------------------	---	--------------------------------------	--

Size 056

6	5.2	30	4650	1	.009
9	7.7				
12	10.3				
18	15.5				

Size 210 and 210L

20	17	25	6425	3	.034
30	26				
45	39				
60	52				
90	78				

Sizes 250 and 280

75	65	50	18,500	5	.215
150	130				
225	194				
300	259				

Size 320

120	104	25	6425	3	.034
150	130				
200	173				
300	259				
450	388				

NOTE: Maximum Speed - 1800 RPM, except Size 210 which is 3600 RPM in horizontal and vertical brake down position.

Static Torque Rating Options

		No. of Discs			
		1	2	3	
Qty. of Springs	3	4.5	9	15	Min PSI to Rel.
	4	6	12	20	
	6	9	18	30	
		No. of Plates			
		1	2		

Static Torque Rating Options

		No. of Discs				
		1	2	3		
Qty. of Springs	2	10	20	30	20	Min PSI to Rel.
	3	15	30	45	28	
	4	20	40	*60	35	
	6	30	*60	*90	51	
		No. of Plates				
		7	6	4		

* Torque not available with 7/8" dia. collet.

Static Torque Rating Options

		No. of Discs						
		1	2	3	4	5		
Qty. of Springs	2	15	30	45	60	75	20	Min PSI to Rel.
	4	30	60	90	120	150	28	
	6	45	90	135	180	225	35	
	8	60	120	180	*240	*300	51	
		No. of Plates						
		11	10	8	7	6		

* Torque not available with 1-1/8" or 1-3/8" dia. collet.

Static Torque Rating Options

		No. of Discs						
		1	2	3	4	5		
Qty. of Springs	3	30	60	90	120	150	20	Min PSI to Rel.
	4	40	80	120	160	200	28	
	6	60	120	180	240	300	35	
	9	90	180	270	*360	Δ450	51	
		No. of Plates						
		11	10	8	7	6		

* Min. shaft diameter - 1-5/8" Δ Min. shaft dia. - 1-7/8"

How to order your Posistop Coupler Brake?

Ordering System Chart

Example: CB-210-C-045-C-H-V7 / _____



4

Coupler Brake

Brake Size (1, 2, 3)

0	5	6	= 056
2	1	0	= 210
2	1	L	= 210L
2	5	0	= 250
2	8	0	= 280
3	2	0	= 320

Quill Input Shaft (4)

- A** = 5/8" Dia.
- B** = 7/8" Dia.
- C** = 1-1/8" Dia.
- D** = 1-1/4" Dia.
- E** = 1-3/8" Dia.
- F** = 1-5/8" Dia.
- G** = 1-7/8" Dia.

Output Shaft (8)

- A** = 5/8" Dia.
- B** = 7/8" Dia.
- C** = 1-1/8" Dia.
- D** = 1-1/4" Dia.
- E** = 1-3/8" Dia.
- F** = 1-5/8" Dia.
- G** = 1-7/8" Dia.

CONTROL VALVE

See Section 10 for Ordering Number. Use **N** if no valve is ordered.

Shaft Diameters Availability (4) and (8)

A1,A2	056	180	210	210L	250	280	320
5/8	X	---	---	---	---	---	---
7/8	X	X ¹	X ¹	X ¹	---	---	---
1-1/8	---	X	X	X	X	X	---
1-3/8	---	X	X	X	X	X	X
1-5/8	---	---	---	---	X	X	X
1-7/8	---	---	---	---	X	X	X

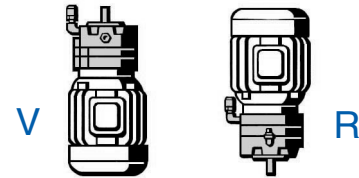
NOTE 1 - Must be 45 Lb.Ft. or less.

Static Torque (Lb.Ft.) (5, 6, 7)

0	0	2	= 2	0	3	0	= 30	1	6	0	= 160
0	0	3	= 3	0	4	0	= 40	1	8	0	= 180
0	0	4	= 4	0	4	5	= 45	2	0	0	= 200
0	0	6	= 6	0	6	0	= 60	2	2	5	= 225
0	0	9	= 9	0	7	5	= 75	2	4	0	= 240
0	1	0	= 10	0	8	0	= 80	2	7	0	= 270
0	1	2	= 12	0	9	0	= 90	3	0	0	= 300
0	1	5	= 15	1	2	0	= 120	3	6	0	= 360
0	1	8	= 18	1	3	5	= 135	4	5	0	= 450
0	2	0	= 20	1	5	0	= 150				

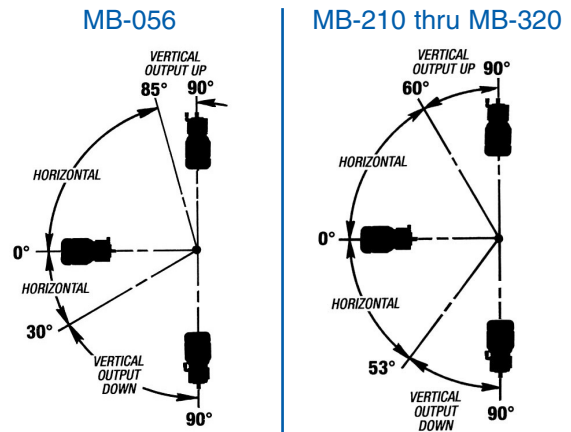
Mounting (9)

- A** = Horizontal
- V** = Vert. Output Up
- R** = Vert. Output Down



Horizontal / Vertical Mounting

The illustration below shows when it is necessary to specify **Vertical Mounting** when you know the mounting angle of the **Posistop Coupler Brake**.



Section 5 MagnaShear Motor Brakes

The Problem and the Solution...



The Problem - Heat Buildup

Heat buildup, the mortal enemy of electric motors can destroy conventional motor brakes. Although heat is the natural product of the braking process, increased starts and stops of the electric motor create intense heat in conventional brake devices. Often heat buildup damages the brake as well as the electric motor - and frequently causes failure of the entire system. This can mean increased downtime - as well as higher maintenance costs.

The Solution - MagnaShear Motor Brakes

MagnaShear Motor Brakes combine oil shear durability with electric actuation, simple control logic and spring-set load holding. Easy to install, economical to operate, MagnaShear motor brakes run on 115 VAC, 50 or 60 Hz.. An optional Step Down Transformer is available for other voltages. They fit a wide range of motors, including NEMA U-frame, and T-frame motors.

MagnaShear Oil Shear Brakes are designed to dissipate the heat buildup that destroy conventional braking devices.

Conventional dry friction brake devices can take the heat from industrial motors, but they sacrifice friction material with each stop. They deteriorate with repeated use. Even though the motor is spared the stress of excessive braking heat, the brakes require routine maintenance such as coil and friction material replacement .

The result of heat buildup - Breakdowns. Dry brakes have a short life, suffer from increased wear and may cause downtime losses that come from frequent maintenance and replacement.

The **MagnaShear** absorbs the energy generated by the braking action and controls the heat buildup - thus providing greater reliability and repeatability, as well as heat dissipation.

Unlike conventional motor brakes, the **MagnaShear** is a multiple surface device that operates on a spring activated, pressure release system. Its' multiple disc stack and internal oil pump helps to eliminate the need to replace coils and friction material - and reduce the heat on any one friction surface.

5

Seven Models & Sizes To Fit Your Motor Brake Needs...

- MSB2 "Quick Mount" MagnaShear** has a non-piloted mounting flange for a 5-7/8" Dia. Mounting B.C. 5/8" Dia. and 7/8" Dia. Hub Bores are available. It has a Static Torque Range of 6 Lb. Ft. to 12 Lb. Ft. Used on 56C, 143TC and 145TC Frame Motors.
- MSB4 "Quick Mount" MagnaShear** has a non-piloted Universal Mounting Flange for a 5-7/8" Dia. or a 7-1/4" Dia. Mounting B.C. 7/8" Dia. and 1-1/8" Dia. Hub Bores are available. It has a Static Torque Range of 14 Lb. Ft. to 33 Lb. Ft. Used on 143TC, 145TC, 182TC and 184TC Frame Motors.
- MSB6 "Quick Mount" MagnaShear** has a non-piloted mounting flange for a 7-1/4" Dia. Mounting B.C. 7/8" Dia., 1-1/8" Dia., 1-3/8" Dia. and 1-5/8" Hub Bores are available. It has a Static Torque Range of 38 Lb. Ft. to 100Lb. Ft. Used on 213TC, 215TC, 254TC and 256TC Frame Motors.
- MSB7 Magnashear** has a piloted mounting flange for a 8-1/2" Dia. AK or 10-1/2" Dia. AK. 1-3/8" Dia. and 1-5/8" Dia. Bores are available. It has a Static Torque Range of 95 Lb. Ft. to 170 Lb. Ft.
- MSB8 Magnashear** has a piloted mounting flange for a 8-1/2" Dia. AK or 10-1/2" Dia. AK. 1-3/8" Dia., 1-5/8" Dia. and 1-7/8" Dia. Bores are available. It has a Static Torque Range of 100 Lb. Ft. to 250 Lb. Ft.
- MSB9 Magnashear** has a piloted mounting flange for a 10-1/2" Dia. AK or 12-1/2" Dia. AK. 1-5/8" Dia., 1-7/8" Dia., 2-1/8" Dia. and 2-3/8" Dia. Bores are available. It has a Static Torque Range of 250 Lb. Ft. to 500 Lb. Ft.
- MSB10 Magnashear** has a piloted mounting flange for a 10-1/2" Dia. AK or 12-1/2" Dia. AK. 1-7/8" Dia., 2-1/8" Dia. and 2-3/8" Dia. Bores are available. It has a Static Torque Range of 600 Lb. Ft. to 900 Lb. Ft.
- MSB12 Magnashear** has a piloted mounting flange for a 16" Dia. AK. 1-7/8" Dia. up to 3-5/8" Dia. Bores are available. It has a Static Torque Range of 625 Lb. Ft. to 1250 Lb. Ft.

Description and Operation

Description

A spring set brake stack is released when 115 VAC power is supplied to the Brake Coil. **Pulse Width Modulation (PWM) Control** is used to minimize heat buildup. Control logic is made simple by use of the motor starter auxiliary contactors. Back EMF effect from the motor windings is eliminated.

The units are ideal for a wide variety of applications including indexing tables, lifts, transfer conveyors, tap heads and other start/stop devices. Applications requiring the brake to be released on an average of more than 50% of the time or for long durations must be reviewed and approved by our Application Engineering Department.

Operation

The cross section below shows the MSB2 **MagnaShear Motor Brake** in the stopped position with the brake stack engaged. The **MagnaShear Motor Brake** will default to this position when all power is lost.

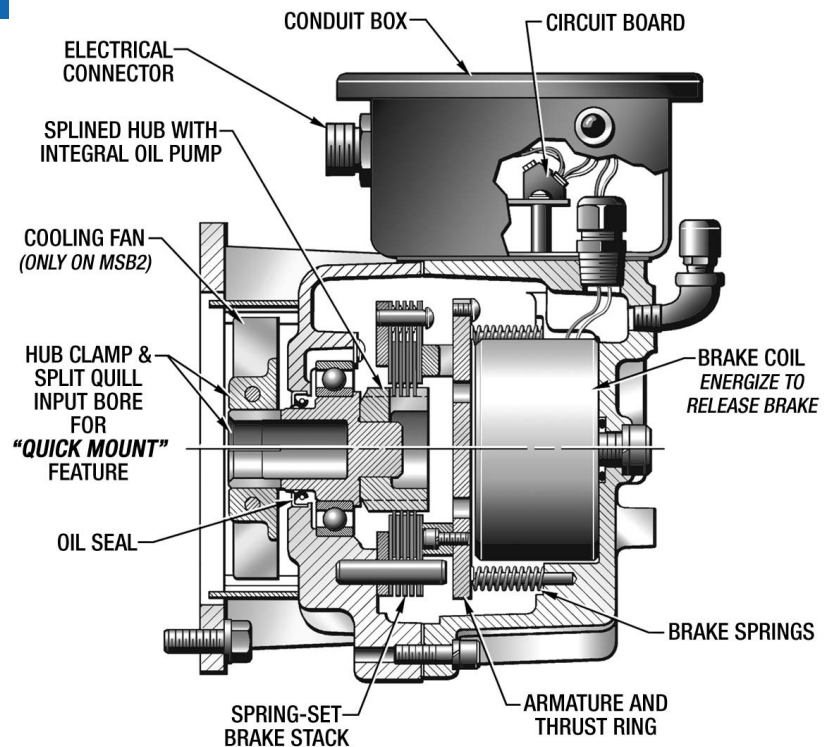
To run the Drive Motor the Brake Coil is energized, pulling the Armature Plate Assembly away from the Brake Stack which allows the splined hub and drive motor to rotate independently from the motor brake.

To stop the Drive Motor the Brake Coil is de-energized. This allows the brake springs to push the Armature Plate Assembly against the Brake Stack, clamping it and stopping the splined hub and drive motor.

5

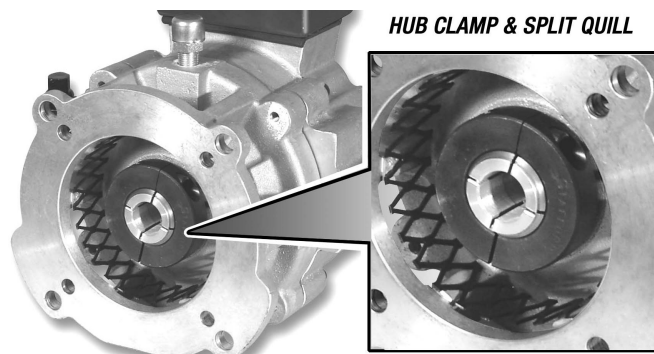
Features

- ◆ 115, 208, 230, 380, 460, 575 VAC electric actuating system.
- ◆ Oil Shear multiple-disc spring set braking.
- ◆ Spring-set Torque ratings from 6 to 1250 Ft. Lbs.
- ◆ Brake release by energizing the coil.
- ◆ Pulse Width Modulation (PWM) Control of the brake coil to minimize heat build-up.
- ◆ Smooth “cushioned” stops for reduced shock to the drive system.
- ◆ Superior heat dissipation.
- ◆ Seal integrity for harsh and washdown environments.
- ◆ Proven long-life friction material for repeatable positioning.
- ◆ The (3) smaller sizes uses a split-quill and hub clamp for quick & easy mounting to the motor face
- ◆ The (4) larger sizes have a Quick mount Bore & key shaft connection to the motor and standard mounting to NEMA motor frames or low inertia IEC frames.
- ◆ Modular design/assembly for ease of servicing and maintenance.
- ◆ Internal surge protection.
- ◆ Excellent service and engineering support.



SIMPLIFIED MOUNTING SYSTEM

The MSB2, MSB4 and the MSB6 **MagnaShear Motor Brakes** adds a new level of convenience with the mounting to the motor with the Universal Mounting Flange and Split-Quill design. The innovative Clamped-Split-Quill and a 360° Clamping Collar absolutely stops all play and movement between the Brake Hub and the Motor Shaft caused by high-torque and rapid-cycling applications.



MagnaShear Motor Brake Typical Applications

A major type of application for the **MagnaShear Motor Brakes** is one in which the motor reverses each cycle. The clutch/brake is not as practical in this case. A brake is needed to stop the motor before reversing. Also applications that operate at low cycle rates and start and stop each cycle.

The **MagnaShear Motor Brakes** are typically used in dirty and wet environments where position is critical and productivity is a major concern. They are also used on many vertical or over hauling applications as the oil shear

technology provides high heat dissipation capability. They can be sized to the correct torque independent of the motor frame size or horsepower.

The **MagnaShear Motor Brake** can be furnished three ways. (1) To fit a NEMA or IEC frame motor. (2) As a complete motor and brake assembly (EBM) (3) To mount on a machine frame or other special mounting configuration. A few typical applications are shown below.

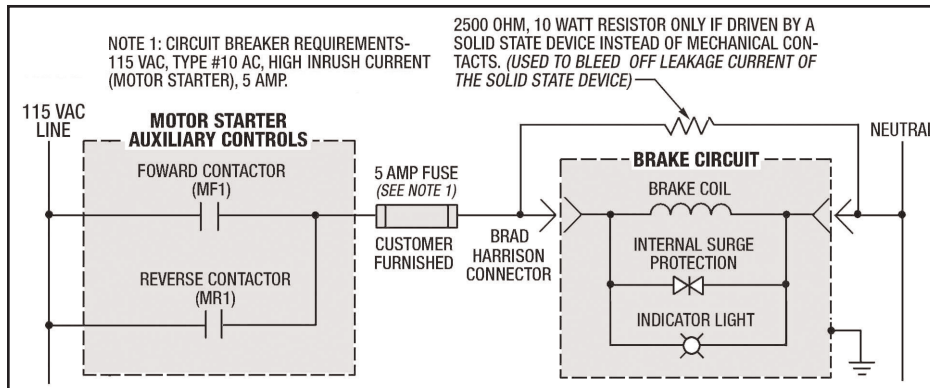


These **MagnaShear Electric "Oil Shear" Motor Brakes** are certified by the **American Bureau of Shipping (ABS)** under ABS Product Design Assessment (PDA) Certificate # 02-HS310430-PDA and Manufacturing Assessment # 02JE305084-X.

They are ideal for a wide variety of heavy-duty and high-torque applications, which are common in the Shipping Industry, such as **Winches, Windlasses, Cranes and Conveyors for Docks**

<h3>MagnaShear Electric Motor Brake</h3>	
<p>Tensioner Pulley for Coal Conveyor Belt</p>	<p>Tap Heads</p>
<h3>MagnaShear Complete Electric Brake Motor (EBM) Assembly</h3>	
<p>Product Conveyor</p>	<p>Ball Screw Drive</p>

Economical and Reliable Electrical Design



Simple control logic uses motor starter auxiliary contactors, enabling the brake to run on the same standard 115 VAC power as the motor starter coil. Back EMF effect from the motor windings is eliminated.

FUNCTION	BRAKE COIL ENERGIZED
RELEASE	ON
BRAKING	OFF

5

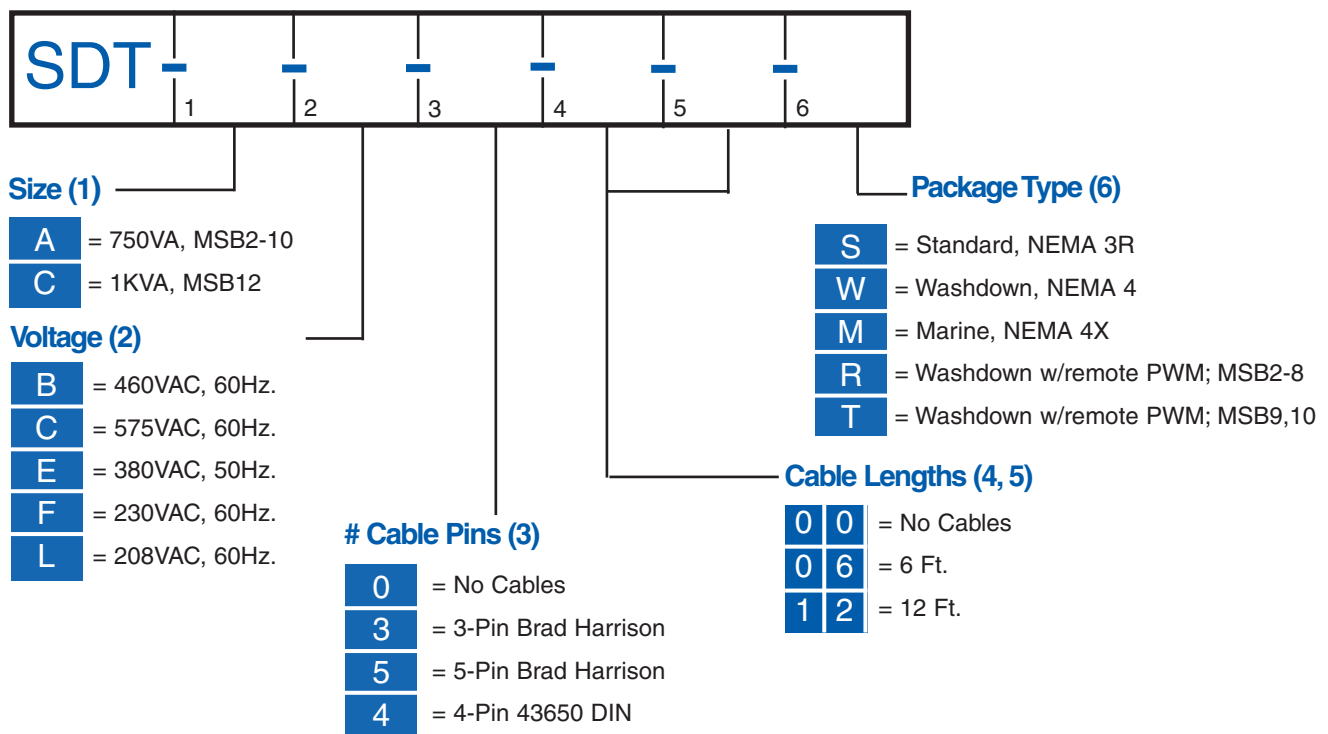
Step Down Transformer

All MagnaShear Brakes are designed to use 115 Volt AC input power. This typically would come from the main motor switch panel auxiliary contactor. Wiring any brake directly into the motor leads can cause problems such as premature coil failure and sluggish response due to back emf. However this is often done for convenience. To wire the MagnaShear Brake directly into the motor leads a step down transformer is required. This makes a single brake available for most standard voltages such as 230VAC 460 VAC, 575 VAC, 360VAC.

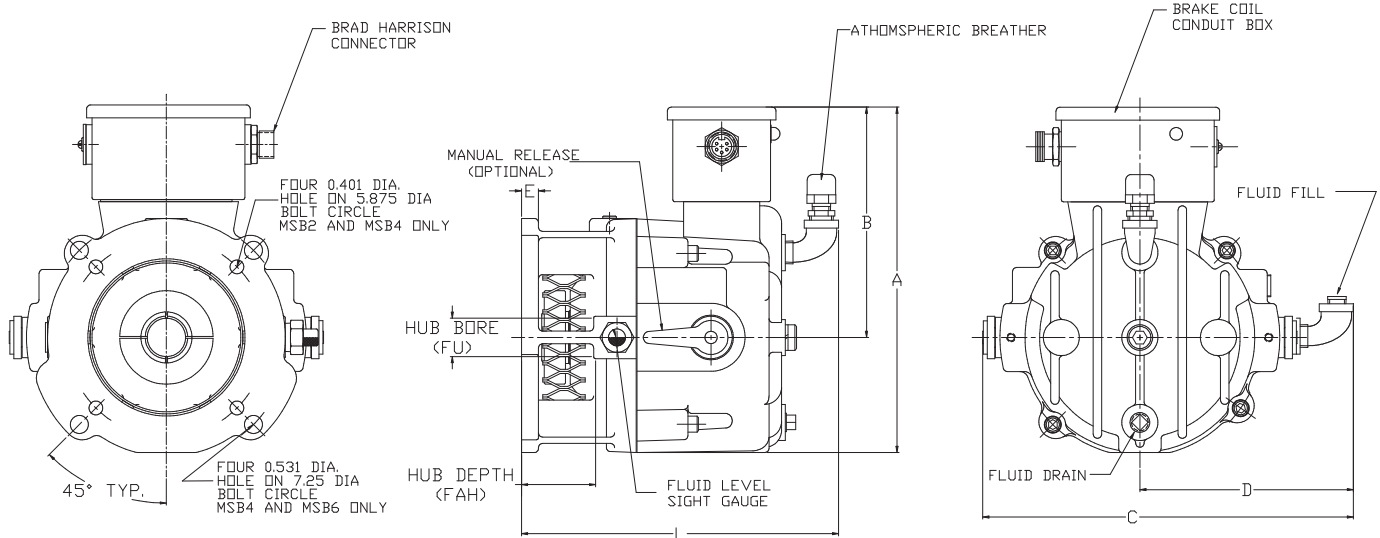


How to Order Your Step Down Transformer

Ordering System Chart



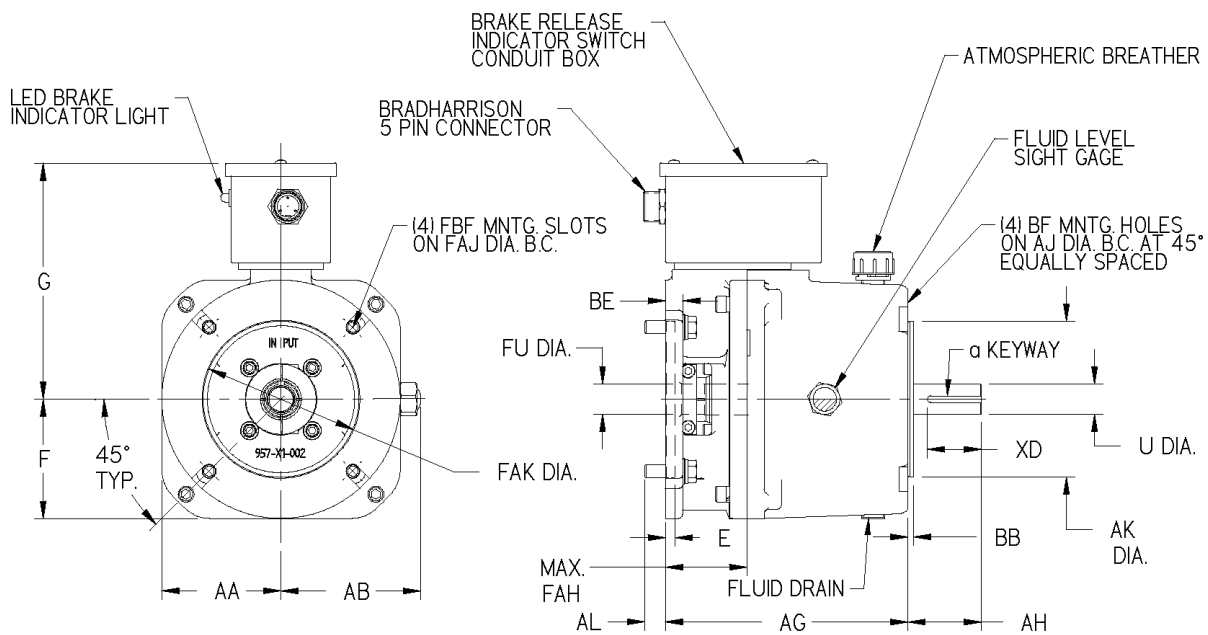
MSB 2, MSB 4 and MSB6 Technical Specifications



5

BRAKE SIZE	DIMENSIONS (Inches)					
	A	B	C	D	E	L
MSB2	9.07	5.63	8.84	3.97	.50	7.96
MSB4	10.25	6.88	10.75	5.00	.50	9.18
MSB6	12.58	7.56	12.72	6.00	.44	11.08

MSB 2, MSB 4 and MSB6 Coupler Technical Specifications



BRAKE SIZE	DIMENSIONS (Inches)						
	U/FU	AK/FAK	AG	AA	AB	F	G
MSB2	.875	4.5	7.00	3.44	4.04	3.44	6.78
MSB4	Coming Soon						
MSB6	Coming Soon						

MSB 2, MSB 4 and MSB6 Technical Specifications (Continued)

BRAKE SIZE	BOLT CIRCLE FAK (Inches)	HUB BORE FU (Inches)	HUB DEPTH FAH (Min/Max)	STATIC TORQUE (Lb. Ft.)	DYNAMIC TORQUE (Lb. Ft.)	MAX. KE per ENGMT. (Ft. Lbs.)	INERTIA (Lb. Ft. ²)	OIL* CAP. (Fl. Oz.)	INPUT VOLT-AGE (VAC)	INRUSH CURRENT (Amps)	INRUSH TIME (Sec.)	HOLDING CURRENT (Amps)
MSB2	5.875	.625 .875	1.00/2.19	6	5	7,975	0.011	28	115	2.5	.4	.8
				8	7							
				12	10							
MSB4	5.875 7.250	.875 1.125	1.37/2.89	14	12	22,000	0.024	40	115	5.5	.4	1.7
				21	18							
				33	28							
MSB6	7.250	.875 1.125 1.375 1.625	1.62/4.25	38	32	26,500	0.058	50	115	6	.4	1.8
				62	53							
				86	73							
				100	85							

How to Order Your MSB2, MSB4 & MSB6 Brake

Ordering System Chart

Example: MSB-6-8-H-062-S-3-1



Size (1)

- 2** = MSB2
- 4** = MSB4
- 6** = MSB6

Mounting Bolt Circle / Pilot (2)

- 4** = MSB2 (5.875" Dia.)
- 5** = MSB4 (5.875" Dia. & 7.250" Dia.)
- 8** = MSB6 (7.250" Dia.)
- C** = Coupler, MSB2 (4.5" Pilot Dia.)
MSB4 (8.5" Pilot Dia.)

Mounting Position (3)

- H** = Horizontal
- U** = Brake Up
- D** = Brake Down

NOTES:

Maximum Torque of 62 lb ft with 0.625" and 0.875" shaft.

Manual Release (7)

- S** = Standard, None
- R** = With Manual Release
(Not Available on MSB2 or Coupler)

Static Torque (4, 5, 6)

Size MSB2

- 0 0 6** = 6 Ft. Lbs.
- 0 0 8** = 8 Ft. Lbs.
- 0 1 2** = 12 Ft. Lbs.

Size MSB4

- 0 1 4** = 14 Ft. Lbs.
- 0 2 1** = 21 Ft. Lbs.
- 0 3 3** = 33 Ft. Lbs.

Size MSB6

- 0 3 8** = 38 Ft. Lbs.
- 0 6 2** = 62 Ft. Lbs.
- 0 8 6** = 86 Ft. Lbs.
- 1 0 0** = 100 Ft. Lbs.

Voltage (9)

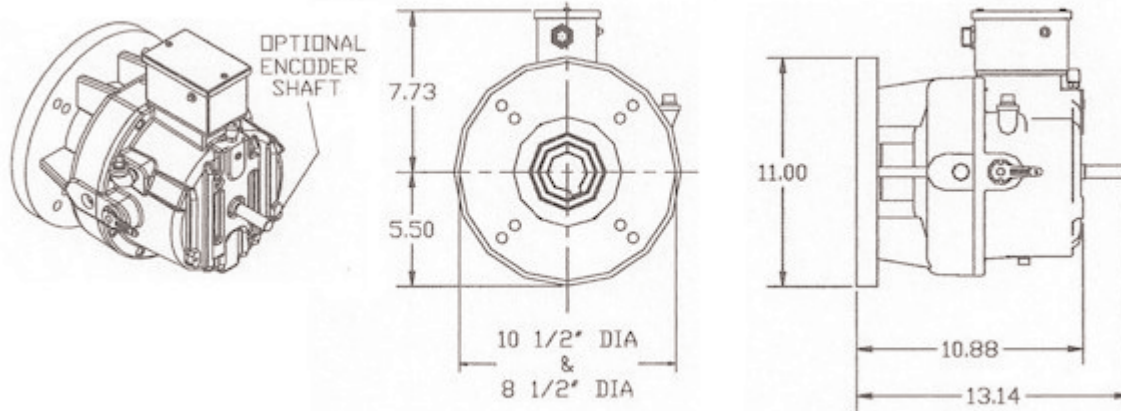
- 1** = 115 VAC
- 2** = Other

Other requires Step Down Transformer - See Section 5.4

Bore Dia. (8)

- A** = .625"
- 0** = .875"
- 1** = 1.125"
- 2** = 1.250"
- 3** = 1.375"
- 5** = 1.625"
- V** = .625" - .625" Coupler, MSB2
- W** = .625" - .875" Coupler, MSB2
- Z** = .875" - .875" Coupler, MSB2
- 1** = 1.250" - 1.250" Coupler, MSB4

MSB7 Technical Specifications



5

BRAKE SIZE	PILOT DIA. FAK (Inches)	BORE DIA. FU (Inches)	BORE DEPTH FAH (Min/Max)	STATIC TORQUE (Lb. Ft.)	DYNAMIC TORQUE (Lb. Ft.)	MAX. KE per ENGMT. (Ft. Lbs.)	INERTIA (Lb. Ft. ²)	OIL CAP. (Fl. Oz.)	INPUT VOLTAGE (VAC)	INRUSH CURRENT (Amps)	INRUSH TIME (Sec.)	HOLDING CURRENT (Amps)
MSB7	8.50 10.50	1.375 1.625	3.00/ 4.38	95	83	26,500	CF	CF	115	6	.4	1.8
				135	115							
				170	148							

How to Order Your MSB7 Brake

Ordering System Chart

Example: *MSB-7-Q-H-095-S-3-M*



Brake Size (1)

7 = MSB7

Pilot Diameter (FAK) (2)

Q = 8.500

R = 10.500

Mounting Position (3)

H = Horizontal, Standard

J = Horizontal, High Oil Level

Z = Horizontal, Marine Duty

Manual Release (7)

S = Standard, None

R = Manual Release

A = Standard, None with Stub Shaft for Encoder

B = Manual Release with Stub Shaft for Encoder

Torque (4, 5, 6)

0 9 5 = 95 Ft. Lbs.

1 3 5 = 135 Ft. Lbs.

1 7 0 = 170 Ft. Lbs.

Voltage (9)

M = 115 VAC

N = Other

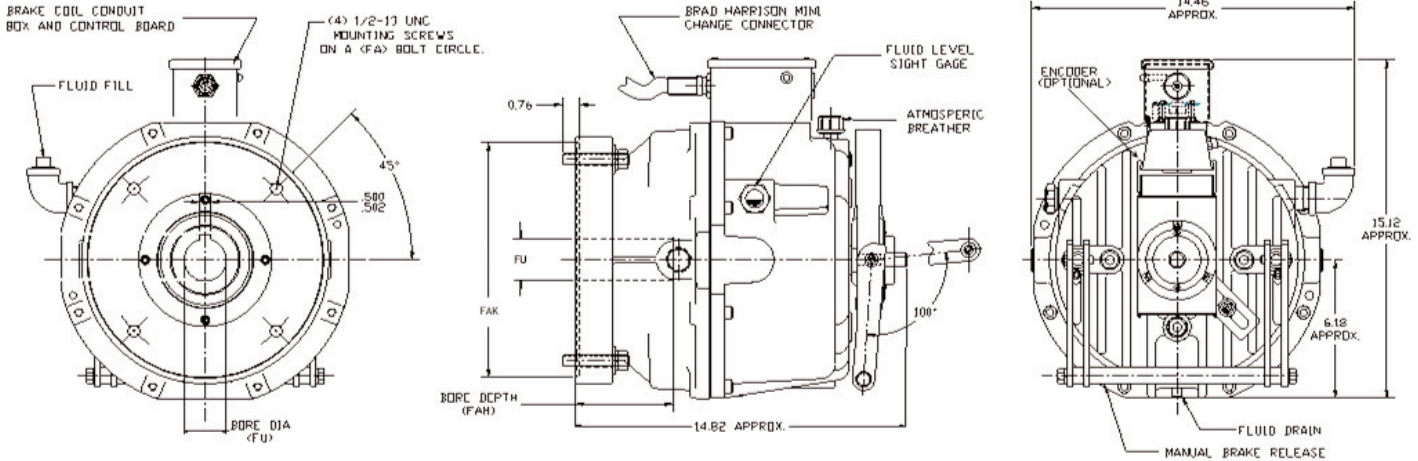
Other requires Step Down Transformer - See Section 5.4

Bore Dia. (8)

3 = 1.375"

5 = 1.625"

MSB8 Technical Specifications



5

BRAKE SIZE	PILOT DIA. FAK (Inches)	BORE DIA. FU (Inches)	BORE DEPTH FAH (Min/Max)	STATIC TORQUE (Lb. Ft.)	DYNAMIC TORQUE (Lb. Ft.)	MAX. KE per ENGMT. (Ft. Lbs.)	INERTIA (Lb. Ft. ²)	OIL CAP. (Fl. Oz.)	INPUT VOLTAGE (VAC)	INRUSH CURRENT (Amps)	INRUSH TIME (Sec.)	HOLDING CURRENT (Amps)
MSB8	8.50 10.50	1.375 1.625 1.875	3.00/ 4.38	100	86	41,500	0.267	180	115	6	.4	1.8
				150	129							
				200	172							
				250	215							

How to Order Your MSB8 Brake

Ordering System Chart

Example: MSB-8-8-H-150-S-5-1



Brake Size (1)

8 = MSB8

Pilot Diameter (FAK) (2)

Q = 8.500

R = 10.500

Mounting Position (3)

H = Horizontal, Standard

J = Horizontal, High Oil Level

Z = Horizontal, Marine Duty

U = Vertical, Brake Up

D = Vertical, Brake Down

Manual Release (7)

R = Manual Release

B = Manual Release with Stub Shaft for Encoder

Torque (4, 5, 6)

1 0 0 = 100 Ft. Lbs.

1 5 0 = 150 Ft. Lbs.

2 0 0 = 200 Ft. Lbs.

2 5 0 = 250 Ft. Lbs.

Voltage (9)

M = 115 VAC

N = 230 VAC

Other requires Step Down Transformer - See Section 5.4

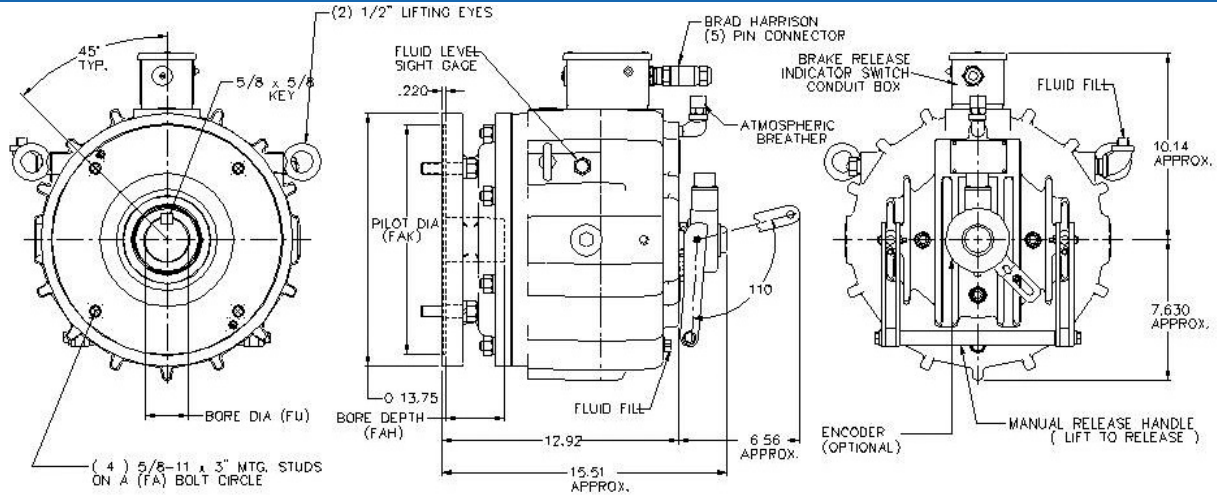
Bore Dia. (8)

3 = 1.375"

5 = 1.625"

7 = 1.875"

MSB 9 and MSB10 Technical Specifications



5

BRAKE SIZE	PILOT DIA. FAK (Inches)	BORE DIA. FU (Inches)	BORE DEPTH FAH (Min/Max)	STATIC TORQUE (Lb. Ft.)	DYNAMIC TORQUE (Lb. Ft.)	MAX. KE per ENGMT. (Ft. Lbs.)	INERTIA (Lb. Ft. ²)	OIL CAP. (Fl. Oz.)	INPUT VOLTAGE (VAC)	INRUSH CURRENT (Amps)	INRUSH TIME (Sec.)	HOLDING CURRENT (Amps)
MSB9	10.50 12.50	1.625 1.875 2.000 2.125 2.250 2.375	2.75/ 4.62	250	215	48,000	0.962	192	115	6	1.4	1.8
				300	258							
				350	301							
				450	387							
				500	430							
MSB10	10.50 12.50	1.625 1.875 2.000 2.125 2.250 2.375	2.75/ 4.62	600	516	69,000	1.244	192	115	6	1.4	1.8
				650	559							
				750	645							
				900	774							

How to Order Your MSB9 & MSB10 Brake

MSB- 1 2 3 4 5 6 7 8 9

Brake Size (1)

9 = MSB9
A = MSB10

Pilot Diameter (FAK) (2)

R = 10.500"
S = 12.500"

Mounting Position (3)

H = Horizontal, Standard
J = Horizontal, High Oil Level
Z = Horizontal, Marine Duty
U = Vertical, Brake Up
D = Vertical, Brake Down

Manual Release (7)

R = Manual Release
B = Manual Release with Stub Shaft for Encoder

Torque (4, 5, 6)

Size MSB9			Size MSB10		
2	5	0	6	0	0
3	0	0	6	5	0
3	5	0	7	5	0
4	5	0	9	0	0
5	0	0			

Voltage (9)

M = 115 VAC
N = Other

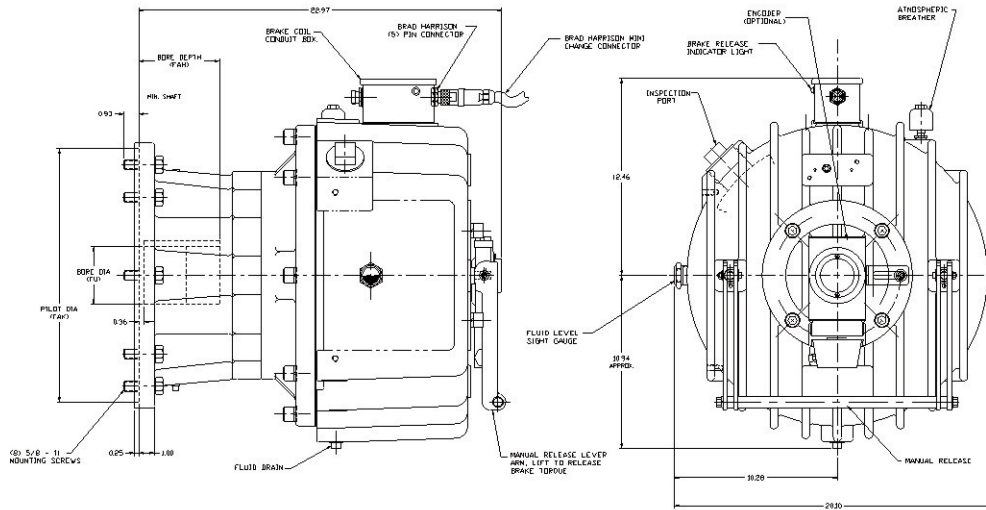
Bore Dia. (8)

5 = 1.625
7 = 1.875"
B = 2.000"
C = 2.125"
D = 2.250"
E = 2.375"

NOTES:

Maximum Torque of 350 lb ft with 1.625" shaft.; Maximum Torque of 750 lb ft with 1.875" shaft. Other requires Step Down Transformer - See Section 5.4

MSB12 Technical Specifications



5

BRAKE SIZE	PILOT DIA. FAK (Inches)	BORE DIA. FU (Inches)	BORE DEPTH FAH (Min/Max)	STATIC TORQUE (Lb. Ft.)	DYNAMIC TORQUE (Lb. Ft.)	MAX. KE per ENGMT. (Ft. Lbs.)	INERTIA (Lb. Ft. ²)	OIL CAP. (Fl. Oz.)	INPUT VOLTAGE (VAC)	INRUSH CURRENT (Amps)	INRUSH TIME (Sec.)	HOLDING CURRENT (Amps)
MSB12	16.00	1.875	3.00/5.12	625	538	158,000	2.068	384	115	8	1.4	2.5
		2.125										
		2.375										
		2.625										
		2.875										
		3.125										
3.375												
3.500												
3.625												
				1250	1075							

How to Order Your MSB12 Brake



Brake Size (1)
C = MSB12

Pilot Diameter (FAK) (2)
T = 16.000"

Mounting Position (3)
H = Horizontal, Standard
J = Horizontal, High Oil Level
Z = Horizontal, Marine Duty

Manual Release (7)
R = Manual Release
B = Manual Release with Stub Shaft for Encoder

Torque (4, 5, 6)
6 2 5 = 625 Ft. Lbs.
9 5 0 = 950 Ft. Lbs.
1 2 5 = 1250 Ft. Lbs.

Voltage (9)
1 = 115 VAC
2 = Other
 Other requires Step Down Transformer - See Section 5.4

Bore Dia. (8)
7 = 1.875" K = 3.000"
C = 2.125" N = 3.125"
E = 2.375" P = 3.375"
G = 2.625" Q = 3.500"
J = 2.875" R = 3.625"

NOTES:
 Maximum Torque of 625 lb ft with 1.875" shaft.
 Maximum Torque of 950 lb ft with 2.125" & 2.375" shaft.

5

Thermal Horsepower Rating

MSB2 MagnaShear Motor Brake			
% DUTY	CYCLE RATE (cpm)	AMBIENT TEMP.	
		25° C	40° C
25%	2	0.45	0.17
	5	0.45	0.17
	10	0.44	0.16
50%	2	0.37	0.16
	5	0.36	0.15
	10	0.35	0.14
75%	2	0.28	0.13
	5	0.27	0.13
	10	0.26	0.12

MSB4 MagnaShear Motor Brake					
% DUTY	CYCLE RATE (cpm)	AMBIENT TEMPERATURE			
		TEFC Motor		TENV Motor	
		25° C	40° C	25° C	40° C
25%	2	0.43	0.28	0.41	0.27
	5	0.41	0.27	0.40	0.26
	10	0.39	0.25	0.38	0.24
50%	2	0.18	NR	0.15	NR
	5	0.17	NR	0.14	NR
	10	0.15	NR	0.12	NR
75%	2	NR	NR	NR	NR
	5	NR	NR	NR	NR
	10	NR	NR	NR	NR

5

MSB6 MagnaShear Motor Brake					
% DUTY	CYCLE RATE (cpm)	AMBIENT TEMPERATURE			
		TEFC Motor		TENV Motor	
		25° C	40° C	25° C	40° C
25%	2	0.18	0.12	0.14	0.09
	5	0.16	0.11	0.13	0.08
	10	0.14	0.08	0.11	0.06
50%	2	0.12	0.06	0.05	NR
	5	0.11	0.12	0.14	0.09
	10	0.09	NR	NR	NR
75%	2	0.07	NR	NR	NR
	5	0.06	NR	NR	NR
	10	NR	NR	NR	NR

MSB8 MagnaShear Motor Brake					
% DUTY	CYCLE RATE (cpm)	AMBIENT TEMPERATURE			
		TEFC Motor		TENV Motor	
		25° C	40° C	25° C	40° C
25%	2	0.43	0.28	0.41	0.27
	5	0.41	0.27	0.40	0.26
	10	0.39	0.25	0.38	0.24
50%	2	0.18	NR	0.15	NR
	5	0.17	NR	0.14	NR
	10	0.15	NR	0.12	NR
75%	2	NR	NR	NR	NR
	5	NR	NR	NR	NR
	10	NR	NR	NR	NR

NOTES:

Above ratings are based on 96° C maximum oil temperature and 1800 RPM motor.

NR - Not Recommended

% - Duty is percentage of time brake is released. (Coil is Energized.)



MagnaShear Electric Brake Motor (EBM)

The **MagnaShear EBM** consists of a motor with a **MagnaShear Electric Motor Brake** assembled and ready to use. The **MagnaShear EBM** is available in many sizes and torque ranges from 3 Ft. Lbs. up to 1250 Ft. Lbs. By ordering the **MagnaShear EBM**, complete motor and brake assembly, installation time is reduced to mounting the motor and wiring in the electrical supply.

EBM units are pre-assembled to your specified torque ratings and configuration, filled with the proper amount of fluid and cycle tested ready for quick installation.

5

MagnaShear EBM Specifications

Motor HP	Motor RPM	Frame Size		Brake Size	Available Torques (Ft. Lbs)
		T	U		
1/4	1800	56	56	MSB2	6, 8, 12
1/4	1200	56	56	MSB2	6, 8, 12
1/3	1800	56	56	MSB2	6, 8, 12
1/3	1200	56	56	MSB2	6, 8, 12
1/2	1800	56	56	MSB2	6, 8, 12
1/2	1200	56	56	MSB2	6, 8, 12
3/4	1800	56	56	MSB2	6, 8, 12
3/4	1200	56	56	MSB2	6, 8, 12
1	1800	143T	184U	MSB2	6, 8, 12
1	1200	143T	184U	MSB2	6, 8, 12
1	1200	145T	184U	MSB2	6, 8, 12
1-1/2	1800	145T	184U	MSB2	6, 8, 12
1-1/2	1200	182T	184U	MSB2	6, 8, 12
2	1800	145T	184U	MSB2	6, 8, 12
2	1200	184T	213U	MSB4	14, 21, 33
3	1800	182T	213U	MSB4	14, 21, 33
3	1200	213T	215U	MSB4	14, 21, 33
5	1800	184T	215U	MSB4	14, 21, 33
5	1200	215T	254U	MSB4	14, 21, 33
7-1/2	1800	213T	254U	MSB4	14, 21, 33
7-1/2	1200	254T	256U	MSB6 | MSB7	38, 62, 86, 100 | 95, 130, 170
10	1800	215T	256U	MSB6 | MSB7	38, 62, 86, 100 | 95, 130, 170
10	1200	215T	256U	MSB6 | MSB7	38, 62, 86, 100 | 95, 130, 170
15	1800	254T	284U	MSB6 | MSB7	38, 62, 86, 100 | 95, 130, 170
15	1200	284T	324U	MSB8 | MSB7	100, 150, 200, 250 | 95, 130, 170
20	1800	256T	286U	MSB8 | MSB7	100, 150, 200, 250 | 95, 130, 170
20	1200	286T	326U	MSB8 | MSB7	100, 150, 200, 250 | 95, 130, 170
25	1800	284T	324U	MSB8 | MSB7	100, 150, 200, 250 | 95, 130, 170
25	1200	324T	364U	MSB8	100, 150, 200, 250
30	1800	286T	-----	MSB8 | MSB7	100, 150, 200, 250 | 95, 130, 170
40	1800	324T	-----	MSB9	250, 300, 350, 450, 500
50	1800	326T	-----	MSB9	250, 300, 350, 450, 500
60	1800	364T	-----	MSB9	250, 300, 350, 450, 500
75	1800	405T	-----	MSB9	250, 300, 350, 450, 500
100	1800	444T	-----	MSB10	600, 650, 750, 900
125	1800	445T	-----	MSB10	600, 650, 750, 900
150	1800	444T	-----	MSB12	625, 950, 1250
200	1800	455T	-----	MSB12	625, 950, 1250

Section 6 Foot Mounted Posistop Brake



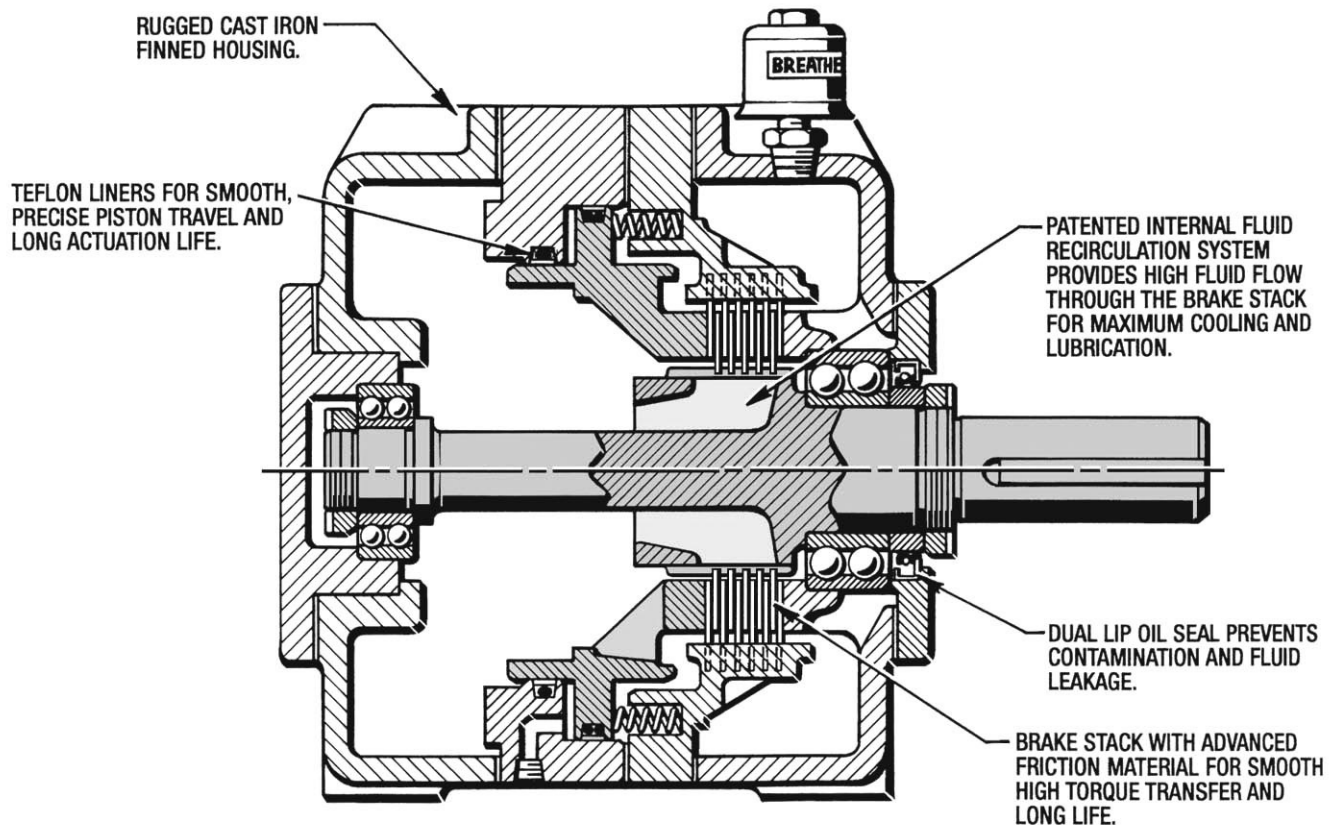
The **Foot Mounted Posistop Brake** is similar in design to the **Posidyne Clutch/Brake** incorporating many of the same features including multiple friction surfaces, lubrication and cooling by recirculating fluid. Six sizes are available with torque ratings up to 1800 Lb.Ft. There are three control logics to select from:

S = Air Set Brake / Spring Release

A = Medium Spring Set Brake / Air Release

B = Heavy Spring Set Brake / Air Release

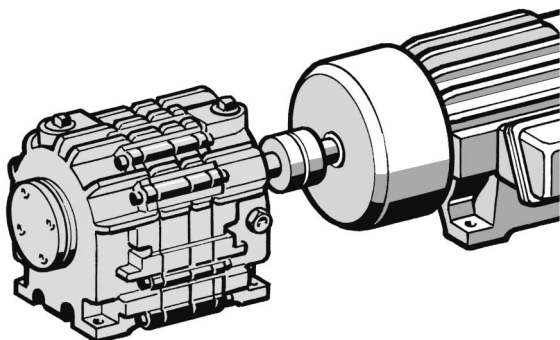
The spring set units are preset at the factory and are not adjustable. The air set units are adjustable over the full range.



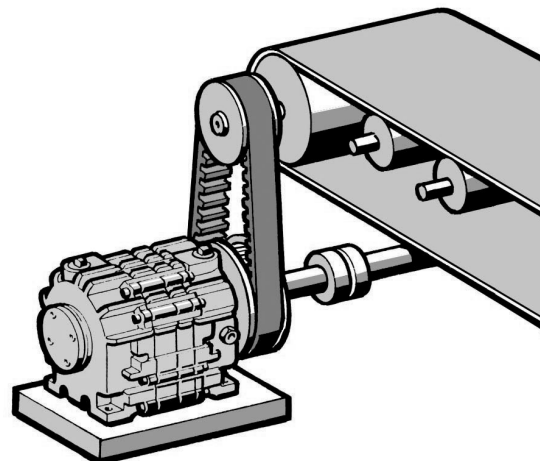
“FS” Model Shown. “FA” and “FB” Models have springs on opposite side of piston.

Typical Applications

MOTOR SHAFT BRAKE



MACHINE SHAFT BRAKE



6

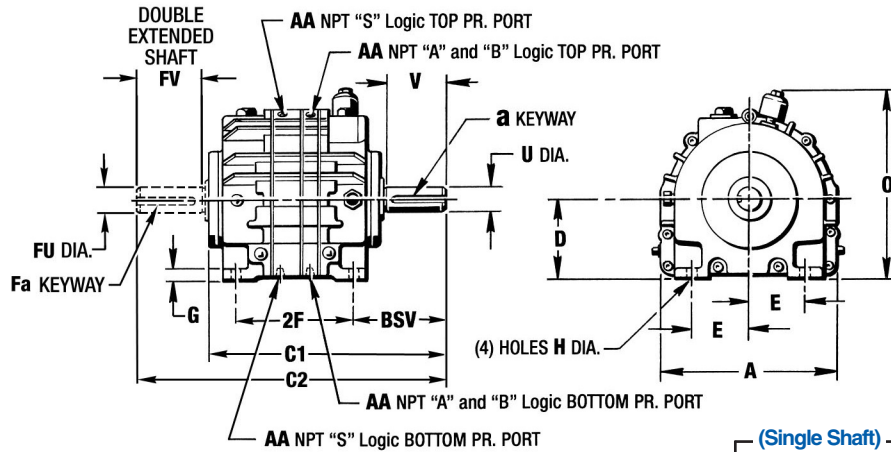
Foot Mounted Posistop Specifications

To select the proper **Foot Mounted Posistop Brake**, the desired control logic should first be determined. The static and dynamic torque ratings for that logic are then used for selection purposes.

Size	Logic	Brake Torque (<i>Lb.Ft.</i>)					Max. RPM Basic	Thermal Ratings		Air Volume per Engmt. (<i>Cu. In.</i>)	Inertia Cyclic Parts (<i>Lb.Ft.²</i>)	Weight (<i>Lbs.</i>)
		Spring Set		With Air Assist				HP Sec/Min	Thermal HP			
		Static	Dynamic	Static	Dynamic	Max Air Pr						
03	S	-----	-----	127	108	60 PSI	3600	45	.75	7.6	.10	125
	A	50	42	-----	-----	-----						
	B	100	85	-----	-----	-----						
05	S	-----	-----	290	245	60 PSI	3600	60	1.0	7.6	.14	174
	A	95	80	-----	-----	-----						
	B	189	160	-----	-----	-----						
10	S	-----	-----	700	592	60 PSI	3600	75	1.25	12	.44	305
	A	233	197	-----	-----	-----						
	B	466	394	-----	-----	-----						
11	S	-----	-----	1095	927	80 PSI	3000	90	1.5	15	.48	349
	A	222	188	-----	-----	-----						
	B	444	375	-----	-----	-----						
14	S	-----	-----	1723	1458	80 PSI	3000	CF	CF	15	.53	CF
	A	387	327	-----	-----	-----						
	B	696	589	-----	-----	-----						
20	S	---	---	2076	1245	80 PSI	2000	120	2.0	23	2.80	768
	A	397	336	-----	-----	-----						
	B	1338	1151	-----	-----	-----						

Tandem or double stack units are available. Ratings are twice the values given for above single stack units. Weights given are for a Single Stack Unit. See page 16.16 for Tandem Unit weights. CF - Consult Factory

Foot Mounted Posistop Dimensions (Inches)



Size	Overall Length (Double Ext. Shaft)	
	C2s*	C2t*
03	16.88	19.51
05	20.59	23.52
10	23.69	27.56
11	26.19	30.06
14	26.54	31.00
20	31.54	36.26

Size	Foot Mounting Dimensions									Overall Length		Shaft Dim.			Port (NPT)-AA	
	A	D	E	2Fs*	2Ft*	G	H	O	BSV	C1s*	C1t*	a/Fa	U/FU	V/FV	(Bot.)	(Top)
03	10.25	4.5	3.31	6.5	9.13	0.50	0.44	10.38	5.19	13.25	15.88	5/16 x 5/32	1-3/8	3.50	1/4	1/4
05	10.25	6.5	3.50	9.09	12.02	0.75	0.56	12.38	5.75	16.50	19.42	3/8 x 3/16	1-5/8	4.00	1/4	1/4
10	12.50	6.5	3.50	12.69	16.56	1.00	0.75	13.63	5.50	19.75	23.62	3/8 x 3/16	1-3/4	3.75	1/4	1/4
11	12.62	6.5	4.75	12.69	16.56	1.00	0.75	14.50	6.75	21.00	24.88	5/8 x 5/16	2-3/8	5.00	1/4	1/4
14	14.00	6.5	4.75	13.04	17.50	1.00	0.75	15.21	6.75	21.38	25.85	5/8 x 5/16	2-3/8	4.43	1/4	1/4
20	17.50	9.0	5.75	16.78	21.50	1.38	0.88	19.00	7.38	26.75	31.50	5/8 x 5/16	2-3/4	4.75	3/8	1/2

* "s" denotes a Single Unit and "t" denotes a Tandem Unit.

How to Order Your Foot Mounted Posistop

The Foot Mounted *Posistop* Ordering System has been developed to simplify the ordering process and to reduce any misunderstanding and costly errors. To correctly order a Foot Mounted *Posistop* it is necessary to determine the following information: **Logic, Size, Type, Mounting Position and Cooling Options and Control Valve.** Just use the **Ordering System Chart** below to develop the proper **Ordering Number.**

Ordering System Chart Example: FB-05-S-1-H-1 / _____

F	1	2	3	4	5	6	7	8
Logic (1)		Size (2) (3)		Type (4)		Mounting Position (6)		CONTROL VALVE
S = Air Set Brake/ Spring Release	03 = 03	S = Single		H = Horizontal				See Section 10 for Ordering Number. Use N if no valve is ordered.
A = Medium Spring Set Brake/ Air Release	05 = 05	T = Tandem		D = Vertical Shaft Down		Cooling (7)		
B = Heavy Spring Set Brake/ Air Release	10 = 10			U = Vertical Shaft Up		1 = Basic (Radiant)		
	11 = 11	Shaft Options (5)		L = Wall on left viewing shaft.		5 = Fan Cooled		
	14 = 14	1 = Single Shaft		R = Wall on right viewing shaft.				
	20 = 20	2 = Double Ext. Shaft						

Section 7 Special Oil Shear Brakes

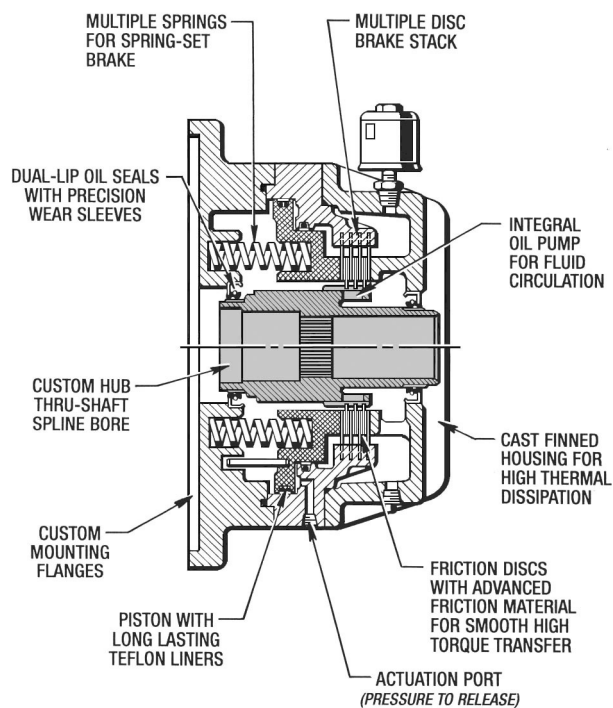
Force Control Industries, Inc. has developed over 150 special Posistop brakes for various applications. Often these are minor changes to a standard unit, but can be a completely new design. Check to see if one of our Posistop brakes might work in your application.

Posistop Flange Mounted Brakes

Many **Flange Mounted Posistop Brake** designs have been developed to fit specific applications. Mountings include a large variety of flange sizes and configurations. Hubs may be furnished to fit shafts with splines, steps, bearings and metric or unusual sizes. Thru-shaft units are also available, along with double flange or coupler brakes. A large range of torque capacities are available from 3 Ft. Lbs. to 2030 Ft. Lbs. (Contact Force Control for a complete range of Torque Capacities.)

Successful applications include hoists, tap heads, ball screw feed units, transfer drives, torque limiting for planetary drives along with many other uses. One of hundreds already designed may fit your application, or a custom unit can be developed to fit your special requirements. Our **Sales Engineering Department** is ready to work with you to provide a **Posistop Brake** to fit your specific application. Encoders or Tachometers are also available.

Below is an example of a **Posistop Flange Mounted Brake** shown with its specific applications listed.



Cross section of a **MB-180 Flange Mounted Posistop Brake** with a thru shaft and spline bore developed for a mechanical ball screw feed unit with a planetary gear drive

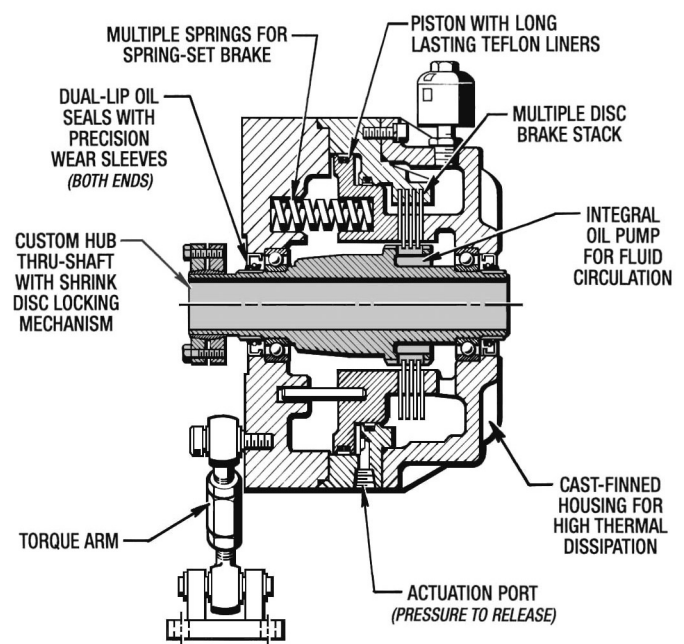
Posistop Shaft Mounted Brakes

Shaft Mounted Posistop Brake designs have been developed to fit many special shaft mounted applications. Hubs can be furnished to fit splined shafts, straight shafts or tapered mill motor shafts. A keyless collet, shrink-disc or other locking mechanism can be used.

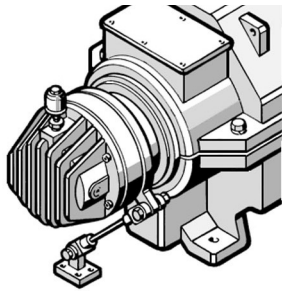
A large range of torque capacities are available from 20 Ft. Lbs. to 2030 Ft. Lbs. (Contact Force Control for a complete range of Torque Capacities.)

Successful applications include hoists, elevators and mill motor brakes along with many other shaft mounted applications. One already designed may fit your application, or a custom unit can be developed to fit your special requirements. Our **Sales Engineering Department** is ready to work with you to provide a **Posistop Brake** to fit your specific application. An Encoder or Tachometer can also be mounted on the brake.

Below is an example of a **Posistop Shaft Mounted Brake** shown with its specific applications listed.



A cross section of a **MB-210 Posistop Torque Arm, Thru-Shaft Mounted Brake**. It has a bearing mounted hub with a shrink-disc mechanism locking it to the equipment shaft. This brake was developed for a block elevator in the concrete industry.



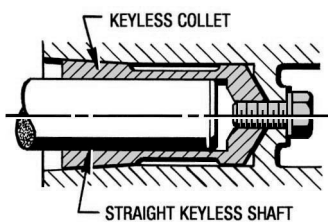
Posistop Mill Motor Brakes

The **Posistop Mill Motor Brake** was designed to mount on standard mill motors with the tapered shaft and lock nut. It is used to replace the drum and shoe type brakes commonly used in steel and other metal industries. Mounting is simple, as the brake mounts directly on the motor shaft and only a torque arm is required to prevent rotation. No special mounting bases, couplings or other fabrication is required.

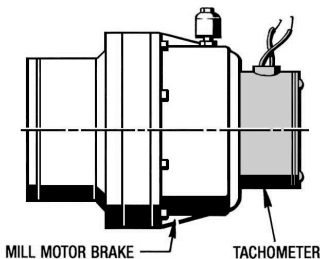
The spring-set, air release **Posistop Brake** is totally enclosed and not affected by scale, moisture or lubricants. Continual adjustments and burned-out electric coils are also eliminated.

Other Available Options

Straight Motor Shaft without Keyway.
(Keyless Collet / Shrink Disc)

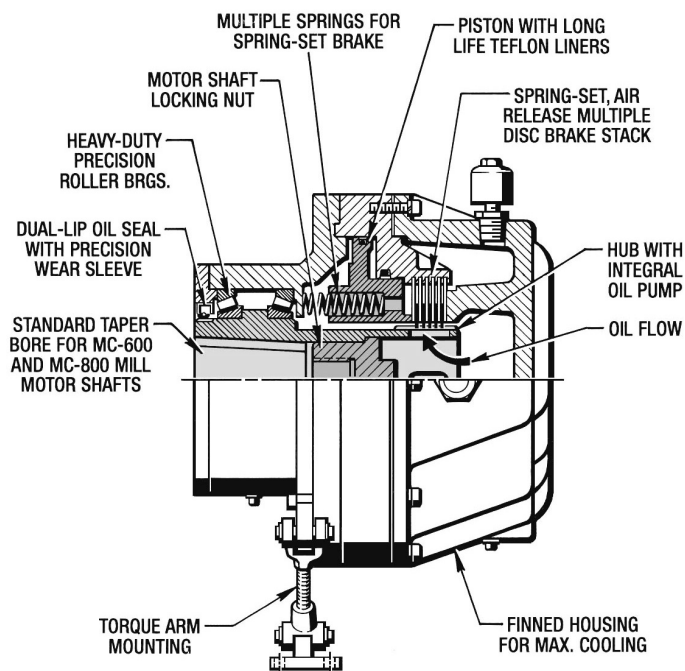


Tachometer Mounting



Tachometers or Encoders can be mounted to the end housing of the **Posistop Brake**.

Posistop Mill Motor Brake Features

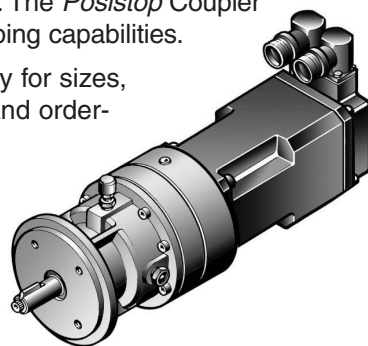


MB-320 MOTOR BRAKE SHOWN FOR MC-806 FRAME MILL MOTOR

Servo Motor Brakes

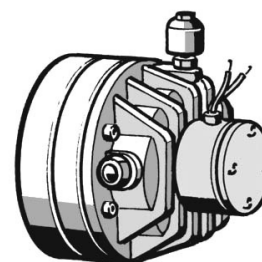
Most **Posistop Coupler Brakes** can be attached to a standard **PosiDrive Servo Motor** that has no internal brake or to replace an internal brake that doesn't function well for long term service. The **Posistop Coupler Brake** also has dynamic stopping capabilities.

Consult Force Control Factory for sizes, dimensions, torque ratings and ordering information.



Motor Brakes with Encoders

Most **Posistop Brakes** are available to accept an **Encoder** or **Tachometer**. Consult factory for sizes and types available.



Encoder/Tachometer

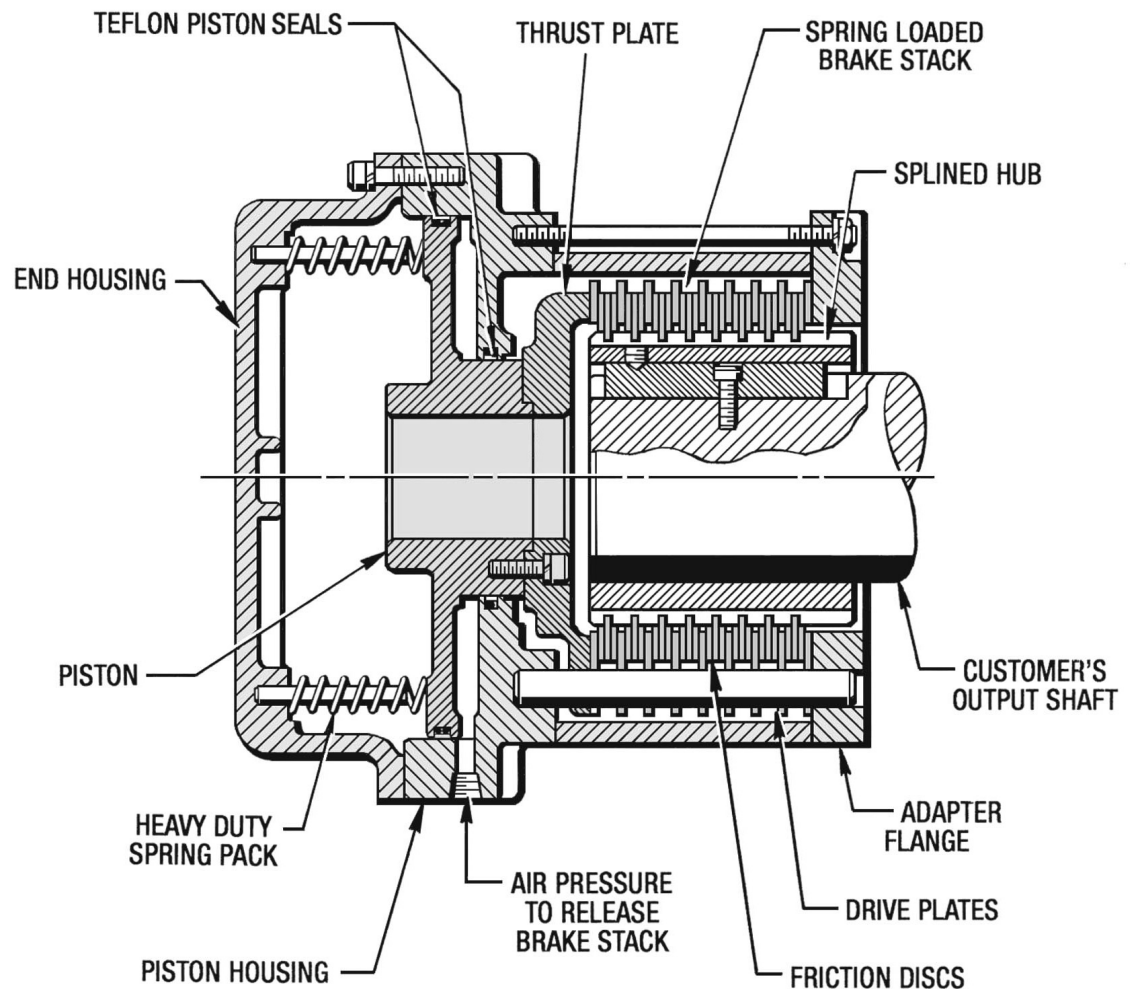
Section 8 Dry Friction E-Stop Brakes

Dry Friction Brakes for Emergency Stop



The **E-Stop Brake** is a dry-friction brake designed to be directly mounted to your machine or drive to provide an extremely fast and positive braking action in response to an E-Stop Event. These brakes are highly compact and space efficient.

They come in three basic frame sizes, 30 models with a range of 3,125 Lb.In. up to 312,700 Lb.In. of Static Torque.



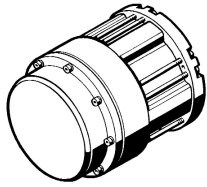
Features...

- Fast acting response.
- Compact and efficient design.
- Multiple Spring Set Brake with Multiple Friction Surfaces.
- High braking torque and low cyclic inertia.
- Totally enclosed.

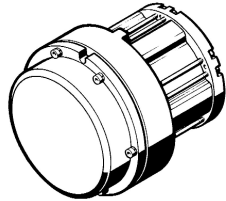
Benefits...

- Increased operator safety.
- Ease of installation.
- Space and cost savings.
- Long service life.
- Low maintenance.
- Energy efficient.

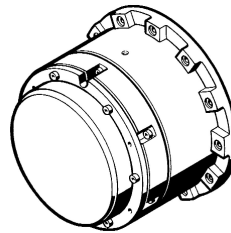
30 Models and Sizes to choose from...



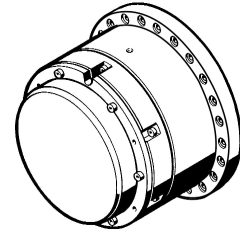
ES-C and ES-D Series



ES-S and ES-L Series



ES-T Series

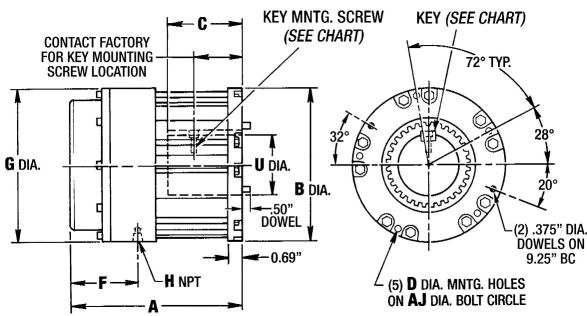


ES-M & ES-X Series

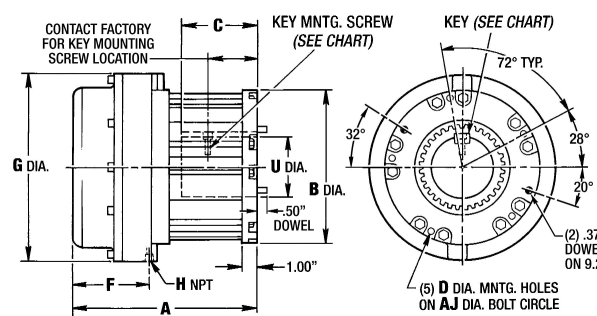
E-Stop Brake Dimensions (Inches)

BRAKE SERIES	A	B	C		D	F	G	H	U BORE		AJ
			MIN	MAX					MIN	MAX	
ES-C	8.87	10.00	2.25	2.69	.41	4.37	10.00	1/4" NPT	1.250	4.000	9.25
ES-D	10.35		3.06	3.81					2.500	4.000	
ES-S	10.50	10.00	4.00	5.12	.41	5.00	12.20	1/4" NPT	2.000	4.000	9.25
ES-L	12.00		4.18	6.20					3.750	6.250	
ES-T	13.05	21.50	4.18	6.20	.69	5.00	17.88	3/4" NPT	3.750	6.250	20.00

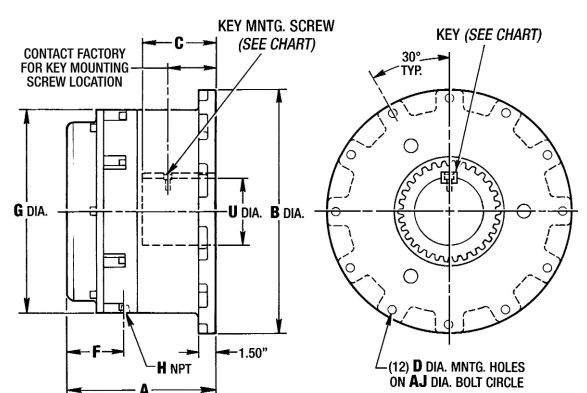
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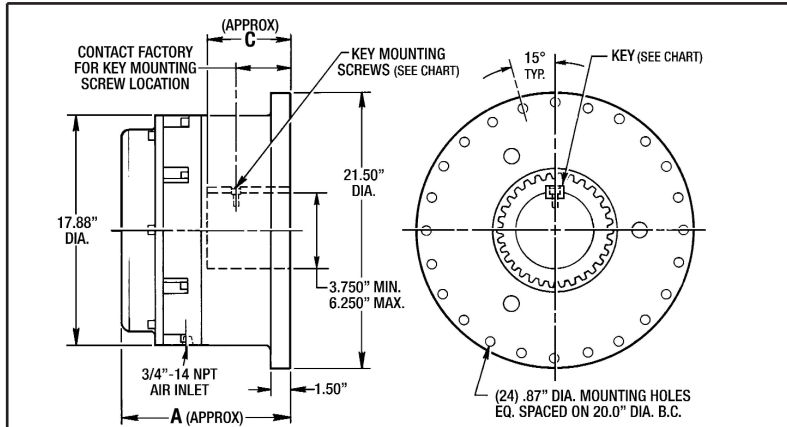
ES-C and ES-D Series



ES-S and ES-L Series



ES-T Series



BRAKE SERIES	A	C	
		MIN.	MAX.
ES-M	13.05	4.18	6.20
ES-X	15.07	6.75	8.34

ES-M and ES-X Series

E-Stop Brake Key Size (Inches)

HUB BORE (Inches)	KEY SIZE (Inches)	KEY SCREW SIZE (Inches)
1.250 to 1.375	5/16 x 5/16	Call Factory
1.375 to 1.750	3/8 x 3/8	Call Factory
1.750 to 2.250	1/2 x 1/2	1/4-20
2.250 to 2.750	5/8 x 5/8	5/16-18
2.750 to 3.250	3/4 x 3/4	3/8-16
3.250 to 3.750	7/8 x 7/8	3/8-16
3.750 to 4.500	1 x 1	3/8-16
4.500 to 5.500	1-1/4 x 1-1/4	3/8-16
5.500 to 6.500	1-1/2 x 1-1/2	3/8-16

E-Stop Brake Hub Bore Tolerance (Inches)

U Bore	Bore Tolerance
1.250" thru 3.150"	+.0005" to +.0017"
3.151" thru 4.730"	+.0005" to +.0019"
4.731" thru 6.250"	+ .0005" to + .0021"

NOTES:

1. Dimensions are subject to change without notice. Certified Installation Drawings are available upon request.
2. Hub Key is supplied with brake.
3. Consult factory for interference fit hubs on high speed applications over 400 RPM.

E-Stop Brake Specifications

Brake Size	Nominal Static Torque (Lb. In.)	No. of Friction Discs	No. of Springs	Pressure to Release (PSI)	Minimum Shaft Dia. (Inches)	Max. Shaft Dia. (Inches)		Piston Volume (Cu. In.)	Cyclic Inertia (Lb. Ft. ²)	Weight (Lbs.)
						Stub Shaft	Thru Shaft			
ES-C-003	3,125	3	2	14	1.39	4.00	3.25	14.6	0.35	105
ES-C-006	6,250	3	4	28	1.39					
ES-C-009	9,375	3	6	42	1.39					
ES-C-013	12,500	3	8	56	1.39					
ES-D-019	18,750	6	4	28	1.76	4.00	3.25	14.6	0.66	128
ES-D-025	25,000	6	8	56	2.06					
ES-S-010	10,400	5	3	13	1.39	4.00	3.25	37.5	0.78	134
ES-S-014	13,900	5	4	17	1.63					
ES-S-021	20,900	5	6	26	1.86					
ES-S-028	27,900	5	8	35	2.26					
ES-S-031	31,400	5	9	39	2.26					
ES-S-035	34,900	5	10	44	2.50					
ES-S-042	41,900	5	12	52	2.76					
ES-L-034	33,500	8	6	26	1.99	4.00	3.25	37.5	0.55	160
ES-L-045	44,700	8	8	35	2.26					
ES-L-050	50,200	8	9	39	2.39					
ES-L-056	55,800	8	10	44	2.67					
ES-L-067	66,700	8	12	52	2.76					
ES-T-059	59,400	5	8	33	3.26	6.25	5.25	73	3.50	463
ES-T-074	74,200	5	10	41	3.75					
ES-T-089	89,000	5	12	49	4.00					
ES-T-104	103,900	5	14	57	4.51					
ES-M-119	118,800	9	12	35	3.61	6.25	5.25	73	6.00	463
ES-M-138	137,600	9	14	41	3.76					
ES-M-157	157,300	9	16	47	4.19					
ES-M-177	177,000	9	18	52	4.51					
ES-M-197	196,600	9	20	58	4.51					
ES-M-216	216,300	9	22	64	4.61					
ES-M-236	236,000	9	24	70	5.03					
ES-X-313	312,700	13	24	70	4.75	6.25	5.25	73	9.3	528

NOTE: Multiply Static Torque by .77 to convert to Dynamic Torque.

How to Order Your E-Stop Brake

Ordering System Chart

Example: ES-L-050-S-400



E-Stop (1, 2)

Size (3)

- C** = Compact Brake - Short Stack
- D** = Compact Brake - Long Stack
- L** = Small Brake - Long Stack
- S** = Small Brake - Short Stack
- M** = Large Brake - Long Stack
- T** = Large Brake - Short Stack
- X** = Large Brake - Extra-Long Stack

Type Shaft (7)

- S** = Stub Shaft
- T** = Thru Shaft

Bore Dia. Range (8, 9, 10)

- Compact Brake**
- 1 2 5** = 1.250" Min.
 - 4 0 0** = 4.000" Max.
- Small Brake**
- 2 0 0** = 2.000" Min.
 - 4 0 0** = 4.000" Max.
- Large Brake**
- 3 7 5** = 3.750" Min.
 - 6 2 5** = 6.250" Max.

Torque (4, 5, 6)

	Compact Brake	Small Brake	Large Brake																												
Short Stack	<table border="0"> <tr><td>0 0 3</td><td>= 3,125 Lb.In.</td></tr> <tr><td>0 0 6</td><td>= 6,250 Lb.In.</td></tr> <tr><td>0 1 3</td><td>= 12,500 Lb.In.</td></tr> </table>	0 0 3	= 3,125 Lb.In.	0 0 6	= 6,250 Lb.In.	0 1 3	= 12,500 Lb.In.	<table border="0"> <tr><td>0 1 0</td><td>= 10,400 Lb.In.</td></tr> <tr><td>0 1 4</td><td>= 13,900 Lb.In.</td></tr> <tr><td>0 2 1</td><td>= 20,900 Lb.In.</td></tr> <tr><td>0 2 8</td><td>= 27,900 Lb.In.</td></tr> <tr><td>0 3 1</td><td>= 31,400 Lb.In.</td></tr> <tr><td>0 3 5</td><td>= 34,900 Lb.In.</td></tr> <tr><td>0 4 2</td><td>= 41,900 Lb.In.</td></tr> </table>	0 1 0	= 10,400 Lb.In.	0 1 4	= 13,900 Lb.In.	0 2 1	= 20,900 Lb.In.	0 2 8	= 27,900 Lb.In.	0 3 1	= 31,400 Lb.In.	0 3 5	= 34,900 Lb.In.	0 4 2	= 41,900 Lb.In.	<table border="0"> <tr><td>0 5 9</td><td>= 59,400 Lb.In.</td></tr> <tr><td>0 7 4</td><td>= 74,200 Lb.In.</td></tr> <tr><td>0 8 9</td><td>= 89,000 Lb.In.</td></tr> <tr><td>1 0 4</td><td>= 103,900 Lb.In.</td></tr> </table>	0 5 9	= 59,400 Lb.In.	0 7 4	= 74,200 Lb.In.	0 8 9	= 89,000 Lb.In.	1 0 4	= 103,900 Lb.In.
0 0 3	= 3,125 Lb.In.																														
0 0 6	= 6,250 Lb.In.																														
0 1 3	= 12,500 Lb.In.																														
0 1 0	= 10,400 Lb.In.																														
0 1 4	= 13,900 Lb.In.																														
0 2 1	= 20,900 Lb.In.																														
0 2 8	= 27,900 Lb.In.																														
0 3 1	= 31,400 Lb.In.																														
0 3 5	= 34,900 Lb.In.																														
0 4 2	= 41,900 Lb.In.																														
0 5 9	= 59,400 Lb.In.																														
0 7 4	= 74,200 Lb.In.																														
0 8 9	= 89,000 Lb.In.																														
1 0 4	= 103,900 Lb.In.																														
Long Stack	<table border="0"> <tr><td>0 1 9</td><td>= 18,750 Lb.In.</td></tr> <tr><td>0 2 5</td><td>= 25,000 Lb.In.</td></tr> </table>	0 1 9	= 18,750 Lb.In.	0 2 5	= 25,000 Lb.In.	<table border="0"> <tr><td>0 3 4</td><td>= 33,500 Lb.In.</td></tr> <tr><td>0 4 5</td><td>= 44,700 Lb.In.</td></tr> <tr><td>0 5 0</td><td>= 50,200 Lb.In.</td></tr> <tr><td>0 5 6</td><td>= 55,800 Lb.In.</td></tr> <tr><td>0 6 7</td><td>= 66,700 Lb.In.</td></tr> </table>	0 3 4	= 33,500 Lb.In.	0 4 5	= 44,700 Lb.In.	0 5 0	= 50,200 Lb.In.	0 5 6	= 55,800 Lb.In.	0 6 7	= 66,700 Lb.In.	<table border="0"> <tr><td>1 1 9</td><td>= 118,800 Lb.In.</td></tr> <tr><td>1 3 7</td><td>= 137,600 Lb.In.</td></tr> <tr><td>1 5 7</td><td>= 157,300 Lb.In.</td></tr> <tr><td>1 7 7</td><td>= 177,000 Lb.In.</td></tr> <tr><td>1 9 7</td><td>= 196,600 Lb.In.</td></tr> <tr><td>2 1 6</td><td>= 216,300 Lb.In.</td></tr> <tr><td>2 3 6</td><td>= 236,000 Lb.In.</td></tr> </table>	1 1 9	= 118,800 Lb.In.	1 3 7	= 137,600 Lb.In.	1 5 7	= 157,300 Lb.In.	1 7 7	= 177,000 Lb.In.	1 9 7	= 196,600 Lb.In.	2 1 6	= 216,300 Lb.In.	2 3 6	= 236,000 Lb.In.
0 1 9	= 18,750 Lb.In.																														
0 2 5	= 25,000 Lb.In.																														
0 3 4	= 33,500 Lb.In.																														
0 4 5	= 44,700 Lb.In.																														
0 5 0	= 50,200 Lb.In.																														
0 5 6	= 55,800 Lb.In.																														
0 6 7	= 66,700 Lb.In.																														
1 1 9	= 118,800 Lb.In.																														
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1 9 7	= 196,600 Lb.In.																														
2 1 6	= 216,300 Lb.In.																														
2 3 6	= 236,000 Lb.In.																														
			<p>Extended Brake</p> <table border="0"> <tr><td>3 1 3</td><td>= 312,700 Lb.In.</td></tr> </table>	3 1 3	= 312,700 Lb.In.																										
3 1 3	= 312,700 Lb.In.																														

NOTE: This just indicates the Minimum and Maximum Bore Diameter for each size brake.

You must specify the Required Bore Diameter with (3) digits as shown in the following examples.

- | | |
|-------------------|-------------------|
| 175 = 1.750" Dia. | 425 = 4.250" Dia. |
| 200 = 2.000" Dia. | 450 = 4.500" Dia. |
| 225 = 2.250" Dia. | 475 = 4.750" Dia. |
| 250 = 2.500" Dia. | 500 = 5.000" Dia. |
| 275 = 2.750" Dia. | 525 = 5.250" Dia. |
| 300 = 3.000" Dia. | 550 = 5.500" Dia. |
| 325 = 3.250" Dia. | 575 = 5.750" Dia. |
| 350 = 3.500" Dia. | 600 = 6.000" Dia. |
| 375 = 3.750" Dia. | 625 = 6.250" Dia. |
| 400 = 4.000" Dia. | |

Section 9 Positorq® Absorber Brakes

Tension Control and Dynamometers

The **Positorq Absorber Brakes and Clutches** use the same basic design of a multiple disc stack furnished with a continuous supply of cooling and lubricating fluid as do the other Force Control products. A major difference between the **Positorq** and the **Posistop** brake is that the **Positorq** is designed as a constant slip device and is normally force lubed for smooth torque control and energy absorption.

Tension brakes and dynamometers are essentially energy absorbers. Rotary motion is transformed through the brake to heat. Therefore, a critical function of the brake is to be able to dissipate this heat during slip. In the **Positorq**, fluid is pumped through the

shaft to furnish a continuous supply of fluid to the friction surfaces. The fluid, both lubricates the surfaces at the point of contact and removes the heat. The heated fluid is then circulated through a cooling unit (either oil to water or oil to air) dissipating the heat and returned to the **Positorq**.

Since the effective radius, number of discs and friction factor remains constant, the torque available is directly equivalent to the (air or hydraulic) actuation pressure furnished to the actuating piston.

Positorq Brakes are rated up to 117,935 Lb. Ft. Slip Torque and 2000 Thermal Horsepower.

Advantages of the Positorq Absorber Brakes

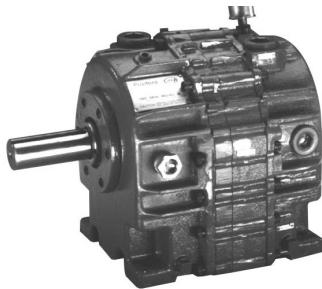
9

A. Simple Precise Torque Control

1. Torque is proportional to the actuation pressure supplied to the actuation piston. This allows for easy control of the Torque.
2. Lubricated friction surfaces provide smooth stable torque control over the entire speed range, even at low speeds.
3. Teflon Piston Liners produce very smooth controllable piston movement for precise control.

B. High Capacity-Compact Size

1. Multiple braking surfaces reduces overall size.
2. A separate forced lube cooling system allows for a small unit size with high thermal capacity.



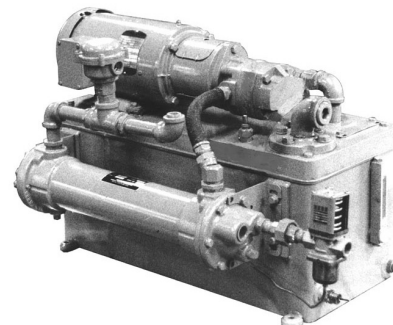
TB-05 Positorq

C. Hostile Environments

1. Totally enclosed cast iron housing design prevents contamination by dust, dirt, chips, chemicals, water, etc.
2. Enclosed unit also prevents contamination of the surrounding environment.

D. Low Maintenance-Long Life

1. Lubricating and cooling of the friction surfaces reduces disc and plate wear to a minimum.
2. Heavy duty construction, lubricated bearings and high quality seals with wear sleeves reduce downtime.
3. Teflon liners on the piston reduce piston seal wear.
4. Wear Indicator (80 Series only) for easy disc wear check.



Typical Force Lube Cooling Unit

Positorq Standard Design Configurations

The *Positorq* comes in various design configurations depending on the required use. These Absorber Brakes & Clutches can be used as Tension Brakes in the steel, plastic

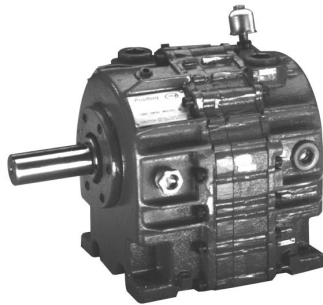
and paper industry as well as energy absorbers for Dynamometers for testing automobiles, tractors, gearing, axles and motors. There are many styles and sizes available.

9

A. FOOT MOUNTED BRAKE

(Sizes TB-03 to TB-20)

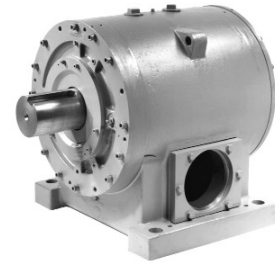
The smaller series foot mounted *Positorq* comes in 6 housing sizes and can be furnished with single or dual brake stacks. (TB-20 can also have 3 stacks for a higher torque range.) They can also be furnished with a single or double shaft extension. They range in torque from 72 to 2146 Lb. Ft. continuous slip and up to 4292 Lb. Ft. static torque. They can dissipate up to 180 thermal horsepower continuously.



B. FOOT MOUNTED BRAKE

(Sizes TB-82 to TB-87)

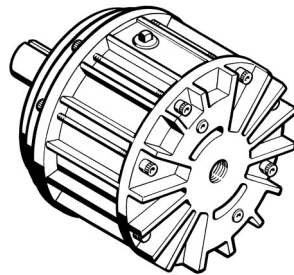
The larger series foot mounted *Positorq* brakes also come in 6 housing sizes with extended or hollow shaft arrangements. They range in torque from 1995 to 118,000 Lb. Ft. continuous slip and up to 235,581 Lb. Ft. static torque. They can dissipate up to 3800 thermal horsepower continuously. These units are suited to large dynamometer applications and primary paper mill and steel unwinding applications.



C. FLANGE MOUNTED BRAKE

(Size TB-20 & TB-83)

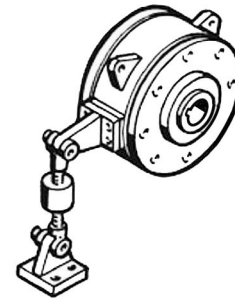
The flange mounted *Positorq* brake comes in an aluminum housing with a flange mounting and either an extended shaft or hollow bore. This is an excellent brake for use on shaftless unwind stands in paper converting applications. Torque is up to 44,000 Lb. Ft. continuous slip and 250 thermal horsepower.



D. SHAFT MOUNTED BRAKE

(Sizes TB-85-205, TB-85-212 and TB-87)

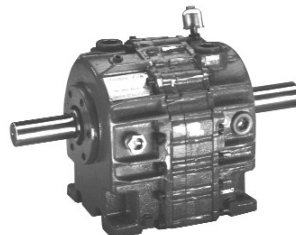
Shaft mounted units are available in 5 torque ranges in the basic TB-85 and TB-87 housing. Torque ranges from 7095 to 118,000 Lb. Ft. with continuous thermal horsepower up to 2000. They can be furnished with either an extended shaft or a hollow shaft design. Flange mounting or torque arm mounting is also available.



E. FOOT MOUNTED CLUTCHES

(Sizes TC-02 to TC-30)

The Foot Mounted TC-02 to TC-30 *Positorq* Clutches can be used as energy absorbers for Dynamometers. The Force Control oil shear design eliminates stick slip and chatter at low speeds. This makes them particularly effective on low speed, high torque applications such as transmission, hydraulic motor and gear testing. The extremely high static torque capability also allows high torque lock-up testing.



F. FORCED LUBE COOLING UNIT

The Forced Lube Cooling Units are required for most continuous slip applications. The cooling units are furnished with a pump/motor/coupling arrangement, filter system, pressure switch, temperature switch and heat exchanger mounted on a reservoir. Heat exchangers can be oil to water or oil to air. They are designed for each particular application.



Positorq Features and Benefits

Smooth Consistent Control

- ◆ State-of-the Art friction materials and fluids have been developed for very smooth and consistent operation. Jerks, steps, chatter, etc. have virtually been eliminated.
- ◆ Controlled fluid temperature through the brake improves consistency for precision testing.

Stable Torque Control

- ◆ Smooth, consistent actuation with low piston hysteresis is experienced by using Teflon Liners over the O-Rings to seal the non-rotating piston. This eliminates stick slip often associated with O-Ring seals.
- ◆ Torque is controlled by actuation pressure and is independent of speeds above the residual (minimum) drag torque.

Low Speed Capability

- ◆ Operational speeds at levels down to 0 RPM are precisely controlled without chatter, stick slip or torque variation.
- ◆ Speed-up drives which can influence test results are eliminated.

High Torque and Horsepower Capability

- ◆ Various sizes available from 53 Ft. Lbs. up to 27,656 Ft. Lbs. Continuous heat absorption capability up to 1500 thermal horsepower.

Quiet Operation

- ◆ Extremely quiet operation with noise levels of the brake system below 65 db. This is beneficial for laboratory operation or noise testing.

Quick Response for Computer Control

- ◆ Quick, precise piston actuation produces excellent response to manually or computer generated signals. Hydraulic actuation can also be furnished for even quicker actuation.
- ◆ Low rotating mass inertia for increased responsiveness to changes in torque requirements.

No Adjustment Required

- ◆ Adjustment is not required, making it very useful for long continuous life tests of many months duration without shutting down for brake adjustments or repairs.

Long Service Life

- ◆ Oil shear technology nearly eliminates the frictional wear of the disc stack. Therefore long life and low maintenance costs are experienced. Inexpensive repair kits are available from stock.
- ◆ An external wear indicator indicates the need for impending stack replacement long before actual failure would occur.

Low Air Pressure Required

- ◆ Maximum required air pressure is below 60 PSI reducing problems associated with low plant air pressure.

Totally Enclosed Design

- ◆ The totally enclosed design eliminates any contamination to the lab or test area with friction materials or other harmful contaminants.

The **Positorq Brake** is an excellent **Energy Absorber** for **Tension & Dynamometer** applications requiring high torque, low speed and especially for endurance testing. The oil shear system is very smooth eliminating stick slip and chatter common to low speed testing. Also by using the fluid for lubrication and cooling the life under load is extremely long allowing for continuous testing for weeks or months with no change in characteristics.

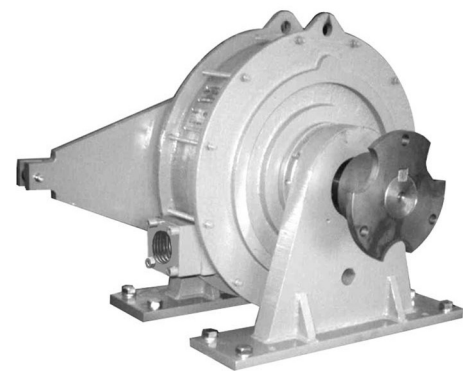
The quick response piston and low inertia is also beneficial in testing under varying load conditions such as computer generated load simulations.

Tension Application



TB-85HT Positorq Absorber Brake for Tension Application

Dynamometer Application



TB-82 Positorq Absorber Brake with torque arm for base mounting.

Positorq Dynamometer Typical Applications

There are many applications where *Positorq* brake dynamometers can be used. A few typical applications are shown below.

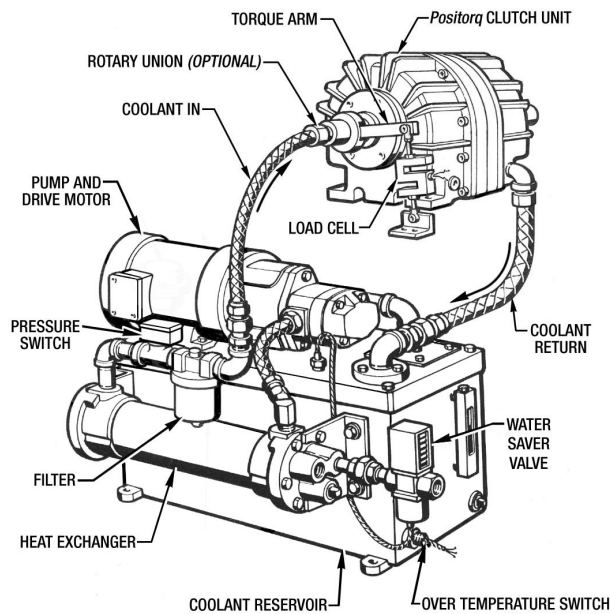
(A) Hydraulic Motor Testing is a way to test hydraulic motors after repair or for trouble shooting. Also full load torque and efficiency can be verified.

(B) Gear Box Testing is an excellent application because the brake can absorb continuous loads and high lock up torque for destructive testing. This could also be used for noise testing of the gear box under load for environmental conditions.

(C) Transmission Testing is a good way to test a transmission from an automobile, truck, tractor or other off-the road equipment. The brake can be controlled by a computer to simulate field conditions for shock loads. Also endurance testing for auto or truck transmissions.

(D) Axle Testing requires high torque at low speeds with no stick slip or chatter. The assemblies can also be tested for efficiency and noise with the *Positorq* Brake.

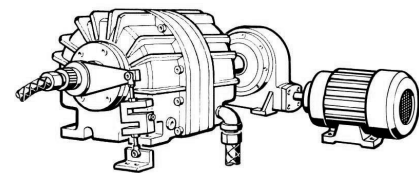
System Components



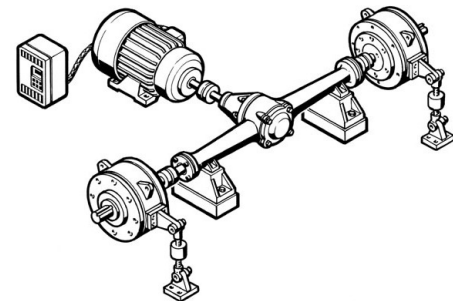
Positorq Foot Mounted Clutch with a Load Cell and Forced Lube Cooling Unit for a dynamometer application.

Typical Applications

A Gear Box or Hydraulic Motor Testing



B Axle Testing



Dynamometer Accessories

There are several accessories that can be furnished with the *Positorq Dynamometer Brakes* to complete the control loop.

■ **Load Cell** - An S-Beam type load cell can be furnished with the *Positorq Brake* when assembled with bearing mounted Positorq and base. These are available in various load ranges depending on the torque requirements.

■ **Servo Valves** - These are used to control the air or hydraulic actuation pressure to the *Positorq Brake* which sets the torque level. These can be ordered to be controlled either manually using a potentiometer, or outputs from a PLC, PID control or computer. Contact the factory for additional information on these items.

■ **Solenoid Valve** - The solenoid valve is simply an On/Off valve to actuate the *Positorq Brake*. It does not control pressure. It only allows the actuation pressure to be applied to the brake stack.

■ **PID Control** - The PID controller is a way of controlling an accurate feedback loop for controlling torque to a set point. The required setting is set at the PID control which will control the actuation pressure to maintain the desired torque.

■ **Speed Pick-Up** - A magnetic speed pick-up can be furnished on the output end of the *Positorq Brake* to measure RPM. A digital readout can also be furnished.

Positorq Typical Tension Applications

There are various tension applications which are excellent for the *Positorq* brake system. A few of them are shown below.

(A) Tension Stand for a paper mill is a common application. The larger *Positorq* brakes are excellent in the Kraft paper applications with the high PLI and high speeds. An optional payout drive can also be furnished for threading. The forced lube cooling unit can be built as a part of the structure eliminating additional components.

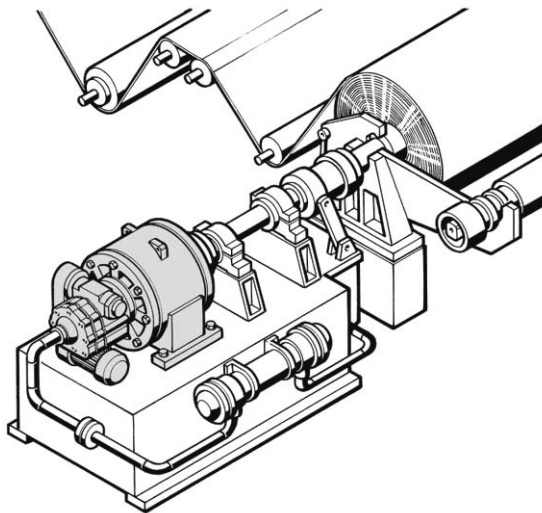
(B) Shaftless Unwind Stands for a paper converting mill can effectively use the flange mounted brakes because the light aluminum housing reduces the weight on the moveable arms. These are excellent for tension stands on corrugated, laminated or coating lines. The smooth

tension improves product quality and the long life reduces maintenance requirements.

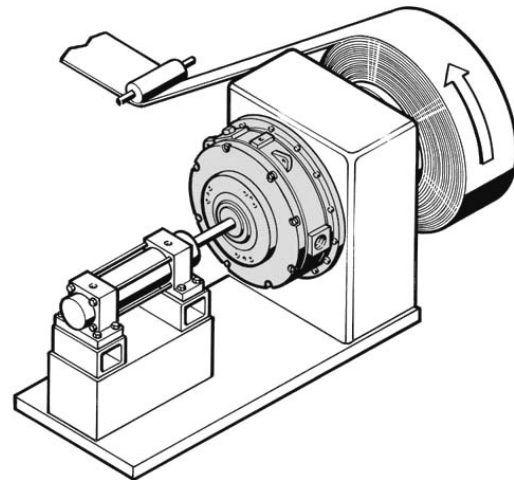
(C) Unwind Stand for a steel mill requires very high torque at low speeds, which is perfect for the *Positorq* brake. The smooth operation eliminates chatter which can cause marks in leveling, polishing or coating. The enclosed housing reduces wear and torque changes due to moisture, scale and chips in the friction material.

(D) Unwind Stands for plastic film need very consistent tension to eliminate stretching and deformation. The oil shear *Positorq* brake is very smooth and with the reduced inertia of rotating components is extremely responsive to changes in controller outputs.

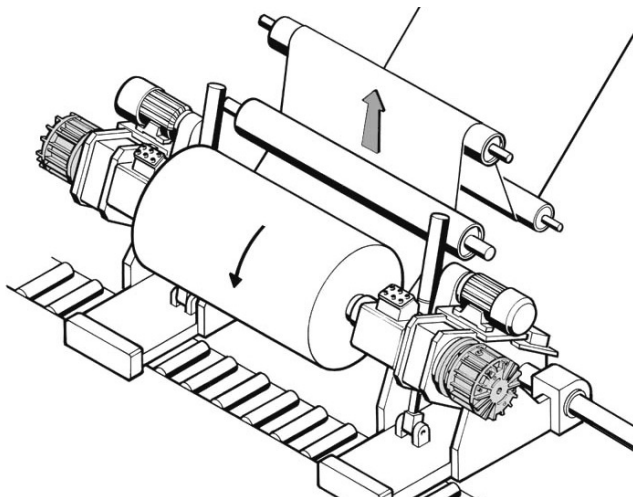
A Tension Stand (Paper Mill)



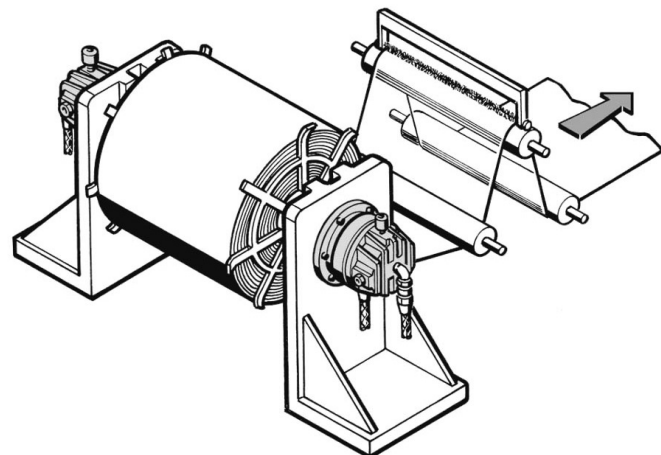
C Unwind Stand (Steel Mill)

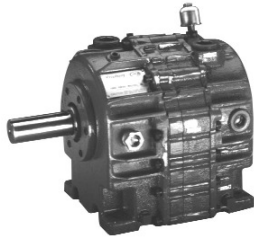


B Shaftless Unwind Stand (Paper Converting Mill)



D Unwind Stand (Plastic Film)





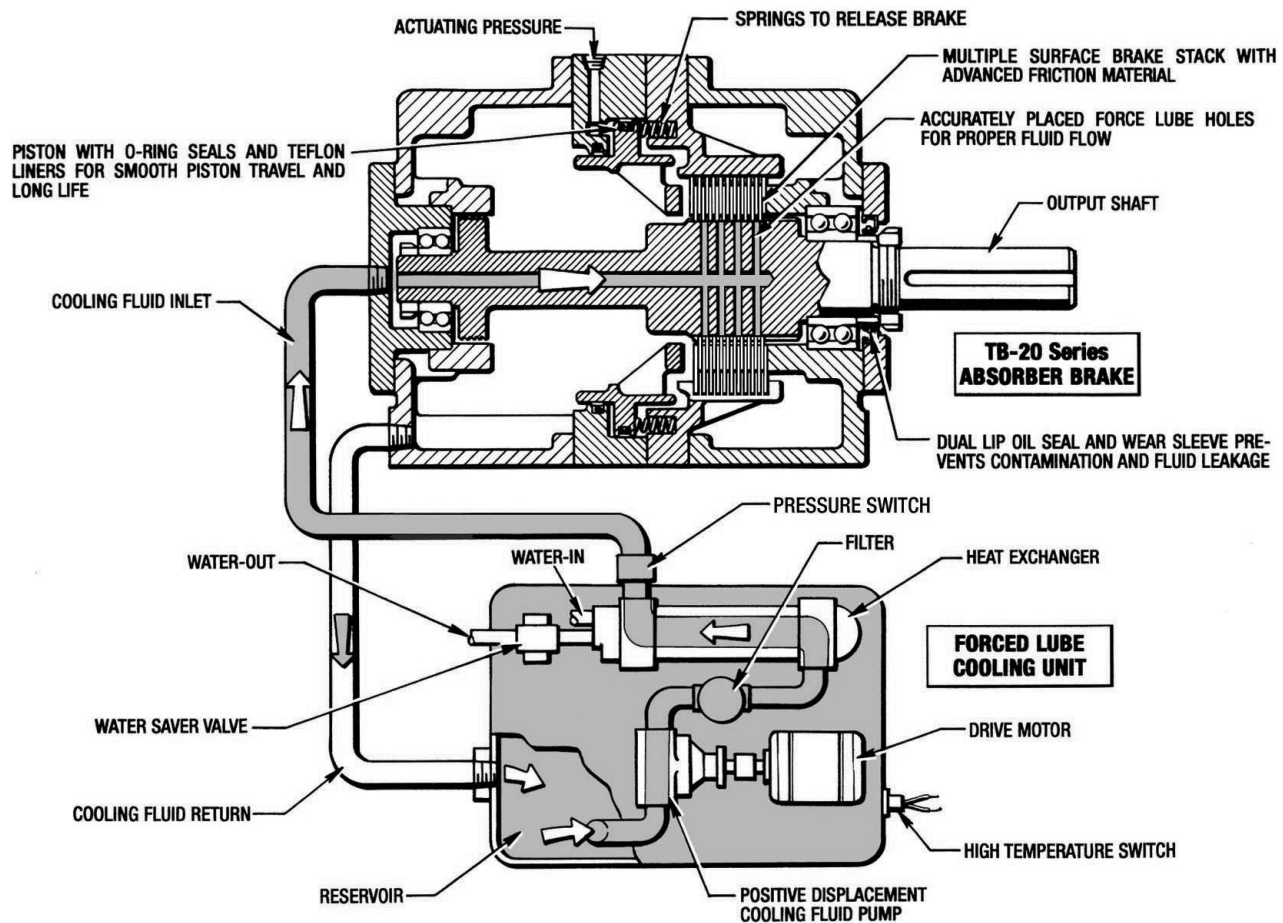
A. Positorq Foot Mounted Absorber Brakes

(Sizes TB-03 to TB-20)

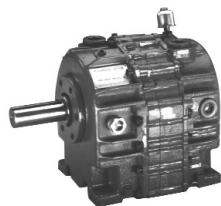
The smaller **Positorq** Absorber Brakes normally consists of a **Positorq** brake and a forced lube cooling unit. Fluid is pumped through the brake under low pressure (less than 80 PSI), to cool and lubricate the stack. The fluid is pumped through the output shaft, through the stack and back

into the sump. A positive displacement pump is used to reduce the possibility of starvation of the stack and flow switches are provided to shut down the system in case of failure. Efficient heat exchangers are used to remove the heat absorbed from the brake.

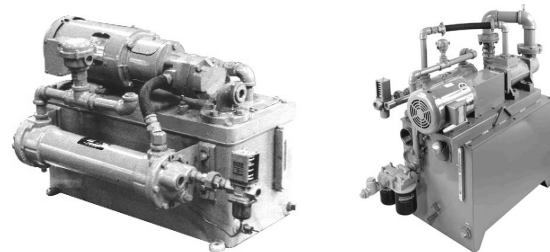
System Features and Components (Without Kidney Filtration)



FOOT MOUNTED
ABSORBER BRAKE



TYPICAL FORCED LUBE COOLING UNITS



Positorq Absorber Brake Specifications

Sizes TB-03 to TB-20 Foot Mounted

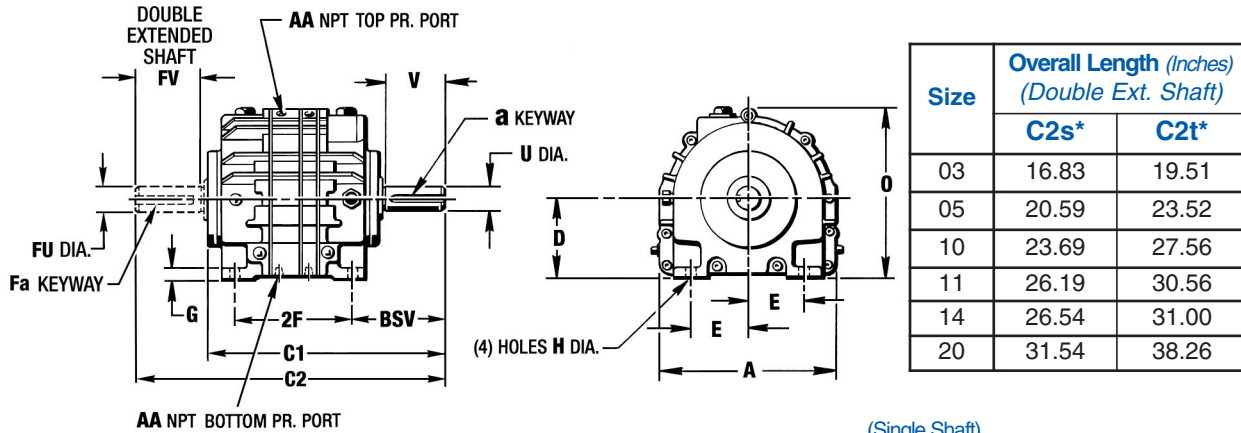
Positorq Size	No. of Discs	Dynamic Brake Torque (Lb. Ft.)		Max. Static Torque @ PSIG	Max. RPM	Thermal		Piston Chamber Volume (Cu. In.)	Inertia Cyclic Parts (Lb. Ft. ²)
		Maximum Continuous Slip @ PSIG	Maximum * Momentary Slip @ PSIG			Basic	Force Lube		
03	5	72 @ 43	107 @ 55	145 @ 69	3600	0.40	35.0	7.6	.04
	10	144 @ 43	214 @ 55	290 @ 69			70.0	15.2	.10
05	9	130 @ 30	195 @ 43	261 @ 60	3600	1.00	63.0	8.0	.08
	18	260 @ 30	391 @ 43	521 @ 60			125.0	16.0	.16
10	7	277 @ 32	415 @ 44	554 @ 56	3600	1.25	90.0	12.0	.25
	14	554 @ 32	831 @ 44	1,108 @ 56			132.0	24.0	.50
11	7	478 @ 50	717 @ 70	956 @ 90	1800	1.20	60.0	12.0	.38
	14	956 @ 50	1,435 @ 70	1,913 @ 90			120.0	24.0	.54
14	11	751 @ 49	1,127 @ 68	1,503 @ 87	1800	1.20	60.0	12.0	.53
	22	1,503 @ 49	2,254 @ 68	3,006 @ 87			120.0	24.0	.99
20	7	641 @ 33	960 @ 47	1,280 @ 60	1800	1.50	95.0	23.0	1.50
	14	1,282 @ 33	1,920 @ 47	2,560 @ 60			190.0	46.0	3.2
	21	1,922 @ 35	2,880 @ 47	3,844 @ 60			190.0	69.0	4.7

* - Less than 60 seconds, less than 60% duty.

Positorq Absorber Brake Dimensions (Inches)

Sizes TB-03 to TB-20 Foot Mounted

9



Size	Foot Mounting Dimensions (Inches)									Overall Length		Shaft Dim. (Inches)			Port (NPT) - AA	
	A	D	E	2Fs**	2Ft**	G	H	O	BSV	C1s**	C1t**	a/Fa	U/FU	V/FV	(Bot.)	(Top)
03	10.25	4.5	3.31	6.50	9.13	.50	.44	10.38	5.19	13.25	15.88	5/16 x 5/32	1-3/8	3.50	1/4	1/4
05	10.25	6.5	3.50	9.09	12.02	.75	.56	12.38	5.75	16.50	19.42	3/8 x 3/16	1-5/8	4.00	1/4	1/4
10	12.50	6.5	3.50	12.69	16.56	1.00	.75	13.63	5.50	19.75	23.62	3/8 x 3/16	1-3/4	3.75	1/4	1/4
11	12.62	6.5	4.75	12.69	16.56	1.00	.75	14.50	6.75	21.00	24.88	5/8 x 5/16	2-3/8	5.00	1/4	1/4
14	12.62	6.5	4.75	13.04	16.32	1.00	.75	14.50	6.75	21.38	25.85	5/8 x 5/16	2-3/8	5.00	1/4	1/4
20	17.50	9.0	5.75	16.78	21.50	1.38	.88	19.00	7.38	26.75	31.50	5/8 x 5/16	4.75	4.75	3/8	1/2

* - Top porting is standard, bottom porting is optional. The use of bottom porting is recommended to purge contaminants out of the cylinders when they are exhausted. Top porting will not purge the cylinders.

** - In the dimensional table "s" denotes a single brake stack unit and "t" denotes a tandem brake stack unit.

***- Keyed shaft not available on Size 20 Tandem stack units

B. Positorq Absorber Brakes (Sizes TB-82 to TB-87)



System Features and Components (With Kidney Filtration)

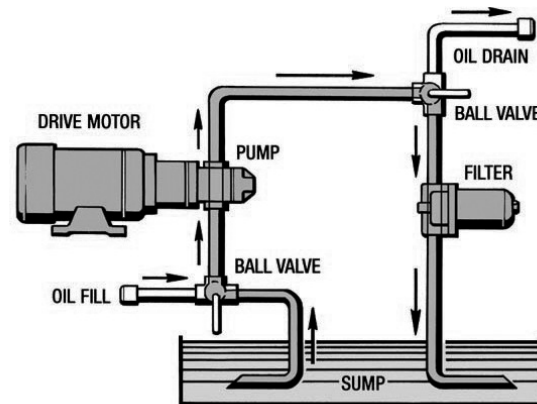
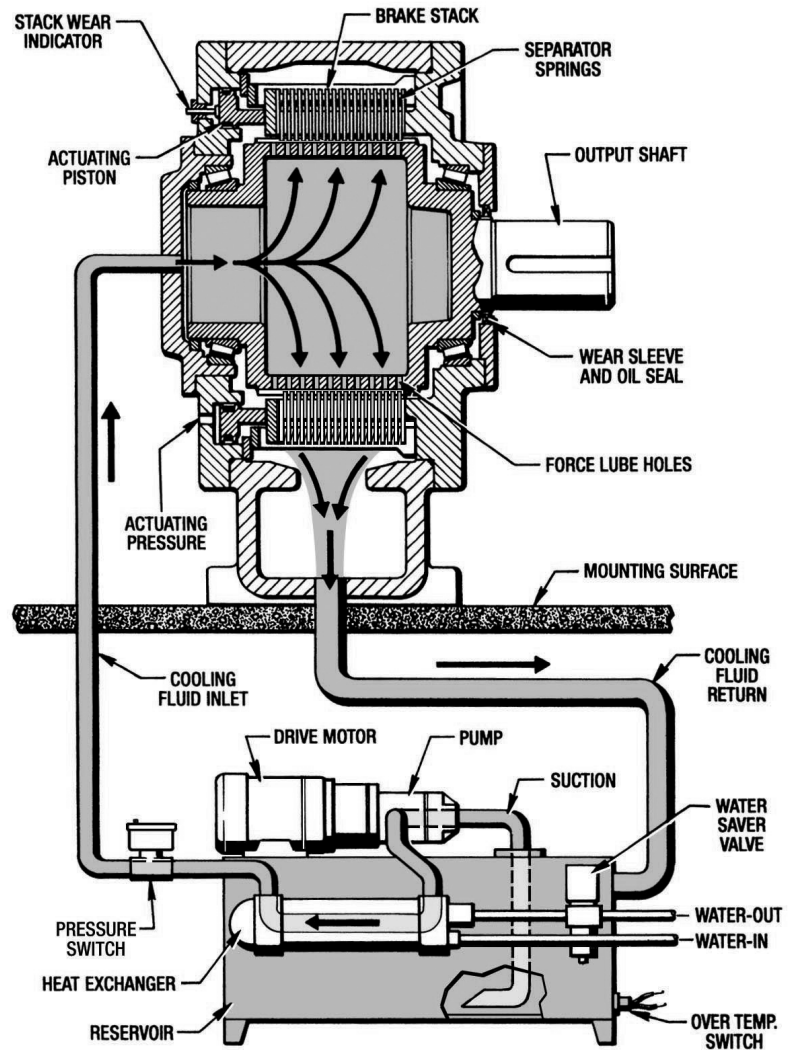
Positive Forced Oil Lubrication fights wear and absorbs heat for long-lasting dependability and fewer shutdowns which reduces maintenance costs and increases mill productivity.

9

In the **Positorq Brake**, a multiple disc brake stack operates in a positive supply of cooling fluid that's delivered from the center of the shaft.

The circulation of fluid between carefully prepared friction surfaces of the disc stack is the key to the service life of the **Positorq**. The circulating fluid, while providing lubrication, carries heat away from the disc stack. The heat is then dissipated by an auxiliary **Forced Lubrication Cooling Unit** designed for your application's thermal horsepower load.

- Positive fluid supply for dependable operation.
- Totally enclosed, will not contaminate your plant environment.
- Quiet operation.
- Closed loop automatic or manual tension control options.
- Use 3-15 PSI process control signal with 2:1 booster for automatic mode.
- Field proven in steel and paper mills.
- Minimal overhaul costs when infrequent overhauls are needed.
- Highly efficient Kidney Filtration System.



Positorq Specifications

Sizes TB-82 to TB-87

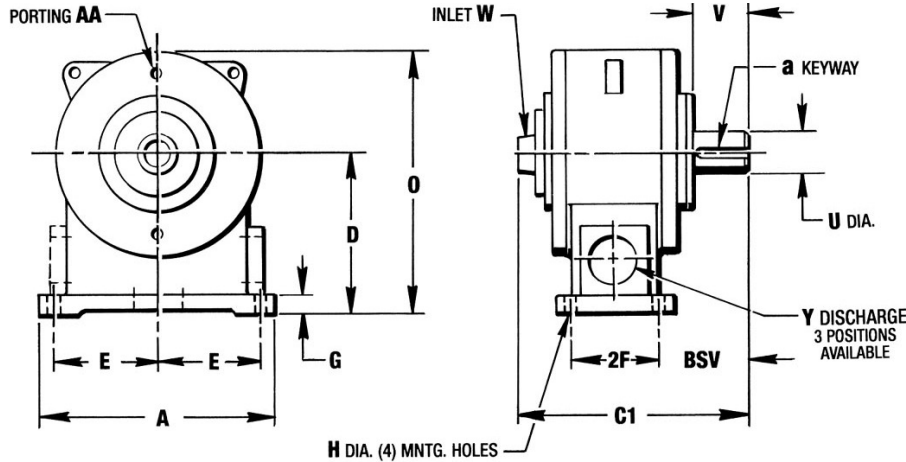
Smaller Units - Page 9.6
 Selection Procedure - Section 15
 Engineering Information - Section 16

Positorq Size	Number of Discs	Dynamic Brake Torque (Lb. Ft.)		Static Torque @ PSIG	Max. RPM	Thermal Horsepower		Piston Chamber Volume (Cu. In.)	Inertia Cyclic Parts (Lb. Ft. ²)
		Continuous Slip @ PSIG	Momentary * Slip @ PSIG			Basic	Force Lube		
82	10	1,995 @ 18	2,992 @ 25	3,989 @ 31	1220	----	188	26	11
	12	2,400 @ 31	3,600 @ 41	4,800 @ 52		----	225		
83	12	4,644 @ 36	6,966 @ 51	9,288 @ 66	1275	----	311	53	33
84	12	8,210 @ 33	12,315 @ 48	16,420 @ 63	1500	----	522	86	55
	18	12,315 @ 19	18,473 @ 27	24,631 @ 36		----	783		75
85	18	26,853 @ 52	40,280 @ 77	53,706 @ 102	1000	----	936	83	140
	24	35,804 @ 52	53,706 @ 77	71,608 @ 102		----	1248		180
86	36	53,706 @ 52	80,560 @ 77	107,413 @ 102	862	----	1873	166	266
	48	71,608 @ 52	107,413 @ 77	143,217 @ 102		----	2496		345
87	28	127,600 @ 43	191,343 @ 65	255,200 @ 86	400	----	3600	209	3910

* - Less than 60 seconds, less than 60% duty.

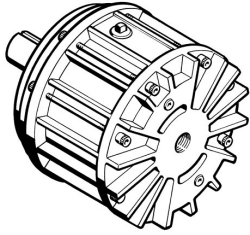
Positorq Dimensions (Inches)

Sizes TB-82 to TB-87 Foot Mounted



Size	No. of Discs	Foot Mounting Dimensions							Overall Dim.		Shaft Dimensions			AA (NPT)	Pipe Size (NPT)	
		A	D	E	2F	G	H	O	BSV	C1	a	U	V		W	Y
82	10	24.0	12.56	9.50	5.63	1.00	0.75	23.00	8.06	23.00	1 x 1/2	4.25	4.88	1/4	1-1/4	3
	12															
83	12	25.0	15.00	11.50	6.00	1.50	0.93	27.50	10.25	23.18	1-1/4 x 5/8	5.00	7.00	1/4	2	4
84	12	27.5	18.00	12.25	8.75	1.50	1.06	33.00	9.94	27.75	1-1/2 x 3/4	6.00	5.93	1/2	2-1/2	4
	18									30.75					3	8
85	18	34.0	23.00	15.00	12.88	2.50	1.56	38.00	12.68	33.40	1-1/2 x 3/4	6.00	7.88	1/2	3	6
	24									36.21					4	6
86	36	36.0	22.00	16.00	23.00	4.00	2.25	37.00	14.56	47.44	1-3/4 x 7/8	7.00	8.75	1/2	4	10
	48									53.06					5	14
87	27	56.0	37.00	24.00	30.00	5.00	3.00	59.00	24.56	61.00	N/A	10.00	N/A	1	6	16

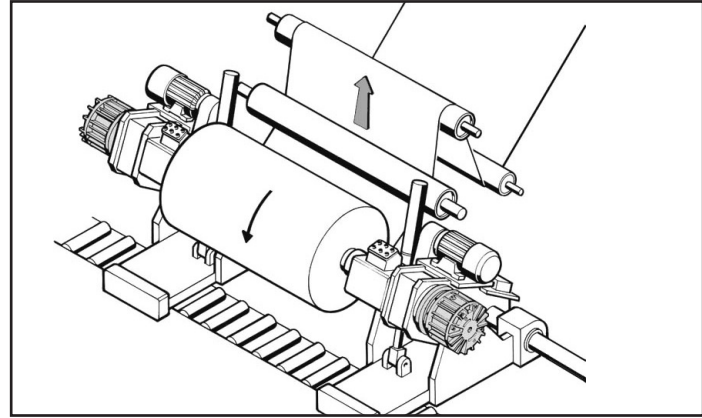
Thru Shaft Options Available - Consult Factory N/A = Non Applicable



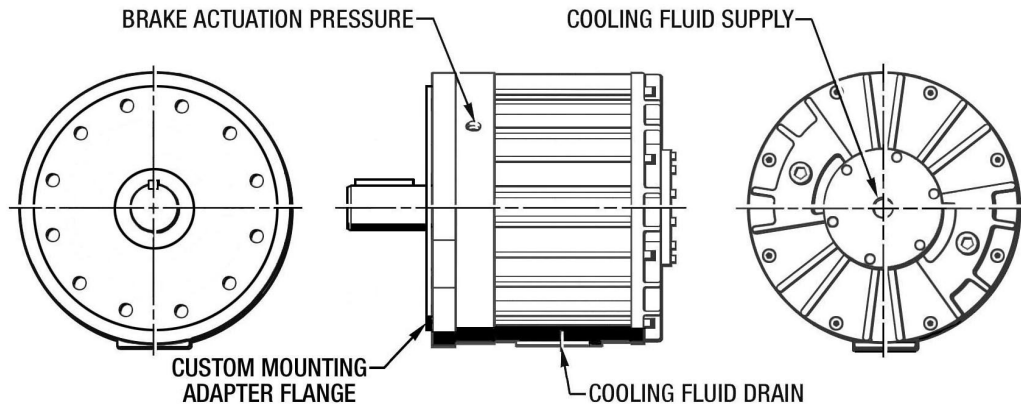
C. Flange Mounted Positorq Brake

The **Flange Mounted Positorq** is furnished in an aluminum housing. It was designed for the shaftless unwind application. Maximum continuous torque is 44,000 Lb. Ft. and the maximum continuous thermal horsepower is 250. The unit can be furnished with an extended shaft or quill type shaft. **The flange mounting can be modified to fit various applications.**

TYPICAL APPLICATION (Shaftless Unwind Stand for Paper Converting Process)



Positorq Brake Views



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These **Flange Mounted Positorq Brakes** normally require special modifications to fit a specific application. Consult our factory for certified installation, dimensional drawings and assistance in ordering.

Positorq Specifications

Selection Procedure - Section 15
Engineering Information - Section 16

Positorq Size	Number of Discs	Dynamic Brake Torque (Lb. Ft.)		Static Torque (Lb. Ft. @ PSIG)	*** Max. RPM	**** Thermal HP With Force Lube Cooling	Piston Chamber Volume (Cu. In.)	Inertia Cyclic Parts (Lb. Ft. ²)
		Continuous Slip @ PSIG	Momentary ³ Slip @ PSIG					
TB-20-804	10	1,027 @ 60	1,540 @ 88	2,055 @ 116	2200	100	20	1.6
TB-20-806	19	1,952 @ 60	2,928 @ 88	3,904 @ 116	2200	190	20	2.7
TB-20-807	19	4,124 @ 412*	6,187 @ 612*	8,250 @ 813*	700	190	7.36*	6
TB-83-211	12	7,252 @ 825*	10,878 @ 1,200*	14,500 @ 1580*	120	560	7.32*	28
TB-83-212	20	12,086 @ 825*	18,120 @ 1,200*	24,170 @ 1580*	120	900	7.32*	39
85-209	32	47,920 @ 800*	71,880 @ 1,150*	95,850 @ 1510*	900**	1500	11.9*	303

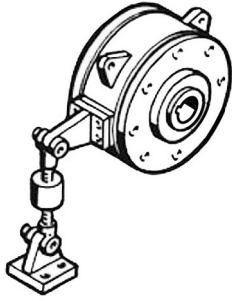
* - Hydraulic Actuation.

** - With High Speed Shaft Seal.

*** - Maximum RPM generally related to type of shaft seal used. Consult factory for higher speeds.

**** - Thermal Horsepower ratings based on current design. Consult factory for higher ratings.

³ - Less than 60 seconds, less than 60% duty.

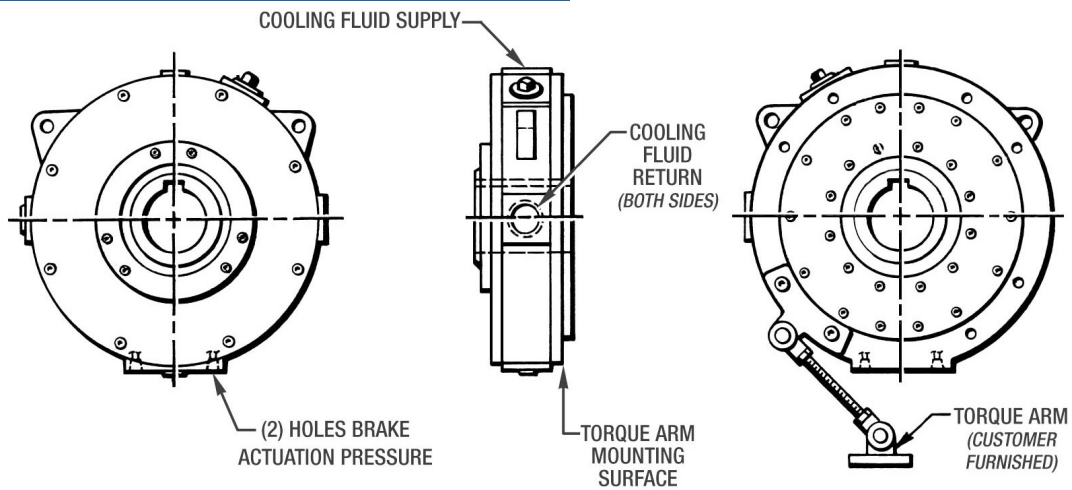


D. Shaft Mounted Positorq (Size TB-85 & TB-87)

The **Shaft Mounted Positorq** was designed to replace dry friction brakes which were flange mounted. Often these are used in steel applications where a hollow bore is required to accommodate a pull rod mechanism which operates the unwind stand mandrel through the large

shaft. (See Example C on page 9.5) The brake is available with 5 different stack configurations for different torque requirements. The brake can be also be flange mounted to suit and match your unit. A forced lube cooling unit is also normally required.

Positorq Brake Views



These **Shaft Mounted Positorq Brakes** normally require special modifications to fit a specific application. Consult our factory for certified installation, dimensional drawings and assistance in ordering.

Positorq Specifications

Selection Procedure - Section 15
Engineering Information - Section 16

Positorq Size	Number of Discs	Dynamic Brake Torque (Lb. Ft.)		Static Torque (Lb. Ft. @ PSIG)	*** Max. RPM	**** Thermal HP With Force Lube Cooling	Piston Chamber Volume (Cu. In.)	Inertia Cyclic Parts (Lb. Ft. ²)
		Continuous Slip @ PSIG	Momentary * Slip @ PSIG					
85-205	7	7,095 @ 61	10,643 @ 88	14,190 @ 114	500	184	175	50
	12	12,163 @ 61	18,245 @ 88	24,326 @ 114		374		90
	18	18,244 @ 61	27,366 @ 88	36,489 @ 114		540		160
85-212	37	55,200 @ 790*	82,800 @ 1,145*	110,400 @ 1500*	900	250	12.27*	253
87	27	117,935 @ 43	176,903 @ 65	235,581 @ 86	400	2000	355	3975

* - Hydraulic Actuation.

* - Less than 60 seconds, less than 60% duty.

How to order your Positorq Absorber Brake

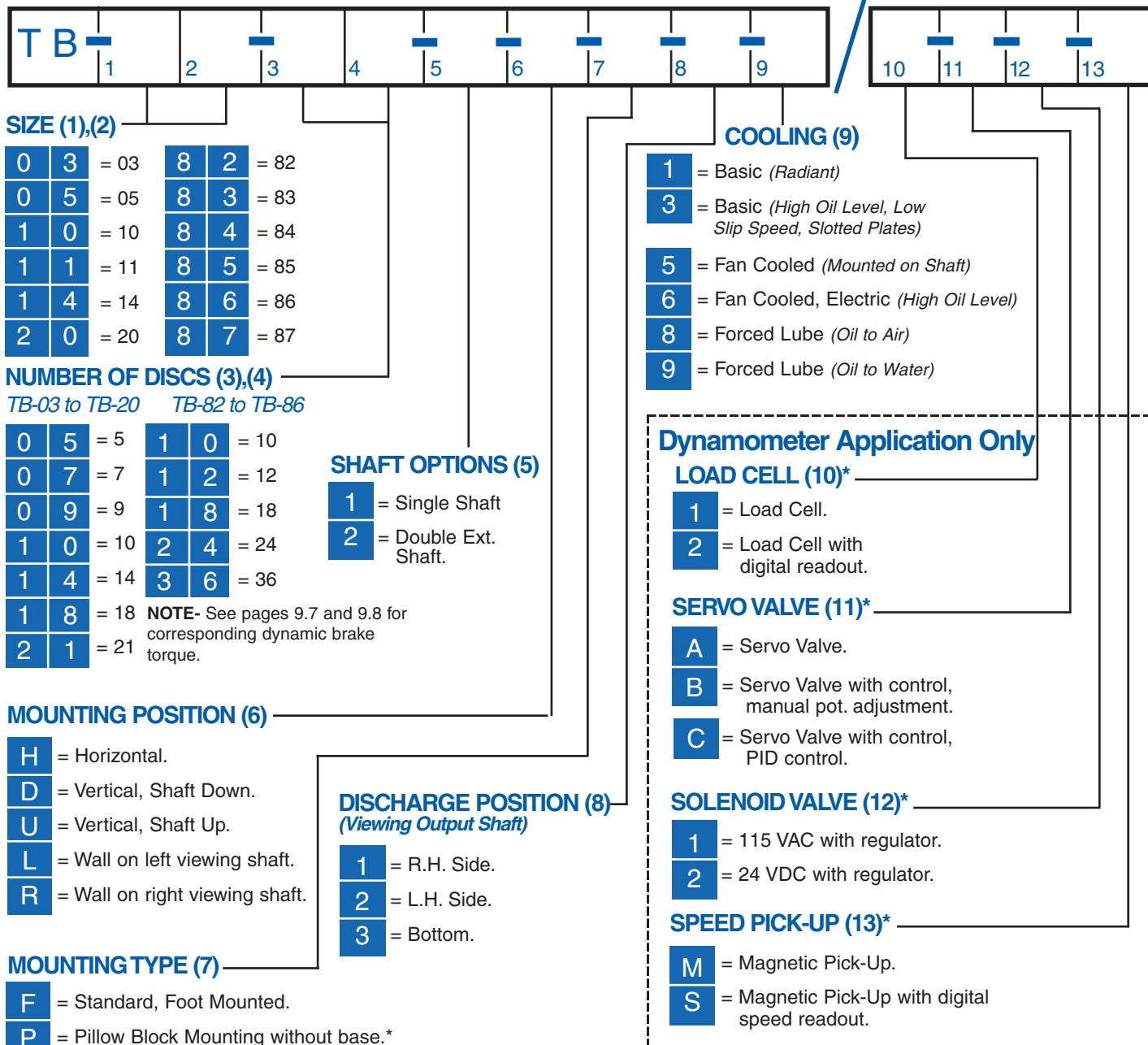
The **Positorq Ordering System** has been developed to simplify the ordering process and to reduce any misunderstanding and costly errors. To correctly order a **Positorq Absorber**

Brake for a **Tension Application** use the **Ordering System Chart (Fill in Items 1 thru 8 only)**. For a **Dynamometer Application (Fill in Items 1 thru 12)**.

Example for Tension Application: TB-20-14-1-H-B-1-9

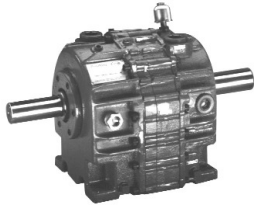
Ordering System Chart

Example for Dynamometer Application: TB-20-14-1-H-B-1-9 / 2-C-1-S



*- **NOTE: (For Dynamometer Application Only)** If Any Options (10) through (13) are not required then place a "N" (which stands for **NONE**) in each appropriate block of the Ordering System Chart for that particular option.

9



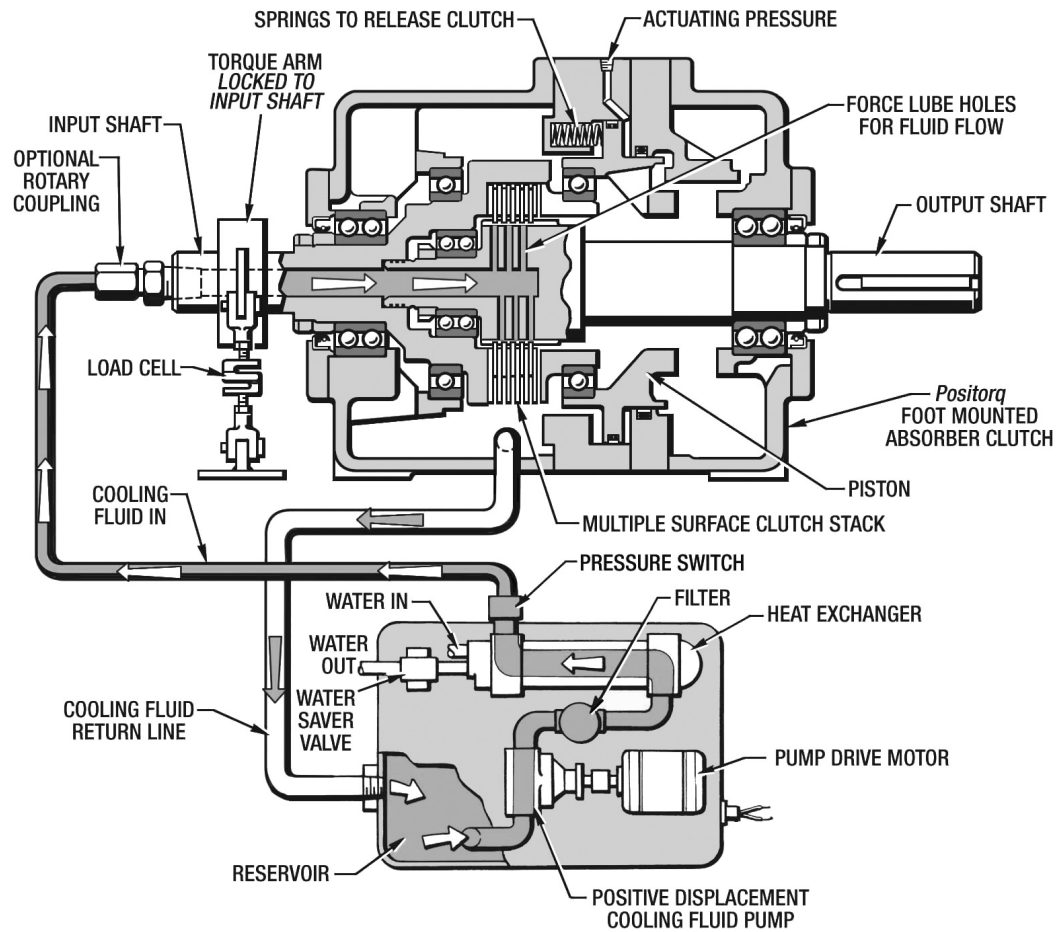
E. Positorq Foot Mounted Absorber Clutch

(Sizes TC-02 to TC-30)

The **Positorq Absorber Clutch** is designed for applications requiring high torque, low speed endurance testing. Fluid is pumped from the sump, through the clutch input shaft and returned to the sump under low pressure to cool and lubricate the clutch stack. A positive displacement pump is used to reduce the possibility of starving the clutch stack, a

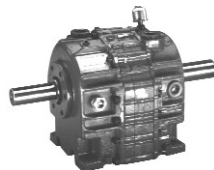
flow switch is provided for shutting down the system in case of a failure, and efficient heat exchangers are used to remove the heat from the cooling fluid that was absorbed from the clutch.

There are nine available sizes with a dynamic continuous slipping torque range of 30 Lb. Ft. to 2792 Lb. Ft.

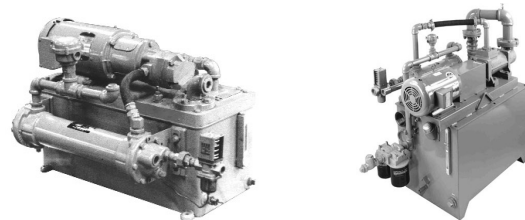


9

FOOT MOUNTED ABSORBER CLUTCH



TYPICAL FORCED LUBE COOLING UNITS



Positorq Absorber Clutch Specifications

Sizes TC-02 to TC-30 Foot Mounted

Positorq Size	No. of Discs	Dynamic Clutch Torque (Lb. Ft.)		Max. Static Torque @ PSIG	Max. RPM	Thermal Horsepower		Piston Chamber Volume (Cu. In.)	Inertia Cyclic Parts (Lb. Ft. ²)
		Maximum Continuous Slip @ PSIG	Maximum * Momentary Slip @ PSIG			Basic	Force Lube		
02	4	27 @38	40 @ 58	53 @ 77	3600	CF	11	1	.02
2.5	4	50 @28	75 @ 42	100 @ 57	3600	CF	34	5	.12
03	6	86 @ 25	130 @ 38	173 @ 51	3600	CF	46	7.6	.05
05	10	144 @ 25	216 @ 38	288 @ 51	3600	CF	46	8	.07
10	8	319 @ 24	479 @ 36	638 @ 48	3600	CF	92	12	.29
11	10	680 @ 38	1,021 @ 57	1,361 @ 76	1800	CF	118	12	.56
14	13	885 @ 38	1,327 @ 57	1,770 @ 76	1800	CF	118	12	.62
20	8	822 @ 27	1,232 @ 40	1,643 @ 53	1800	CF	176	23	1.59
30	14	2,792 @ 21	4,188 @ 32	5,583 @42	1800	CF	136	97	12.96

* - Less than 60 seconds, less than 60% duty.

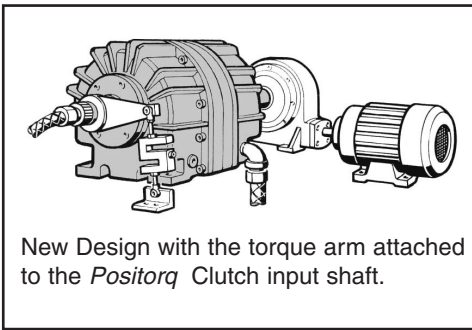
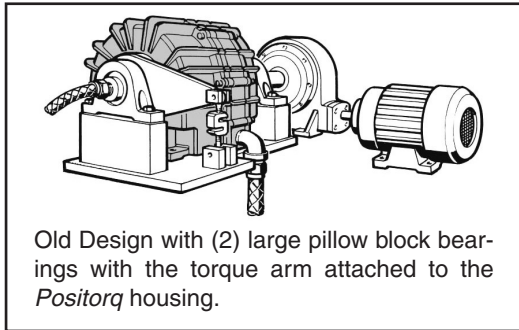
CF - Consult Factory

9

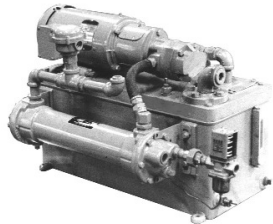
An Innovative Answer for the Dynamometer Application

Force Control has brought a low cost alternative for your dynamometer applications. We have eliminated the need for large pillow blocks and mounting hardware by attaching the torque arm directly to the *Positorq* Clutch input Shaft. See the illustrations below.

Gearbox or Hydraulic Motor Testing



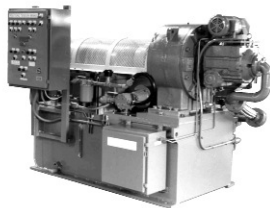
F. Forced Lube Cooling Unit



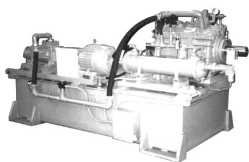
A free-standing Forced Lube Cooling Unit for sizes TB-03 to TB-20 Positorq.



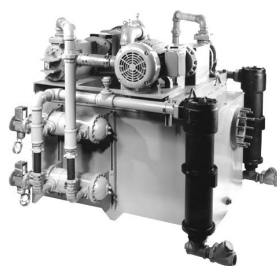
A free-standing Forced Lube Cooling Unit for sizes TB-82 to TB-86 Positorq.



A Positorq Tension Brake mounted on a structural type Forced Lube Cooling Unit.



A size 20 Posidyne Clutch/Brake Centrifuge Drive mounted on a structural type Force Lube Cooling Unit.



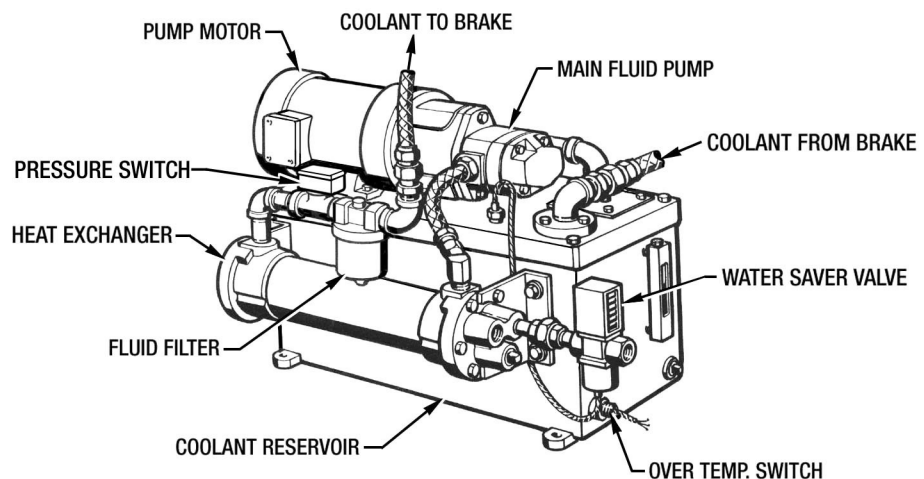
A Dual Pump Forced Lube Cooling System all mounted on a common tank for maximum cooling efficiency and oil delivery.

In most cases the **Positorq Absorber Brakes** require a **Forced Lubrication System**. The **Forced Lube Cooling Unit** is basically a steel reservoir with a pump, motor and heat exchanger to pump cooling fluid from the reservoir through the heat exchanger, to the brake and back. The cooling fluid is specially designed transmission fluid used for cooling and lubrication. This system is different than many hydraulic systems in that it has very high flow capacity (GPM) with low system pressure. **(See next page for specific Forced Lube Cooling Systems.)**

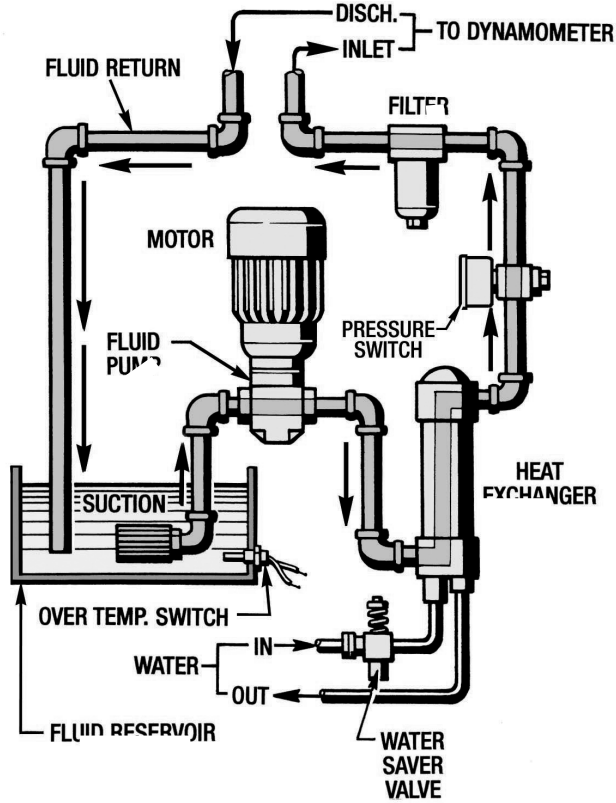
The standard Forced Lube Cooling Unit is designed for years of trouble free service, safety and also includes protection for the cooling unit as well as the **Positorq Brake**. There are many variations, depending on system requirements, all systems will generally include the following:

1. **Main Fluid Pump** - A rotary screw type pump with over 25 GPM. Sometimes a small gear type pump can be used on smaller systems unless gear noise is a problem.
2. **Heat Exchanger** - Oil-to-Water or Oil-to-Air. The oil-to water type of heat exchanger will require a water modulating valve.
3. **Filter** - Installed in Coolant to Brake line. Canister screw type with replaceable filter element. Used on systems with less than 60 GPM flow capacity.
4. **Pressure Switch** - This Pressure Switch is wired into the system to stop the prime mover in case of loss of fluid pressure.
5. **Over Temperature Switch** - This is wired into an alarm system to warn of an over temperature condition.
6. **Kidney Filtration System** - For larger systems, a kidney filtration system is used that includes another small pump and motor to re-circulate the fluid through a filter. A vacuum gauge is included to identify a dirty filter. When using the kidney filtration system a ball valve arrangement is used to allow use of the filter system to pump old fluid out of the reservoir and new fluid in. Fluid coming in is pumped through a filter before going into the reservoir. This Kidney Filter System is shown and described on page 9.16.
7. **Reservoir** - A reservoir is sized to hold all the fluid and contains special baffles to cause sediment to drop out and for any aeration to settle down.

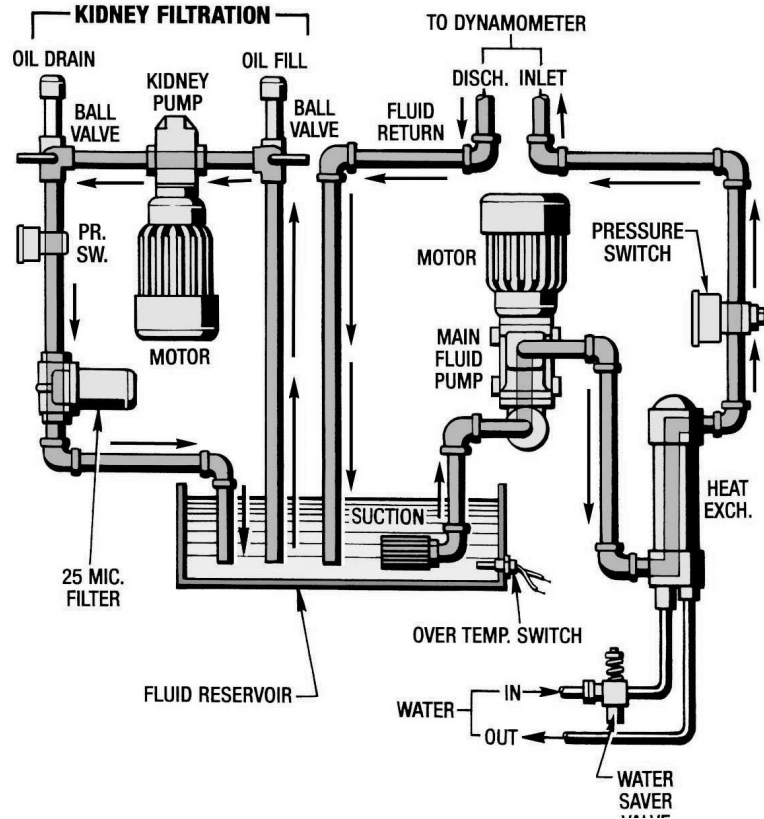
Sizing and selection of the Forced Lube Cooling Units is based on many factors which cannot all be described in this catalog. The cooling system is designed to work with a particular Positorq brake under certain conditions and therefore has to be sized and selected by Force Control with the brake.



Forced Lube Cooling System
(Without Kidney Filtration)

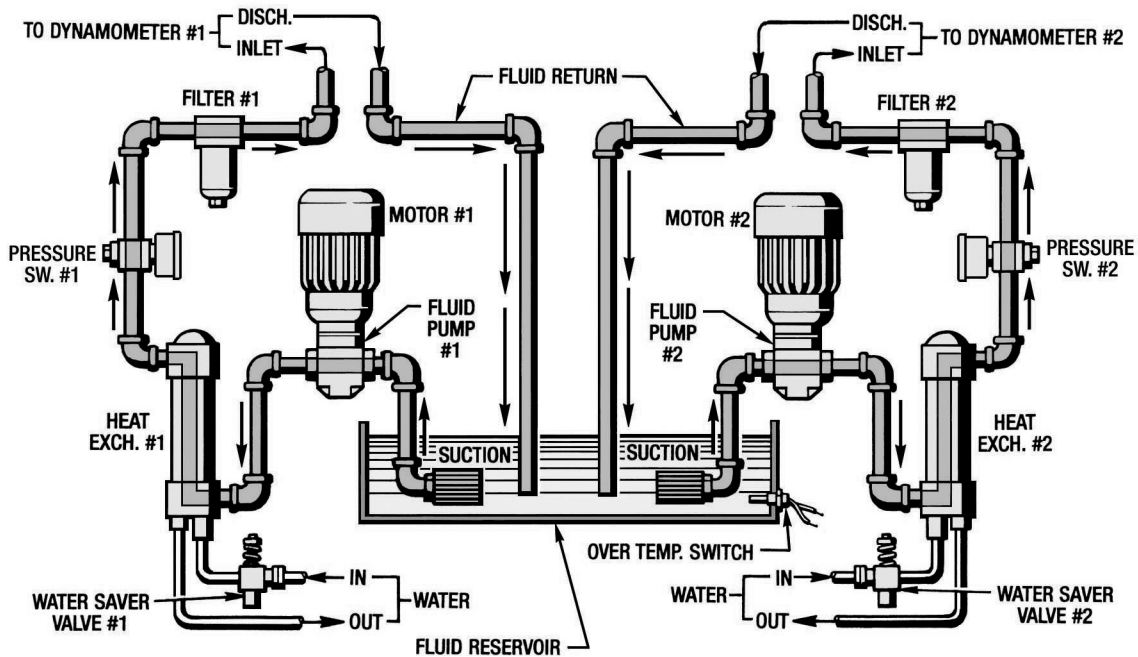


Forced Lube Cooling System
(With Kidney Filtration)



9

Dual-Pump Forced Lube Cooling System
(Without Kidney Filtration)



NOTE: Kidney Filtration can also be included on this Dual-Pump Forced Lube Cooling System.

Section 10 Pneumatic Control Valves

Force Control's family of Oil Shear Clutch and Brake Products is most often actuated by a Pneumatic Control Valve. Torque control of the units is accomplished by adjusting the actuation pressure. To aid the designer in the selection specification of the correct control circuit the charts below have been provided. During the selection process of the **Posidyne** or **Posistop** a particular logic type was decided upon. Based on the logic type of your unit find the correct control valve model number indicated in the appropriate chart.

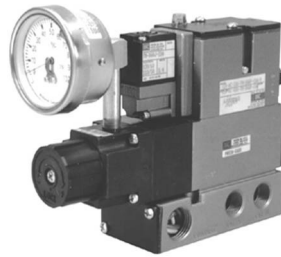
Posidyne Clutch/Brake				
Logic	Valve Model Number			
	Standard Posidyne Clutch/Brake			X Class Posidyne Clutch/Brake
	Sizes 02 to 10	Size 11	Sizes 20 & 30	
S	2PC-3/8 or 2PI-3/8	2PI-5/8	2PI-3/4	N/A
SA	2PC-3/8 or 2PI-3/8	2PI-5/8	2PI-3/4	N/A
A	1PC-3/8 or 2PI-3/8*	2PI-5/8*	2PI-3/4*	1PI-1/8 or 2PI-1/8*
B	1PC-3/8 or 2PI-3/8*	2PI-5/8*	2PI-3/4*	N/A
C	1PC-3/8 or 2PI-3/8*	2PI-5/8*	2PI-3/4*	1PI-1/8 or 2PI-1/8*
SCP	2PC-SC-3/8	2PC-SC-5/8	2PC-SC-3/4	N/A
P	2PC-3/8 or 2PI-3/8	2PI-5/8	2PI-3/4	2PI-1/8

Posistop Motor Brake		
Logic	Valve Model No.	
	MB Series Brake	XB Class Brake
S	1PI-Br-3/8	1PI-Br-1/8
A	or 1PC-3/8	or 1PI-1/8
B		

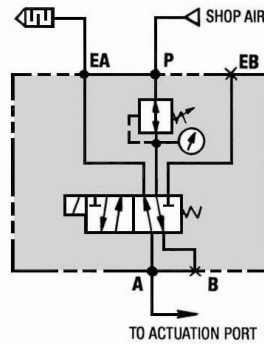
* - When using a Model 2PI Control Valve for A, B or C Logic Single Clutch Unit, the brake port is not used and must be plugged.

N/A - Not Available

1PC-3/8

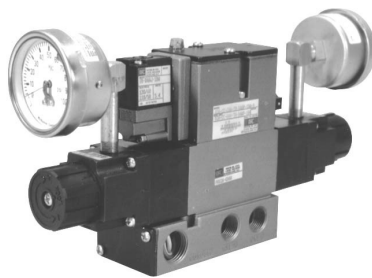


See Optional Manifold Mounting on page 10.3.

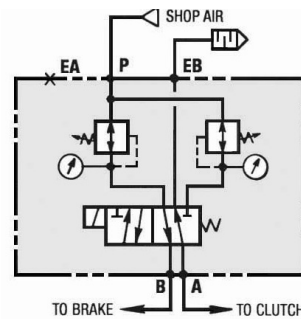


Two position, four way, five ported, single solenoid, spring return, with single pressure sandwich regulator sub-base mounted, 3/8" NPT.

2PC-3/8



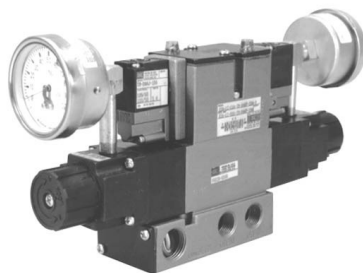
See Optional Manifold Mounting on page 10.3.



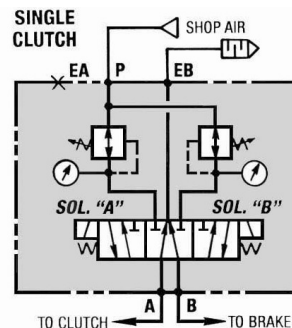
Two position, four way, five ported, single solenoid, spring return, with dual pressure sandwich regulator sub-base mounted, 3/8" NPT.

2PC-SC-3/8 2PC-SC-5/8 2PC-SC-3/4

(Single Clutch)

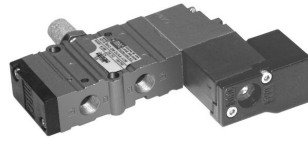


See Optional Manifold Mounting on page 10.3.

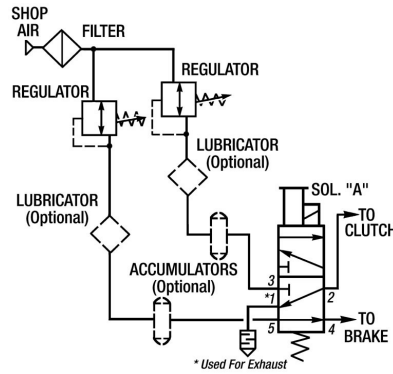


Three position, four way, five ported, center position to exhaust, dual solenoid, spring centered, with dual pressure sandwich regulator sub-base mounted, 3/8" NPT, 5/8" NPT and 3/4" NPT.

2PI-1/8
Manifold
Mounted
and
Remote
Mounted



“P” Logic Only



Two position, four way, five ported, single solenoid, spring return, 1/8” NPT.

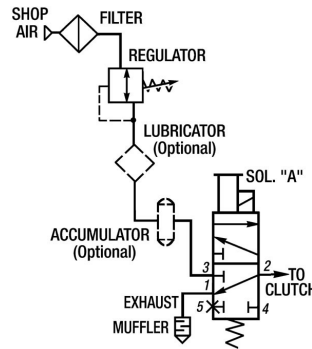
This pneumatic valve set-up requires the use of external pressure regulators. *(The Pressure Regulators must be sized to furnish the required torque.)*

2PI-1/8
Manifold
Mounted



“A” and “C”
Logic Only

Brake Ports
Plugged

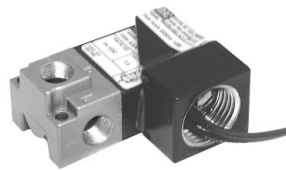


Two position, four way, five ported, single solenoid, spring return with brake ports plugged, 1/8” NPT.

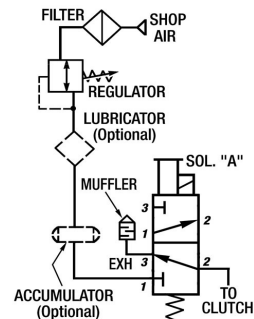
This pneumatic valve set-up requires the use of external pressure regulators. *(The Pressure Regulators must be sized to furnish the required torque.)*

10

1PI-1/8
Remote
Mounted



“A” and “C”
Logic Only



Two position, two way, three ported, single solenoid, spring return, 1/8” NPT.

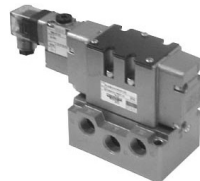
This pneumatic valve set-up requires the use of external pressure regulators. *(The Pressure Regulators must be sized to furnish the required torque.)*

2PI-3/8
(2 Pr. Inlet-3/8)



2PI-5/8
(2 Pr. Inlet-5/8)

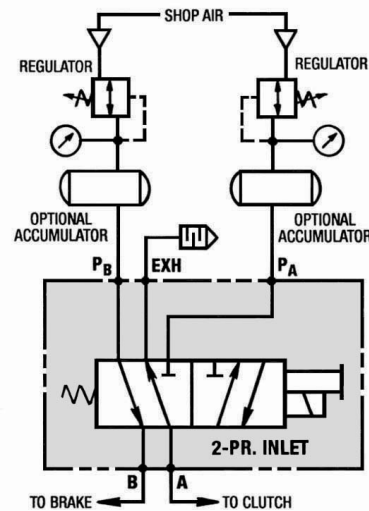
2PI-3/4
(2 Pr. Inlet-3/4)



See Optional Manifold Mounting on page 10.3.

The 2PI-3/8 Control Valve is used on Sizes 02 to 10 Posidyne Clutch/Brake Units. The Size 11 Posidyne uses a 2PI-5/8 and a Size 20 & 30 Posidyne uses a 2PI-3/4 Control Valve.

NOTE: The 2PI-5/8 and 2PI-3/4 Control Valves are furnished with a DIN Connector and 6 Ft. long electrical cable.

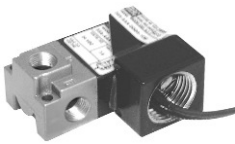


Two position, four way, five ported, single solenoid, spring return, 3/8”, 5/8” & 3/4” NPT.

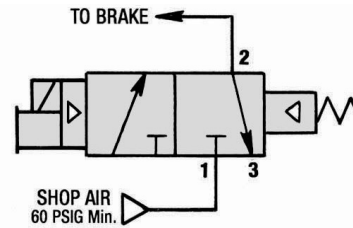
This pneumatic valve set-up requires the use of external pressure regulators. *(The Pressure Regulators must be sized to furnish the required torque.)*

For high cycle applications when a **CLPC** (Closed Loop Position Control) is used an accumulator is recommended to be installed in the inlet pressure line. *(The accumulator must be sized to be 10 x the air required per engagement.)*

1PI-Br-1/8



1PI-Br-3/8



Control Valve Logic

	RUN	STOP
Solenoid Function	ON Energized	OFF De-Energized

Motor Brake Application

Two position, Two Way, Three Ported, Single Solenoid, Spring Return, Internal Pilot Operated, Normally Closed, 1/8" or 3/8" NPT Pneumatic Control Valve.

Valve Specifications:

Ambient Temp. 0° F. to 120° F.

Electrical 120 VAC
60 Hz

Inrush - 14.7 Volt/Amp
(.12 Amps)

Seal - 10.4 Volt/Amps
(.09 Amps)

Coil General Purpose Class A
Continuous Duty.

Pr. Range.....150 PSI Max.

Optional Manifold Mounted Control Valve

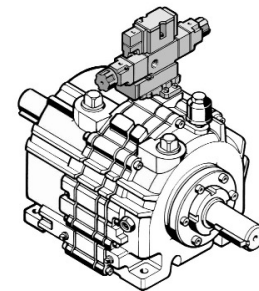
1PI-1/8, 1PI-3/8, 2PI-1/8, 2PC-3/8, 2PI-1/8, 2PI-3/8, 2PI-5/8, 2PI-3/4 and 2PI-2-3/8 Control Valves

These pneumatic control valves can also be furnished with porting for Manifold Mounting. This allows the control valve to be directly mounted to the drive unit which gives you a **compact and efficient drive unit with improved response time.**

When ordering a **Manifold Mounted Control Valve**, just use the **Ordering System Chart** and specify "Manifold Mounted" in the appropriate block.

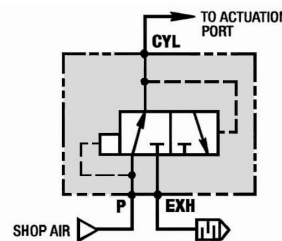
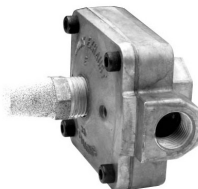


The example shown is a Posidyne X Class Clutch/Brake Unit with a 2PI-1/8 Manifold Mounted Control Valve.



The example shown is a 03 Posidyne Clutch/Brake Unit with a 2-PC-3/8 Manifold Mounted Control Valve.

Quick Exhaust Valve (QE-3/8)



The use of Quick Exhaust Valves installed directly at the actuation port of the clutch or brake improves response time, repeatability and final positioning accuracy for most applications. It is recommended that when the control valve is located 10 Ft. or more away from the drive unit this Quick Exhaust Valve is used in each pressure line. This valve is available as part number QE-3/8.

Installation and Design Suggestions

Mounting Locations

The internal piston volumes of Force Control Clutch/Brake and Brake Products are quite low. The control valves should be located as close as possible to the unit, as this directly affects the response time and consistency. Many of the products have manifold mounted valves available, which is the best arrangement because it eliminates the plumbing between the valve and the Force Control unit.

Air Line Sizes and Fittings

The optimum air line size is 3/8" for sizes 01 through 11 *Posidyne* clutch/brakes and 056 through 280 *Posistop* brakes. The size 20 *Posidyne* clutch/brake and size 320 *Posistop* brake should have 1/2" air lines. The fewest number of fittings should be used and all fittings should be maximum flow type. A tee and pressure gauge located near the actuation port is often helpful for troubleshooting.

Accumulators

In High Cycle Applications, for the best response and consistency, accumulators should be used for the clutch and one for the brake on *Posidyne* clutch/brakes. This will maintain a constant pressure to the unit. Regulators should be located on the inlet to the accumulators.

Air Line Connections and Air Supply

Both top and bottom porting is supplied in many of the models. Whenever possible, bottom porting is recommended to purge any contamination from the piston chamber.

The air supply should be dry and free of all contamination. The cleaner the air is the longer the control valves and drive unit will last. Lubricated air will make the control valves last longer but... too much oil will fill up the piston chamber with oil and cause sluggish action of the piston.

High Speed - High Accuracy Applications

For High Speed and High Accuracy Applications the system should be equipped with a consistent air supply, accumulators of the proper size

Electronic Controls

Many of the positioning problems associated with the clutch/brake can be traced to the control system. PLC controls often include scan time delays depending on the speed of the control and number of lines of code used. High-speed cards may be required. The type of limit switches can also cause position error.

Force Control has developed the **CLPC** Closed Loop Positioning Control which eliminates scan time problems. The **CLPC** will correct positioning errors and compensate for cold start to hot run shifts, as well as adjustment for changing speeds, loads and other variables .

NOTES: All valves Cv = 1.0 Min.; All solenoids are std. 120 VAC continuous duty rated for 60 Hz operation.	Inrush Current (amps).....	.11	Time to de-energize (sec.).....	.016
	Holding Current (amps).....	.08	DC and hazardous location solenoids are available.	
	Time to Energize (sec.).....	.011	Consult factory.	

How to order your Pneumatic Control Valve...

Ordering System Chart

Example: V-2-PC-A-1A-M-4BH-G



10

Number of Pressures (1)

- 1 = 1 Pressure
(Single Clutch or Brake)
- 2 = 2 Pressure
(Single Clutch & Brake)

Valve Type (2)

- PC = Sandwich Regulators *(Single Clutch)*
- PC-SC = Sandwich Regulators *(Single Clutch SCP Logic Only)*
- PI = No Regulators, Single Valve
- PI-2V = No Regulators, Dual Valves
- PI-Br = No Regulators *(Motor Brake Only)*

Port Size (3)

- A = 1/8" NPT
- B = 3/8" NPT
- C = 5/8" NPT
- D = 3/4" NPT

Voltage (4,5)

- | | | |
|---|---|-----------|
| 1 | A | = 115VAC |
| 2 | A | = 220 VAC |
| 4 | A | = 460 VAC |
| 1 | D | = 12 VDC |
| 2 | D | = 24 VDC |

Mounting (6)

- L = Shipped Loose. *(Mounted and Plumbed by Customer)*
- M = Manifold Mounted on *Posidyne.*
- PR = Pre-Plumbed and Brkt. Mntd. *(Right Side Viewing Output Shaft)*
- PL = Pre-Plumbed and Brkt. Mntd. *(Left Side Viewing Output Shaft)*

Wire Connector (7)

- 3BH = 3 Pin BH Mini-Change Connector.
- 4BH = 4 Pin BH Mini-Change Connector.
- 5BH = 5 Pin BH Mini-Change Connector.
- DIN = DIN Connector (#11 & #20 *Posidyne* Only) *(Includes 6 Ft. Long Cable.)*
- MS = Mil Specifications
- N = None

Gauges (8)

- G = Glycerin Type
- D = Dry Type
- N = None

Section 11 Electronic Position Controls & Encoders

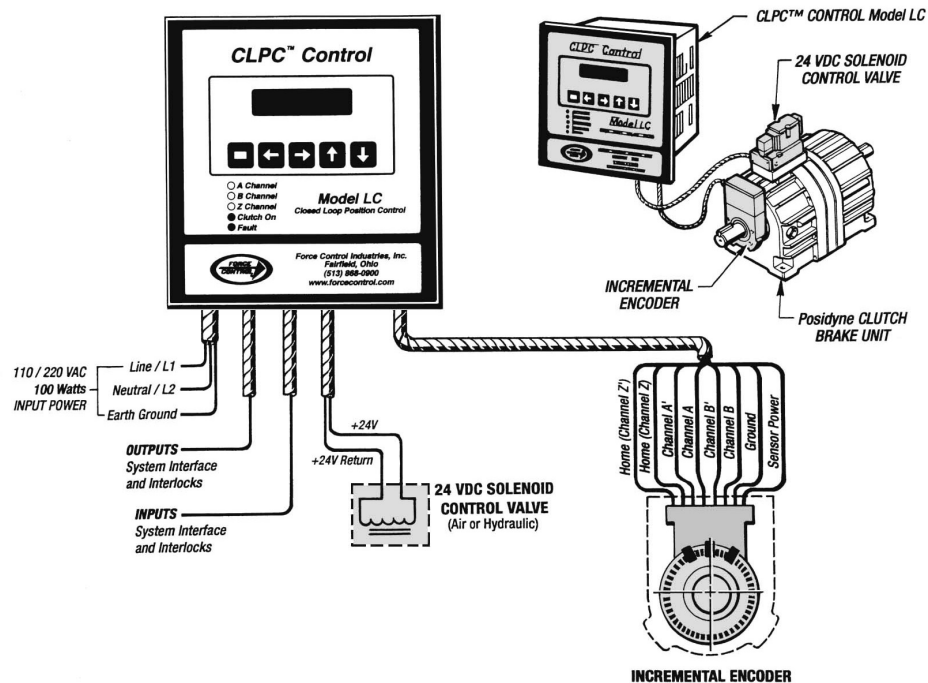
CLPC™ Closed Loop Position Controls

The **CLPC Closed Loop Position Control** is used to improve positioning accuracy on *Posidyne* Clutch/Brakes and *Posistop* Motor Brakes beyond what can be achieved with just a limit switch, or a PLC control system. The **CLPC** is a closed loop positioning control, which looks at the stopping position and continually makes adjustments if any “Stopped Position” errors begin to occur. This is particularly important during a cold start to hot run, and if changes that occur on the line such as changes in load, speed or temperature.

FEATURES:

- **Closed Loop, error compensating** - Corrects the stopping position on each index for precise accuracy.
- **Self compensating** - Control compensates for changes in speed, dynamic load, air pressure, friction in bearings, slides, etc.
- **Simple, straight forward** - Minimal programming, no complex velocity profiles to develop.
- **In Position** - Output indicates drive has reached position.
- **Optional MIP/PLS** - Multiple Indexing Parameter groups. Select between 16 different index distances that are user programmed. Programmable Limit Switch is capable of 4 Programmable Outputs based on position.
- **Complete Package** - No need for external power supplies or accessories.
- **Watchdog timer** - Control will stop index if not made within the set time frame adjustable from 100 milliseconds to 1 minute.
- **Stall detection** - Control will stop the drive when it senses the system comes to an unexpected stop, preventing damage to the clutch, or other components in the system.
- **Easy installation and operation** - Simple menu to set-up, with on the fly electronic fine tuning of the start/stop position.
- **Ultra-Quick** - Interrupt driven microcontroller, no scan time problems.

Typical System Diagram (CLPC-LC, Posidyne Clutch/Brake with Optical Encoder)





A. CLPC Control Model LC

CLPC™ Control Model LC

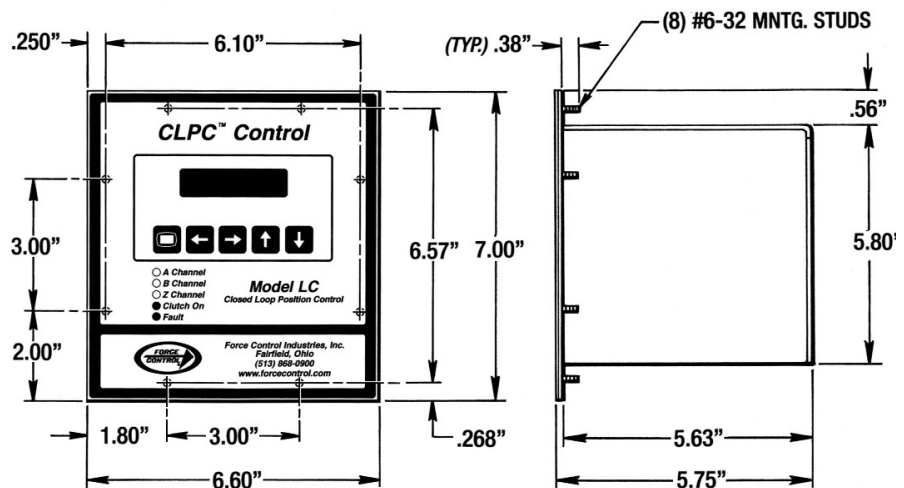
The CLPC Control Model LC

The basic **CLPC Control Model LC** is designed to operate a standard *Posidyne* Clutch/Brake in an indexing application. The **CLPC-LC** is programmed for the desired index distance (encoder counts). The **CLPC-LC** will energize the clutch valve until the trigger point, de-energize the valve and stop in position. The trigger point is self compensating to actuate the brake at the proper time to consistently stop in position and will float as conditions change. The **CLPC Control Model LC** is a single direction single clutch drive control.

The CLPC Control Model LC has numerous features such as:

- **Universal Supply Input** - 85-264 VAC, 47-63 Hz.
- **Interface** - All functions adjustable with a simple menu through a display panel.
- **Program Lockout** - via external cold contact.
- **Eleven Internally Tested Functions** - Error Codes with descriptions displayed to identify Faults.
- **Compact Design** - Door Mount or Panel Mount.
- **Always Ready** - No calibration required.
- **Stall Detection** - Detects a jam (no rotation of the encoder) before reaching the desired stop position and disengages the clutch.
- **Watch Dog Timer** - Adjustable (100 milliseconds to 1 minute) timer which will disengage the clutch if timed out before reaching the desired stop position. Used to protect against jams which may stop or slow down the drive.
- **Encoder Resolution Settings** - X1, X2 and X4.
- **Manual Adjustment** - Allows a positive or negative adjustment from the home sensor position. Used to align the machine position with the home sensor
- **Emergency/Fault Stop** - Abort Input allows the control to react to an external request to stop the index or prevent any further indexes from occurring.
- **In Position Output** - An output to indicate when the drive has reached position. A plus or minus count can be set as an allowable in position window.
- **Optional (MIP/PLS)** - Multiple Indexing Parameter groups - Capable of storing up to 16 different groups (Index Distances). Programmable Limit Switch - Capable of 4 Programmable Outputs based on position.

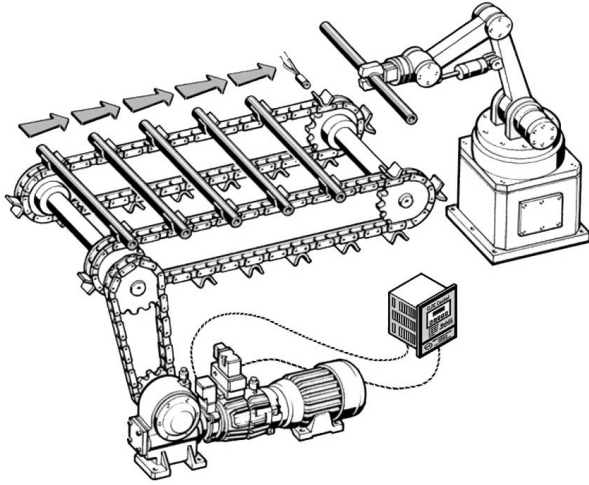
Electrical Enclosure Dimensions (Inches)



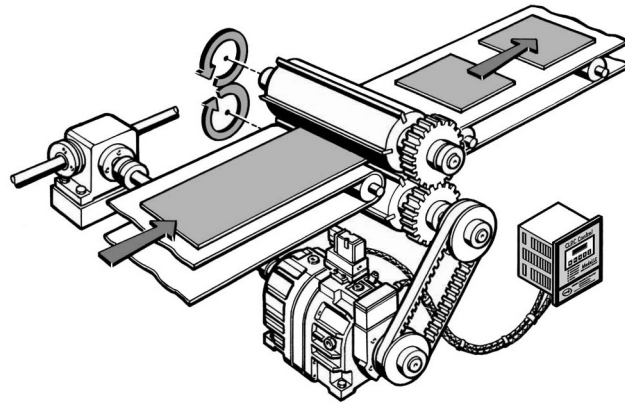
Dimensions are subject to change without notice. Certified Installation Drawings are available upon request.

Typical Applications

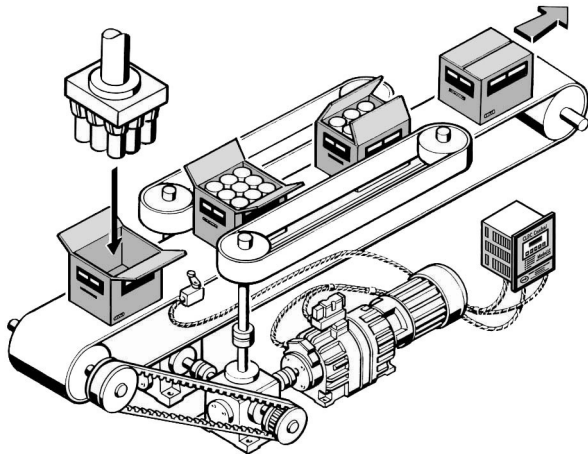
Assembly Line Part Conveyor (CLPC-LC Control)



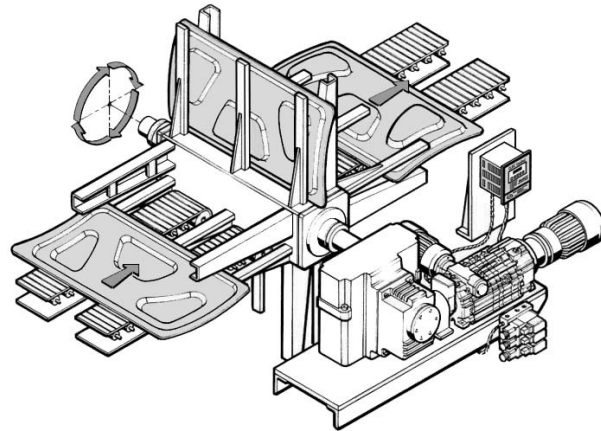
Part Cut-Off - CLPC-LC (CTL) Cut-To-Length Control



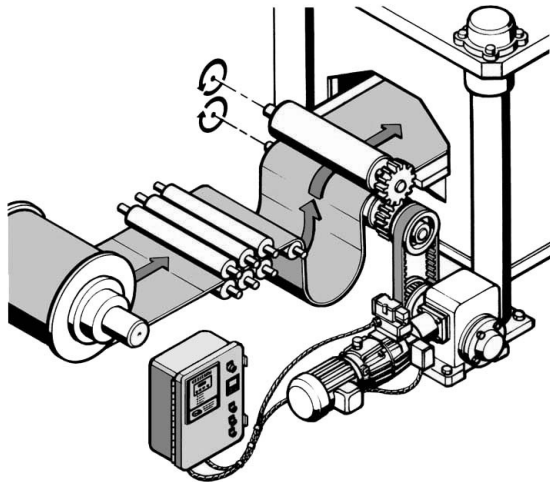
Case Packer (CLPC-LC Control)



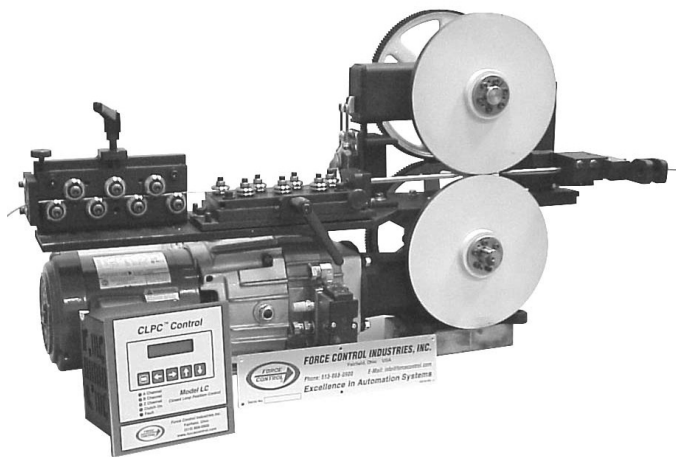
Ferris Wheel Turn Over (CLPC-LC Control)



Press Feeder - CLPC-LC (FTL) Feed-To-Length



Wire Feed Application (CLPC-LC Control)



General Specifications

CLPC™ Control Model LC

Electrical

Input Power	85-264 VAC, 47-63 Hz., Single phase, 100 watts max., Fused @ 4 amps.
Encoder Input	Six Signals: A, A', B, B', Z and Z'; 7.2 kHz max.; 0-3 VDC (Low), 2-12 VDC (High)
Auxiliary Supply	12 VDC, 1 amp, Current limited, Short circuit protected. Used for Encoder and Home Switch.
Solid State Inputs	Three: 120 VAC and 24 VDC standard, Fused @ 1/16 amps, - Start Cycle, Fault Reset and Abort Cycle.
Program Interlock Input	External cold contact switch required
Solid State Outputs	Two: 115 VAC standard (7 to 60 VDC available), Fused @ 3 amps, N.O. - Fault and In Position,
Clutch/Brake Output	One: 24 VDC, 1 amp max., Fused @ 3 amps.
Displays	16 characters by 2 lines, .22" character height, Backlit
LED Status Indicators	Five: Channel A, Channel B, Z Channel, Clutch On, Fault.
Diagnostics	Eleven: Internally tested functions. Error codes and description displayed to identify faults.

Mechanical

Enclosure	Aluminum/Stainless, Black anodized, NEMA 1, IP20 Enclosure. NEMA 4, IP66 when door mounted with gasket
Weight	3.5 Lbs.
Dimensions	6" x 6" Face x 5-3/4" Deep

Environmental

Operating Temp.	32° - 140° F (0 - 60° C)
Storage Temp.	0° - 186° F (-18° - 85° C)
Ambient Humidity	90% non-condensing max.
Vibration	2.5 g's, 30 to 200 Hz.

Programmability

Interface:	All functions adjustable through display panel push buttons. Some of these Functions include:
Index Count	Up to 65,535 pulses.
Manual Adjust	± 1/4 of maximum count.
Encoder Input Control	x1, x2 and x4 operation.
Watch Dog Timer	Off, 100 ms to 1 min. in 16 increments.
Push Buttons	Five: Program, Menu Back, Menu Forward (Fault Reset), Increment and Decrement.
Optional (MIP/PLS)	Multiple Indexing Parameter Groups - Capable of storing up to 16 different groups. Programmable Limit Switch - Capable of 4 Programmable Outputs based on position.

How to order your CLPC™ Model LC Control

Ordering System Chart

Example: *CLPC-14-B-S-D-A-A-N-N-8*



Model (a, b)

1 **4** = Model LC

Overlay (1)

B = Standard (Force Blue)
[] = Other (*Consult Factory*)

Chassis Options (2)

S = Door Mount
P = Panel Mounted

In Position Output (3)

N = None
A = 115 VAC
D = 24 VDC
1 = 240 VAC

Fault Output (4)

N = None
A = 115 VAC
D = 24 VDC
1 = 240 VAC

Input Power (5)

A = 115 VAC to 230 VAC

Unused (6)

N = None

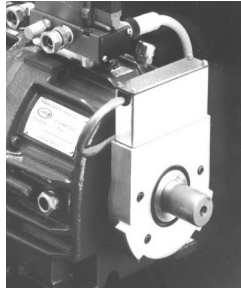
Unused (7)

N = None

Options (8)

N = None
1 = 115 VAC (PLS)
2 = 24 VDC (PLS)
3 = 115 VAC (MIP)
4 = 24 VDC (MIP)
5 = 115 VAC (PLS) + 115 VAC (MIP)
6 = 24 VDC (PLS) + 115 VAC (MIP)
7 = 115 VAC (PLS) + 24 VDC (MIP)
8 = 24 VDC (PLS) + 115 VAC (MIP)

PLS = Programmable Limit Switch
MIP = Multiple Index Parameters



Incremental Optical Encoders

The Optical Encoder provides the pulse counting system for the CLPC Closed Loop Position Control using a disc with precision holes and photo interrupters placed in the correct position. By sending a pulse when the interrupter sees the edge of a hole, an accurate count is made. Using two interrupters improves the resolution and the direction of rotation is also known. A third interrupter is used to establish a home position. The home position is used as a starting point for the count, which eliminates any possibility of any accumulated error.

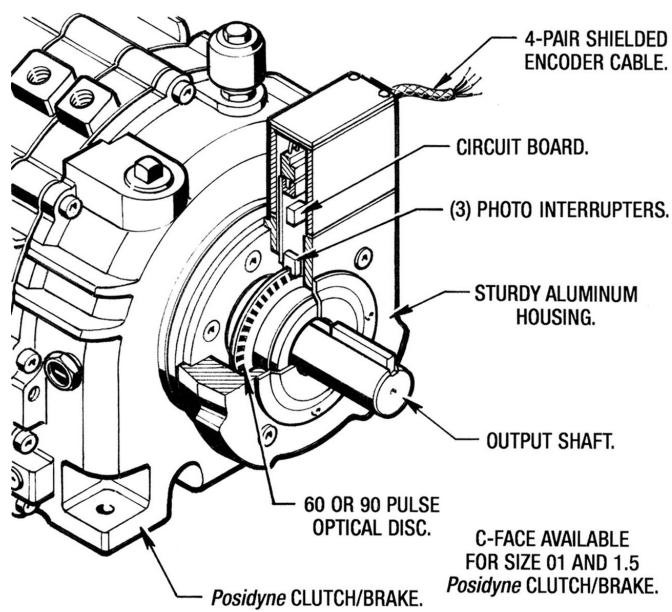
FEATURES:

- **Low inertia pulse disc** - Reduces cyclic load.
- **Precision counting** - Eliminates errors due to metallic build up in the encoder housing.
- **Differential line driver** - Reduces any chance of error to the control due to long encoder line runs, or electrical noise from other operating machinery.
- **Heavy-duty circuit board** - Made for use in dirty industrial applications.
- **Sturdy aluminum housing** - Made to fit on the various sizes of *Posidyne* clutch/brakes provides sealed protection for the encoder disc and electronic circuits.
- **4 pair shielded cable with connector** - Furnished with the encoder.

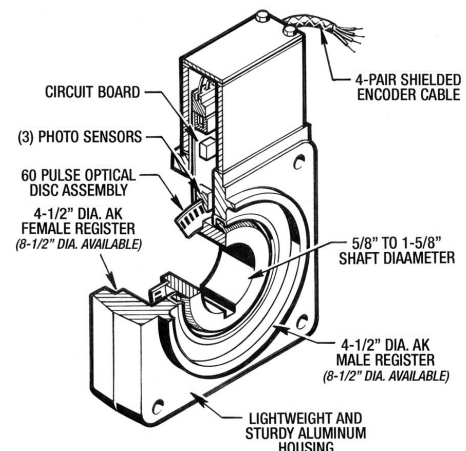
The (2) basic types of Optical Encoders are:

1. **Posidyne Mounted Encoders** are directly mounted to the output housing and output shaft of the *Posidyne* Clutch/Brake Unit. They are available for all sizes of Single Clutch and Dual Clutch *Posidyne* Units. (See each specific section for dimensions and see this section for all specifications, additional information and ordering information.)
2. **Double C-Face Encoders** could also be mounted on the output end of the *Posidyne* Unit or Motor and then be C-Face mounted to a gear reducer or mounted on the back end of a Brake Motor between the motor and the brake. These C-Face Encoders come with a 4-1/2" AK register. They can accept a 5/8" Dia. and 7/8" Dia. Shaft. (See this section for additional information and ordering information.)

Posidyne Mounted Encoder



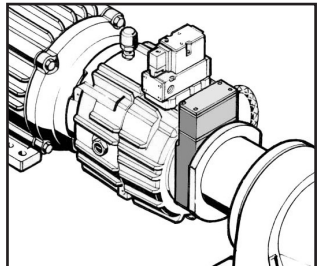
Double C-Face Encoder



This type of Encoder can be used in any applications where NEMA standard C-Face Motors and Gear Reducers are used.

The above application shows a double C-Face Encoder sandwiched in between a 1.5 *Posidyne* Clutch/Brake and a Eurodrive Reducer which is operating a swing plate to divert shingle direction.

Typical Application



Optical Encoder Specifications...

Electrical Specifications (All Optical Encoders)

Input	
Voltage	5 to 15 VDC.
Current	100 mA max. (with No Line Loading).
Ripple	2% peak to peak @ 5 VDC input.
Regulation	± 5% for 5 VDC power supply.

Output	
Type	Quadrature (A & B) with zero ref. (Z) plus 1 spare channel. All with differential line driven square wave outputs.
PPR	<i>Posidyne</i> C-Face Encoder - 60 count for sizes 1.5 to 10 <i>Posidyne</i> 90 count for sizes 11, 14 and 20 <i>Posidyne</i>
Current	Sinking, 250 mA open drain (Collector). Sourcing, 250 mA open source (Emitter) No pull ups or downs.
Circuit	TC1 428 Dual High Speed Mosfet Driver. Latchup Protection: Will withstand 500 mA reverse output current. ESD Protection to ±2000 volts. High Output Peak Voltage: 1.2A peak. High Capacitance Load: 1000pF in 38nS. Output voltage swing to within 25mV to ground or the control voltage. Low Output Impedance: 8 ohms.
Freq. Response	250K CPS.
Symmetry	180 electrical degrees ±18°.
Quad. Phasing	90 electrical degrees ± 36°.
Rise Time	Less than 1 microsecond.
Accuracy	Within ± 0.1° from one pulse to next pulse, or 60 arc min.
Elect. Conn.	10 pin Phoenix 1827787

Environmental Specifications (All Optical Encoders)

Operating Temp.	0° to 70° C.
Storage Temp.	-25° to 85° C.
Humidity	95% RH Non-Condensing.
Vibration	10 G's @ 50 to 500 CPS.
Shock	50 G's @ 10 mS duration.

Mechanical Specifications (Posidyne Mounted)

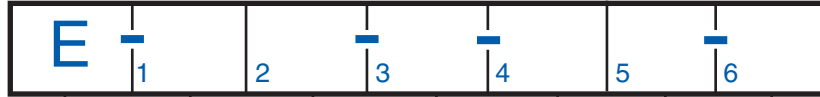
Max. Operating Speed	= 3600 rpm
Inertia	= .00916 Lb. Ft. ²
NEMA Rating	= 12

Mechanical Specifications (Double C-Face Mounted)

Max. Operating Speed	= 3600 rpm
Inertia	= .00916 Lb. Ft. ²
NEMA Rating	= 12
Register	= 4-1/2"AK or 8-1/2" AK

How to order your Encoder...

Ordering System Number Example: E-PM-T-60-E







ENCODER

Encoder Type (1,2)

- P** **M** = Posidyne Mounted (Std.)
- C** **4** = Double C-Face, 4-1/2" AK*

* C-Face Encoders can be Posidyne Mntd.

Mounting Position (3)

- T** **R** **B** **L** **N**
-     **N** Does Not Apply
- Top Right Bottom Left

Mounting Position only applies when Encoder is Posidyne Mounted.

Resolution (4,5)

- 6** **0** = 60 PPR (Pulses per Revolution) (5/8" to 1-3/4" Shaft Diameter)
- 9** **0** = 90 PPR (Pulses per Revolution) (2-3/8" to 2-3/4" Shaft Diameter)

Shaft Size (6)

- A** = 5/8" Dia.*
- C** = 7/8" Dia.*
- D** = 1-1/8" Dia.
- E** = 1-3/8" Dia.
- F** = 1-5/8" Dia.
- G** = 1-3/4" Dia.
- H** = 2-3/8" Dia.
- J** = 2-3/4" Dia.

* Available Shaft Sizes for Double C-Face Encoders.

Posidyne Mounted Shaft Size (6) Availability

Shaft Size	Posidyne Size								
	1.5	02	2.5	03	05	10	11	14	20
5/8	X	---	---	---	---	---	---	---	---
7/8	X	---	---	---	---	---	---	---	---
1-1/8	X	X	---	---	---	---	---	---	---
1-3/8	---	---	X	X	---	---	---	---	---
1-5/8	---	---	---	---	X	---	---	---	---
1-3/4	---	---	---	---	---	X	---	---	---
2-3/8	---	---	---	---	---	---	X	X	---
2-3/4	---	---	---	---	---	---	---	---	X

Section 12 PosiDrive Servo Systems

A Revolutionary Approach To Complex Servo Systems.



Servos made simple...

So simple that laptop computers are not required to make an adjustment to your motion profile. You no longer need to learn the complex, proprietary servo programming language.

An Industrial grade Touch Screen Interface (TSI) is preprogrammed and included with every *PosiDrive* servo system. Setup, motion control, and troubleshooting is greatly simplified. The TSI will record fault history, monitor motor performance, and display temperatures. It also lets you make any change to your motion profile. Even motor tuning is painless. Change your index speed, and adjust your accel/decel, all at the touch of a screen.

With the Force Control *PosiDrive* Servo System Solutions, you get a system that is complete, without hidden cost.

Don't be misled by others that will sell only individual components, and leave you to put together the pieces and struggle to get the system up and running.

With the *PosiDrive* Servo Systems, you get a package that is **plug and play**, ready to run out of the box, and is friendly to all users, not just servo factory-direct field service techs. With the optional 8.4" color TFT (Thin Film Transistor) Touch Screen Interface, you can run Multi-Axis Applications with just one display.

Take advantage of our application-engineering department. For decades, Force Control has been a leader in providing solutions for difficult indexing applications. Our engineers will meticulously review your specific application and properly select components that will perform up to you're expectations. Our Goal is to provide you with a trouble free system with years of up-time performance. Our packages are pre-engineered and leave our plant ready to install with minimum start-up time. Also available from Force Control is our *PosiDrive* support team. We have experienced Programming Engineers and Controls Engineers that can be dispatched to your location for additional support.

PosiDrive Servo System Features and Benefits

Multi-Axis TSI TFT (Thin Film Transistor)

- ◆ Servos made simple.
- ◆ User friendly.
- ◆ Can run Multi-Axis Applications (Max. of 8) with one display.
- ◆ Painful proprietary software running on a PC/notebook is not necessary.
- ◆ Monitor key functions, fault history.
- ◆ Local control of servo motor.
- ◆ Motor tuning.
- ◆ Modify motion profile.
- ◆ Password protected.
- ◆ 8.4" Color Display
- ◆ Ethernet Ready
- ◆ Reliable Linux Operating System



Single-Axis TSI (Touch Screen Interface)

- ◆ Servos made simple.
- ◆ User friendly.
- ◆ Standard single axis applications preprogrammed.
- ◆ Painful proprietary software running on a PC/notebook is not necessary.
- ◆ Monitor key functions, fault history.
- ◆ Local control of servo motor.
- ◆ Motor tuning.
- ◆ Modify motion profile.
- ◆ Password protected.
- ◆ 8.4" Color Display



PosiDrive Servo Motors

- ◆ Rugged industrial motors.
- ◆ Fractional through 20 HP (15kW).
- ◆ Brushless design.
- ◆ Efficient, low inertia.
- ◆ Neodymium iron boron magnets used for superior performance and low cogging.
- ◆ High frequency response.
- ◆ Motor feedback is resolver based for added ruggedness.
- ◆ Encapsulated windings for superior heat dissipation.
- ◆ Heavy duty cable connectors, rotatable, and water tight.



PosiDrive Amplifier

- ◆ 208-480 Volt AC three phase power.
- ◆ Integrated power supply.
- ◆ 3 to 70 amps, 200% peak.
- ◆ All digital design.
- ◆ Rugged metal design, ESD.
- ◆ Protection on short circuit, under/over voltage, over current, over temperature
- ◆ Built-in line filter.
- ◆ UL and CE.



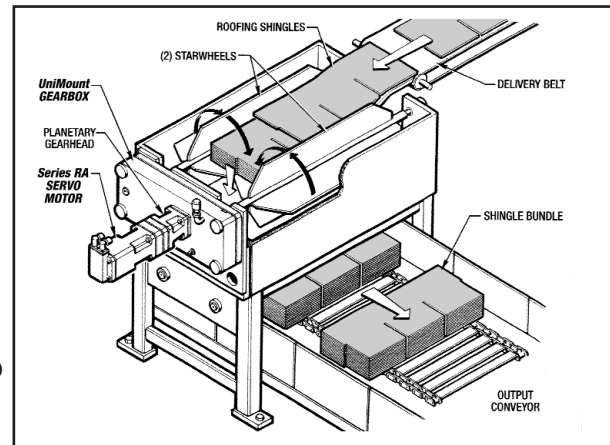
PosiDrive Application

APPLICATION: Auto Catcher & Stacker (PosiDrive)

INDUSTRY: Asphalt Roofing Shingle Plants

PRODUCT: PosiDrive Servo System with UniMount Gearbox

WHERE THEY ARE USED: Shingles are manufactured by spreading colored granular material on one side of a wide web of paper or fiberglass saturated with hot asphalt. After the asphalt has cooled, the web is slit into three or four strips. Each strip is then notched and cut to length forming a finished shingle. Shingles are fed into a speed up conveyor to establish spacing between the ends of each shingle. Shingle Catchers, (also called Auto Catchers or Shingle Stackers), are used to catch and stack finished shingles into bundle size groups prepared for wrapping.



HOW THEY WORK: Shingle Catchers have two parallel shafts with blades located at 90 degrees along each shaft called “Star Wheels”. The inside blades of the star wheels are positioned to form a shelf for the finished shingles fed by a high-speed conveyor. When a pre-determined number of singles, usually ranging from three to seven, are caught on the inside horizontal blades, the star wheels are indexed 90 degrees allowing the group of shingles to drop into a collection chamber below. Precise, rapid indexing between the continuously fed shingles is required to prevent jams. The Star Wheels require precise accuracy to ensure the blade position is maintained. This is easily achieved using the UniMount Gearbox and the PosiDrive Servo System. After a full bundle is caught, the collection chamber is opened and the full bundle is dropped onto a conveyor, which takes the shingles to be wrapped.

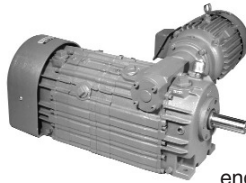
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PROBLEMS SOLVED: The PosiDrive Servo System provides more consistent performance to minimize shingle jams and maximize machine output. There are very few mechanical components so there is little maintenance required.

IMPORTANT FEATURES:

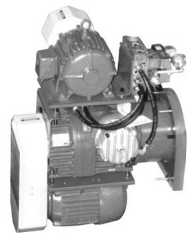
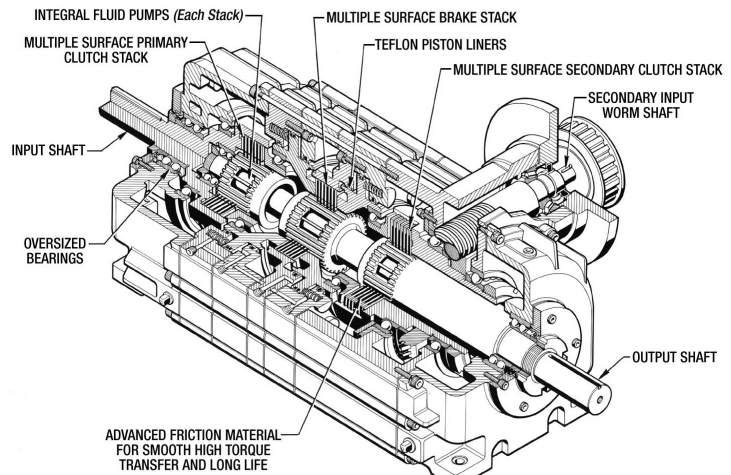
- ◆ PosiDrive Servo Motor with low inertia and high torque provides maximum performance for this demanding application.
- ◆ PosiDrive Servo Control is prepackaged and pre-programmed for the customer. The control panel may have two or more PosiDrive Servo Amplifiers for multiple diverters, catchers, flippers, or stackers for a customized solution to the plant. Final system startup variables are input through the TSI (Touch Screen Interface). There is no complex programming language to learn.
- ◆ The TSI can be mounted in its own small enclosure near the catcher with the main amplifier control panel being remote on multi-axis systems. This saves space in the critical area near the catcher while providing operators the flexibility of having the TSI nearby for system operation and monitoring. The TSI can communicate with multiple (8) PosiDrive Servo Drives on multi-axis systems.

Section 13 Additional Oil Shear Products



Posidyne Multi-Speed Drive (MSDr)

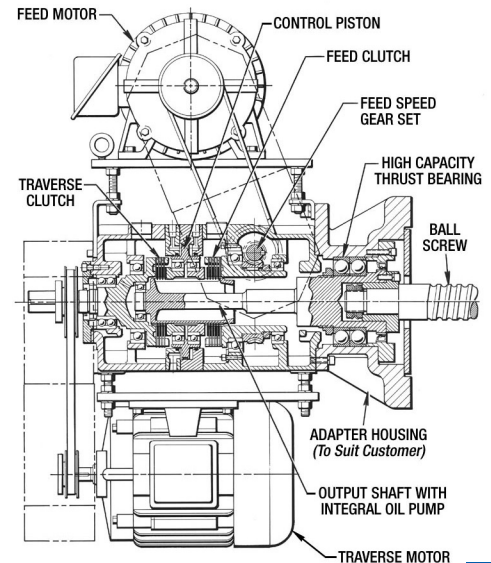
provides a broad range of speed ratios to select from. They usually operate in the same direction of rotation. The **MH Model** has an internal brake and a secondary motor connected through a worm gear set for slow speed output. Selecting engagement of the proper clutch will determine high or slow speed and the brake can be used to stop the drive between speed changes. Reversing the motors will determine the direction of rotation of the output shaft. The **Multi-Speed Drive** is a **Posidyne** with a second clutch connected to a second drive input which is normally a reduction drive using a worm shaft and gear. This adaptable design can be used as a main drive for inching or positioning, mid-stroke slow down for soft touch, slow speed reversing to back out, etc. The exclusive **Posidyne** oil shear technology with fluid recirculation is used in all multi-speed designs. The sealed cast iron housing provides heat dissipation for high cycle loads and protects the multiple disc clutch and brake stacks from contamination in hostile environments.



Posidyne Multi-Speed Mechanical Feed Drive

These **Posidyne Multi-Speed Drive Units** were originally developed to provide a high speed and inching speed in a single drive package for operation of lift or transfer drives in the automotive fabrication and assembly plants. Mounting kits have now been developed to adapt to ball screw slide units produced by a variety of machine tool manufacturers. The **Posidyne** low inertia, multiple disc and oil shear units can provide traverse rates up to 600 in. per min., feed rates ranging from 1 to 200 in. per min. and thrust ratings up to 17,000 lbs. operating a 1/2" lead ball screw. The same basic unit may be used with various adapters to retrofit many different makes of slides providing a common drive for all units in service.

- **Direct Replacement** - Installation is a simple bolt-on procedure. Slide bases do not require any modification.
- **Faster Acting and Improved Repeatability** - Oil shear clutch design disconnects traverse motor and pulley inertia when shifting from traverse to feed speed. Tooling can be positioned closer to the part.
- **Thrust Limiting** - Oil shear clutches are designed to limit torque smoothly and consistently at the end of the feed stroke. External adjustment of thrust is possible with a simple actuation pressure change.
- **Reduced Shock Loading** - Oil shear clutch and brake reactions induce less stress to the ball screw than planetary drives with dry friction brakes.
- **Reduced Maintenance Costs** - Long life, low cost friction discs and drive plates take the wear and tear. Expensive planetary gearing is eliminated.
- **Straight Forward Mechanical Units** - Standard motors and simple controls. Easy to troubleshoot and repair.

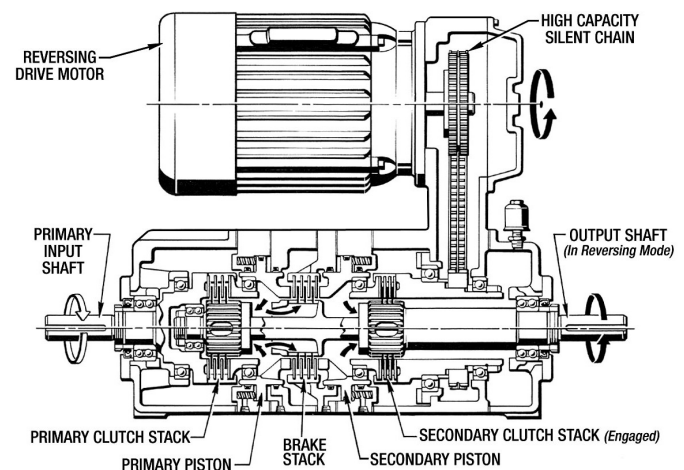


Posidyne High Speed Reversing Drive (HSRvD)

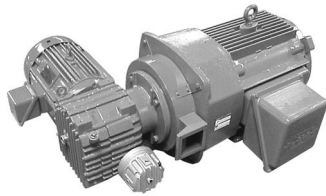
The **High Speed Reversing Drive** uses the dual clutch concept to provide rapid reversing without undo strain on the motor or drive system.

In a reversing application the load must be accelerated in the forward direction, stopped, and then accelerated in the opposite direction. This activity consumes large amounts of power and generates heat which must be absorbed. If the drive motor is reversed each cycle the major inertia load is most often the motor rotor itself.

The **Type II High Speed Reversing Drive** dual clutch **Posidyne** eliminates stopping, starting and accelerating the motor. One motor rotating in a forward direction is connected through the primary clutch and a second motor in a reverse direction is connected through the secondary clutch. By actuation of the proper clutch and brake, the reversing is handled within the **Posidyne** while the motors run continuously.



Contact Force Control Industries, Inc. for additional information concerning Available Sizes, Operating Specifications, Dimensions, Usage and Ordering Information.



Posidyne Two Speed Drive (TSDr)

The operation of the *Two Speed Drive Type II and Type III* centers around the bearing mounted four lug shaft with attached worm gear. The multiple disc stack carried by the

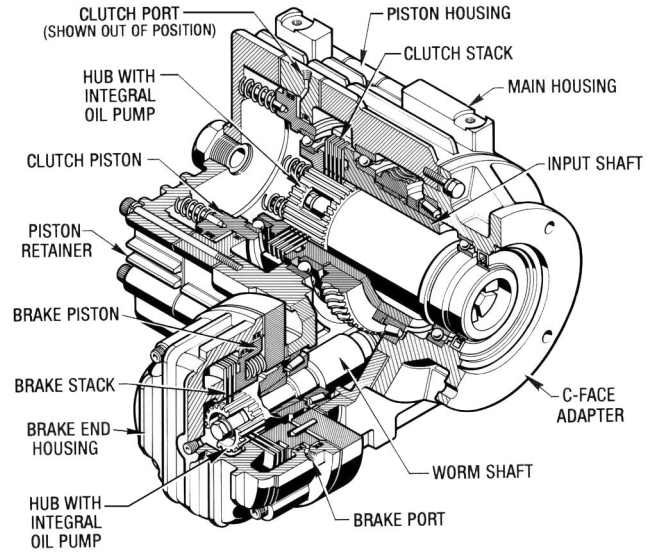
four lugs controls the interface between the high speed, low speed, braking and torque limiting operations of the drive.

In high speed mode, the multiple disc spring-set stack is released by pressurized air entering the main piston housing. This disengages the main motor from the rest of the two speed drive permitting the main motor to run at high speed.

Braking mode occurs as the high speed main motor is de-energized and the spring-set multiple disc stack is engaged by exhausting the air pressure. A spring-set brake, mounted on the input shaft of the worm gear set prevents the four lug shaft from rotating.

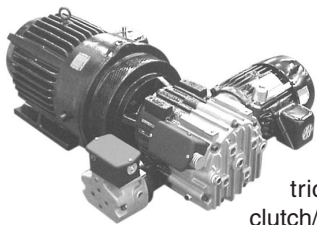
Low speed mode is initiated by dis-engaging the spring-set brake and energizing the feed motor. The worm gear set then rotates the four lug shaft and engaged multiple disc stack to drive the main motor and controlled load.

The multiple disc stack is enhanced by Force Control's unique oil recirculation feature. This increases the capacity of the multiple stack to dissipate heat, which enhances the life of the drive.



The Force Control Two Speed Drive, Type II and Type III offers a viable solution for the most demanding transfer and lift drive applications. Capabilities include low speed mode for initial setup requirements. Excellent repeatability allows design flexibility and in many applications can eliminate the need for mechanical stops.

Reliability is imperative to a successful design and Force Control stands behind its products with a two (2) year limited warranty on approved applications.

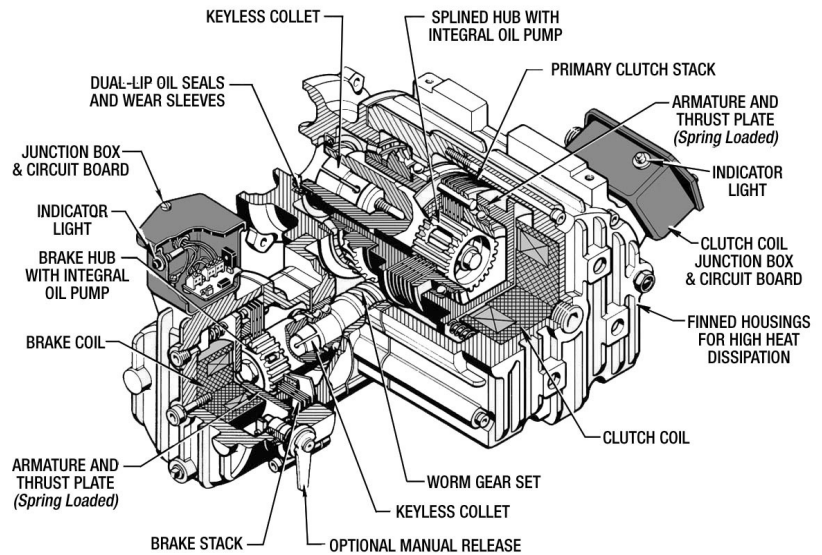


MagnaShear Two Speed Drive (Fully Electric)

The *MagnaShear Two Speed Drive* is a fully electric, two speed oil shear clutch/brake. It can be operated in high speed, low speed and spring-set braking mode.

High speed and low speed modes are selected by energizing the appropriate electronically controlled coils. The spring-set braking mode is selected when both coils are de-energized, allowing the springs to engage both disc stacks to stop the drive system.

Applications include transfer systems, lift systems, rotary components or any applications that require high speed motion with precise positioning and low speed setup capabilities.



Features...

- 115 VAC electric actuating system.
- Oil shear spring-set braking.
- Internal surge protection.
- Proven long-life friction material for repeatable positioning.
- Sealed from harsh environments.
- Standard NEMA motor mounting.
- Standard electrical connections.
- Modular assembly design.
- Wide range of gear ratios.
- Low speed capabilities for set-up and precise positioning.
- Excellent service and engineering

Contact Force Control Industries, Inc. for additional information concerning Available Sizes, Operating Specifications, Dimensions, Usage and Ordering Information.

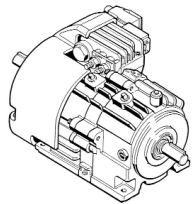
Posidyne Electro-Hydraulic Clutch/Brakes

There are times when compressed air is unattainable or not feasible (cold ambient temperatures, etc.) for actuation of the Clutch/Brake Unit. The **Electro-Hydraulic Posidyne** was developed for these applications. The fluid in the unit is pumped under pressure to the actuation piston and by-passed back into the unit through pressure regulators.

On the smaller size EL-02 the pump is internal. For the larger EH sizes, the pump is external and can be driven from the input shaft of the *Posidyne* Clutch/Brake or motor driven.

- **Does not require compressed air** - Completely controlled by electricity which eliminates the problems of low air pressure, freezing, long air lines for outdoor applications, etc.
- **Long Life** - No air with normal moisture content in the piston chamber eliminates piston seal leakage due to rust and early spring breakage. The fluid filter removes carbon build-up in the fluid reducing friction disc and drive plate wear.
- **Quick Response** - Reduced piston volume with higher hydraulic pressures (500 PSI Max.) allows the same quick response as the air actuated units

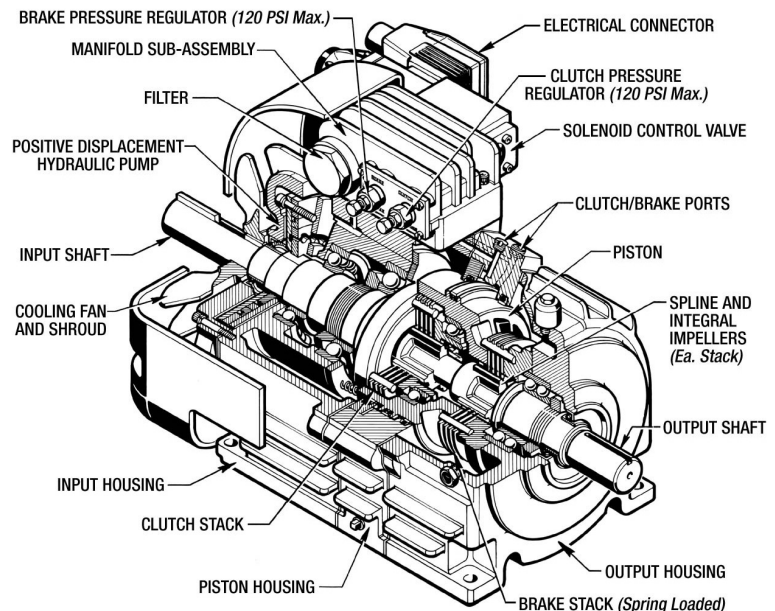
Posidyne EL Series (Internal Hydraulic Pump)



The Size **EL-02 Posidyne** has an internal Hydraulic pump mounted on the input shaft. Fluid is pumped through a filter, solenoid valve and into the actuation piston. Regulators are used to set the actuation pressure and relieve into the sump.

This is a self-contained unit and requires no external equipment except the electrical signal to activate the solenoid valve.

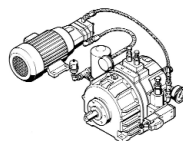
This unit is multi-directional but not recommended for applications requiring a reversing input.



Posidyne EH Series (External Hydraulic Pump)

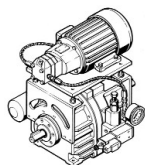
The larger units (**EH Series**) requires an external hydraulic actuation pump. A small hydraulic pump is used to pump the fluid from the unit sump through a filter, system pressure regulator, solenoid valve and into the piston actuation chamber. A pressure relief valve by-passes the fluid back into the unit sump. The pump

can be belt driven from the *Posidyne* input shaft or by a separate drive motor. Hydraulic pressure can be adjusted for the clutch and brake independently. This external hydraulic pump also allows for reversing applications.



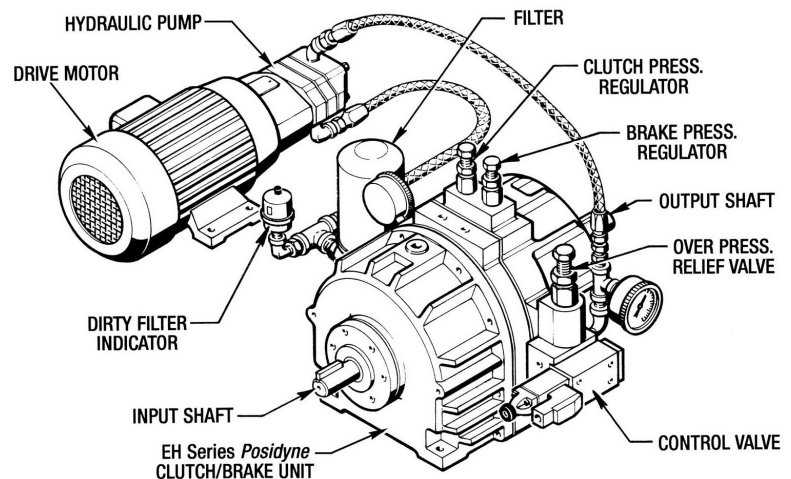
Side Mounting-Motor Driven Pump

The hydraulic pump and drive motor is mounted on the side of the *Posidyne* unit, usually on a common base which is customer furnished unless otherwise specified.



Piggyback Mounting-Motor Driven Pump

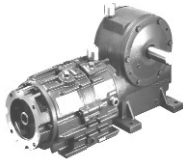
The hydraulic pump and drive motor is piggyback mounted above the *Posidyne* unit for an **efficient and compact design**.



Posidyne Packaged Machine Drives (PMD)

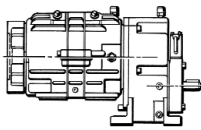
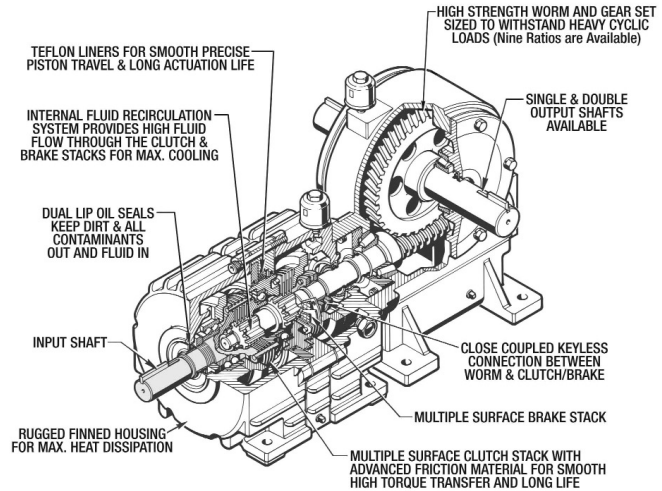
Many applications that use a **Posidyne Clutch/Brake** also requires a gear reduction unit. As the **Posidyne Clutch/Brake** is often most efficient at higher speeds, the gear reducer is subjected to the oscillating loads of starting and stopping of the output shaft. Many standard reducers that are sized to motor horsepower will not provide reasonable life under these conditions. The shaft quill connection is also a weak area where fretting and rolling of the key are constant sources of problems.

The **Posidyne Packaged Machine Drive** is a combination of a Clutch/Brake with a Gear Reducer integrally mounted. This arrangement eliminates the shaft quill connection and the associated problems. Also the gearing is designed to be as low inertia as possible, as well as providing a long trouble-free life comparable to the **Posidyne Clutch/Brake**. Three basic types are covered in this section. (A) **Worm Gear Reducer**; (B) **Helical Gear Reducer**; (C) **Planetary Gear Reducer**.



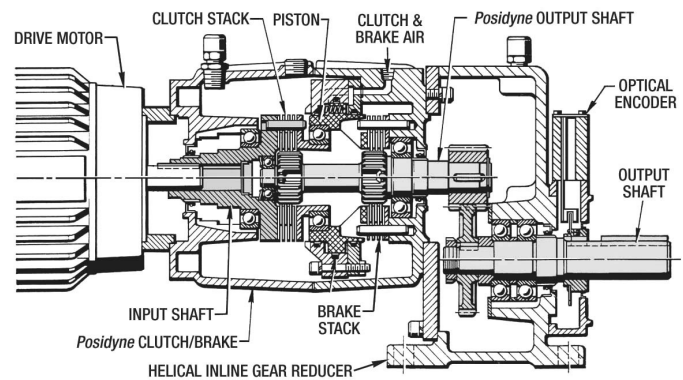
Posidyne PMD 1500-W and PMD 2000-W (Worm Gear Reducer)

The **PMD-1500-W** uses a **1.5 Posidyne** and the **PMD 2000-W** uses an **02 Posidyne Clutch/Brake** unit. It is integrally mounted with a **Worm Gear Reducer** to provide a compact **Packaged Machinery Drive** made to withstand the high loading of normal cyclic applications. The unique keyless coupling arrangement to the reducer input is compact and provides reliable torque transfer. Nine gear ratios are available from 9:1 to 60:1 to fit various applications. The optional C-Face input can utilize a C-Face motor providing motor, clutch/brake and reducer in one integrated package. An **Encoder** can also be furnished to give you a complete system that accurately stops/starts to position your product where it's needed and when it's needed.



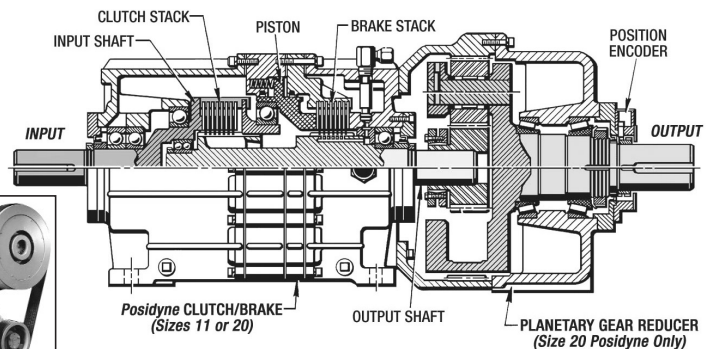
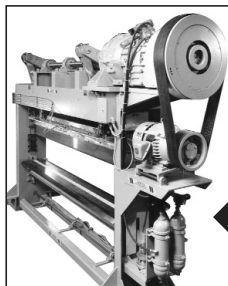
Posidyne PMD 1500-H and PMD 2000-H (Inline Helical Gear Reducer)

The **PMD 1500-H** uses a **1.5 Posidyne** and **PMD 2000-H** uses an **02 Posidyne Clutch/Brake** unit. Both sizes are integrally mounted to an **Inline Helical Gear Reducer** to provide a compact **Packaged Machinery Drive** made to withstand the high loading of normal cyclic applications. The unique Split Quill and Locking Ring arrangement for the C-Face input to the drive motor is compact and provides reliable torque transfer. Eleven gear ratios are available from 1.52:1 to 5.74:1 to fit various applications. The optional C-Face input can utilize a C-Face motor providing motor, clutch/brake and reducer in one integrated package. An **Encoder** can also be furnished to give you a complete system that accurately stops/starts to position your product where it's needed and when it's needed.



Posidyne PMD 20,000-P (Planetary Gear Reducer)

The **PMD 20,000-P** utilizes a **20 Posidyne Clutch/Brake**. It is integrally mounted to an **Inline Planetary Gear Reducer** to provide a compact **Packaged Machinery Drive** made to withstand the high loading of normal cyclic applications. An **Encoder** can also be furnished to give you a complete system that accurately stops/starts to position your product where it's needed and when it's needed.



One common and typical application of the PMD 20,000-P is an Insulation Shear or commonly referred to as the "Whopper Chopper". This unit is made for a high production rate and is proven to be reliable and dependable over a long period of time.

Contact Force Control Industries, Inc. for additional information concerning Available Sizes, Operating Specifications, Dimensions, Usage and Ordering Information.

Section 14 Application Engineering Services

Force Control Industries, Inc., over the past 45 years has developed an expertise in solving tough industrial drive applications. For this reason many customers have expressed a desire to have **Force Control** design and build the complete package that solves their unique and often complex drive problems. These applications range from high cycle precise positioning drives to dynamometers that can absorb 20,000 Lb. Ft. of torque.

Force Control Industries, Inc. will modify a standard product to accommodate metric or odd shaft sizes. **Force Control** can build a clutch/brake with an integral gear box or design and fabricate a mounting base for easy retrofit. Whatever it takes to solve those tough applications. Some of these special applications are shown below and on the next page.

Solving those tough drive applications has led **Force Control** to add a Controls Department that includes software development as well as design and assembly of the control. This led to the development of a standard line of

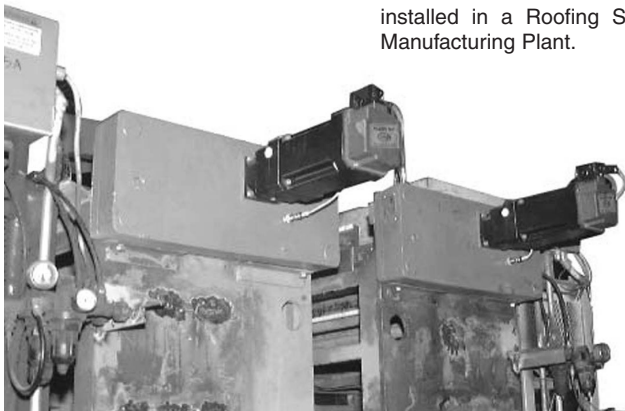
controls. As customer needs arose even the standard controls have been modified to handle the tough applications.

Force Control even has service technicians that will go into the field and collect the required data it takes to design and build the drive. This can include taking strip chart recordings to determine cycle times, torque and horsepower requirements, as well as product flow rates. They will take measurements so a mounting base can be fabricated for an easy retrofit. They are even available to help with the start-up of the new drive.

Force Control Industries, Inc. will continue through the next century to develop new products, expand the drive fabrication, add special modifications to standard drives and grow in the electronics and control area to benefit our customers.

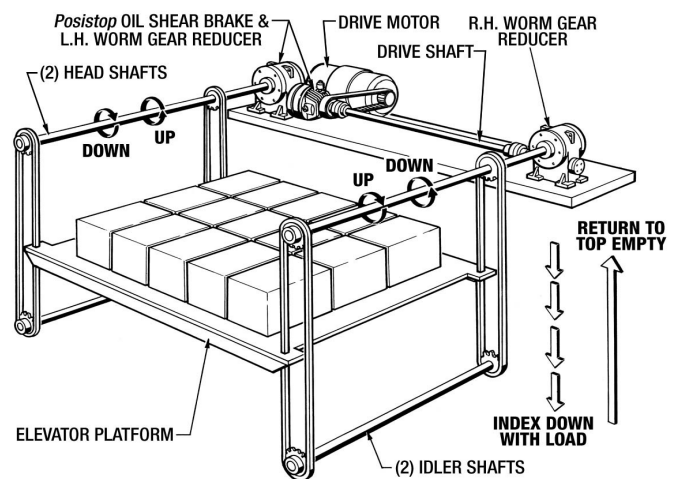
If you think it can't be done - Ask Force Control Industries, Inc.

Auto Catcher Servo Drive Assembly

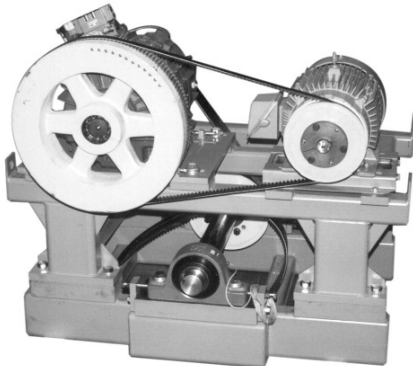


Tandem Shingle Auto Catchers using two Uni-Mount Gearboxes and two PosiDrive Servo Motors installed in a Roofing Shingle Manufacturing Plant.

Palletizer



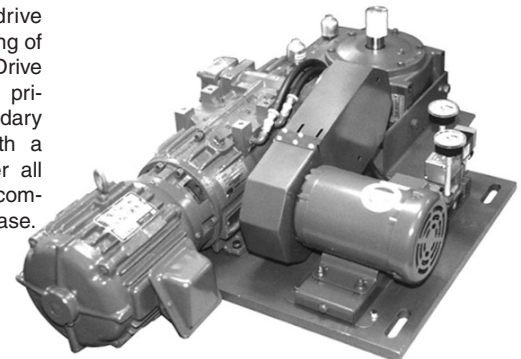
Fiberglass Retrofit Cut-Off Drive



Specifically designed ultra quick Posidyne Clutch/Brake with flywheel and welded tubular base completely assembled.

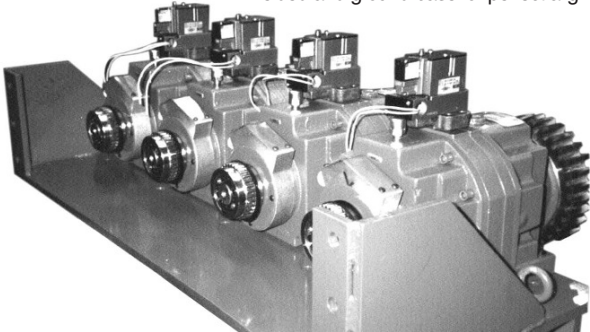
A Complete Drive Package

A common drive package consisting of a Multi Speed Drive Type II (MSDr), primary and secondary drive motors with a 90° gear reducer all mounted on a common machined base.



Shingle Blender Drive

Modified 2.5 Posidyne Clutch/Brakes for high cycle quick response with special self cleaning gears. The complete package is mounted on a welded and ground base for perfect alignment.



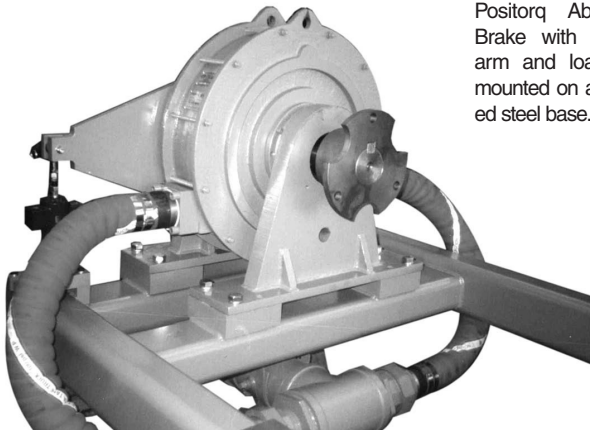
Blender Drive Control

A primary Control for the blend drops providing consistency over variable speed ranges.



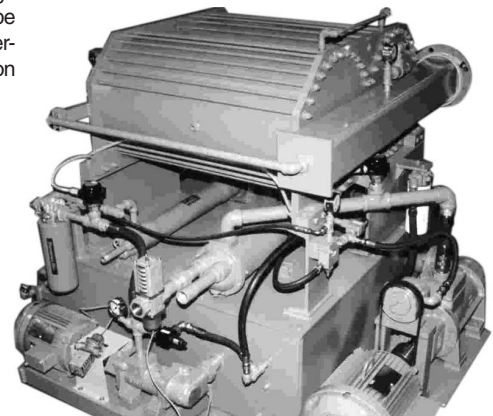
Dynamometer Brake with Frame

Positorq Absorber Brake with torque arm and load cell mounted on a welded steel base.



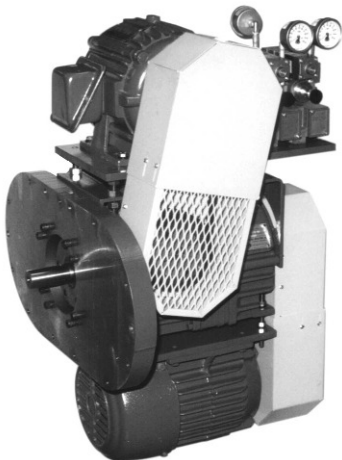
Forced Lube Accumulator Cooling Unit

Special one-shot high volume forced lube system for high thermal short duration loads.



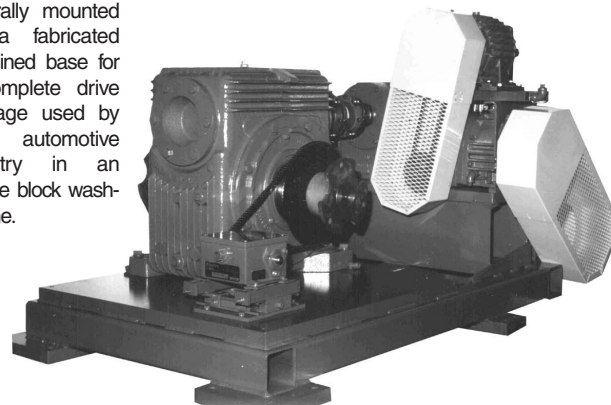
Greenlee Retrofit Ball Screw Drive

Special retrofit drive packages to fit existing applications which includes the clutch/brake, drive motor and mounting adapter for easy assembly.



Ferris Wheel Drive Package

Multi-speed Drive and Gear Reducer integrally mounted on a fabricated machined base for a complete drive package used by the automotive industry in an engine block washing line.



If you think it can't be done - Ask Force Control Industries, Inc.

Section 15 Unit Selection Procedures

▶ How to select a *Posidyne*

The selection of a **Posidyne** Clutch/Brake, PMD-2000, Multi-Speed or Reversing Drive should include the following information:

- Step 1** Control LogicSee page 15-1
- Step 2** Static Torque.....See page 15-3
- Step 3** Dynamic TorqueSee page 15-4
- Step 4** Thermal EnergySee page 15-4
- Step 5** Thermal Horsepower.....See page 15-5
- Step 6** Overhung LoadSee page 15-5

A complete selection procedure is provided in the Engineering Section.

Step 1 Control Logic

The torque transmitted by **Force Control** clutch and brake products is proportional to and controlled by the clamping force exerted by the piston on the stack. Pressure can be applied to the piston by internal springs or by externally controlled air or hydraulic pressure. The springs are generally used to engage the brake stack or to center the piston. The actuation pressure is used to (1) overcome the pressure generated by the springs, (2) furnish controlled pressure to the piston or (3) furnish additional pressure to assist the spring pressure.

This interaction of internal springs and externally applied

pressure determines how the drive unit reacts to control commands. This is called the **Torque Control Logic**.

As you can see, to exert pressure on the stack using the actuation pressure in many cases it is necessary to first overcome the internal spring pressure on the piston. The Control Logic is very important to the torque rating of the drive unit because of a maximum allowable actuation pressure, and must be known when calculating either actuation pressure for a required torque, or actual torque at a given actuation pressure.

Control Logic Availability

Logic	Description	X1	X2	X3	1.5	02	2.5	03	05	10	11	14	20	30
S	Air set clutch / Light spring set brake with air assist	X	X	X	X	X	X	X	X	X	X	X	X	X
SA	Air set clutch / Medium spring set brake with air assist	X	X	X	X	X	X	X	X	X	X	X	X	X
A	Air set clutch / Medium spring set brake	X	X	X	X	X	X	X	X	X	X	X	X	X
B	Air set clutch / Heavy spring set brake	----	----	----	X	X	X	X	X	X	X	X	X	X
C	Air set clutch / No brake	X	X	X	X	X	X	X	X	X	X	X	X	X
SCP	Spring centered piston / Air set clutch / Air set brake	----	----	----	----	----	X	X	X	X	X	X	X	X
P	Air set clutch / Air set brake / No springs	X	X	X	X	X	X	X	X	X	X	X	X	X

All clutches are air engaged. The Logic Selection is determined by the type of brake required.

S-Logic is for applications requiring a wide range of torque adjustment.

Example: Indexing conveyors typically require a very low brake torque. This is because there is a lot of friction, low back driving efficiency of worm gear reducers and the product may slip on the conveyor belt if stopped too quickly.

SA-Logic has the safety advantages of the A-Logic with an air assist to further increase brake torque if required.

Example: Lumber tilt hoist drive. The spring set brake holds the load if the air supply fails. Air assist allows operator to adjust desired operating torque.

A and B-Logic is for lifting devices or applications where adjustable brake torque is not required.

Caution: B-Logic (Heavy spring set brake) may have too much brake torque and may damage connected equipment

Example: Indexing cam operated dial table. The cam profile will stop the dial table. The **Posidyne** Brake only stops the drive train. A-Logic (Medium spring set brake) will not allow operator

to increase brake torque which could damage the cam and cam followers. Check with cam manufacturer for maximum allowable brake torque.

C-Logic is used when no brake is required. If there is very little connected load, the output shaft may rotate when the clutch is released due to residual drag

Example: Inching drive. Motor and gear reducer connected to **Posidyne** input. **Posidyne** used for jogging machine. Separate **Posidyne Clutch/Brake** used as main drive on machine. (Consider **Posidyne Multi-Speed Drive** for this application.)

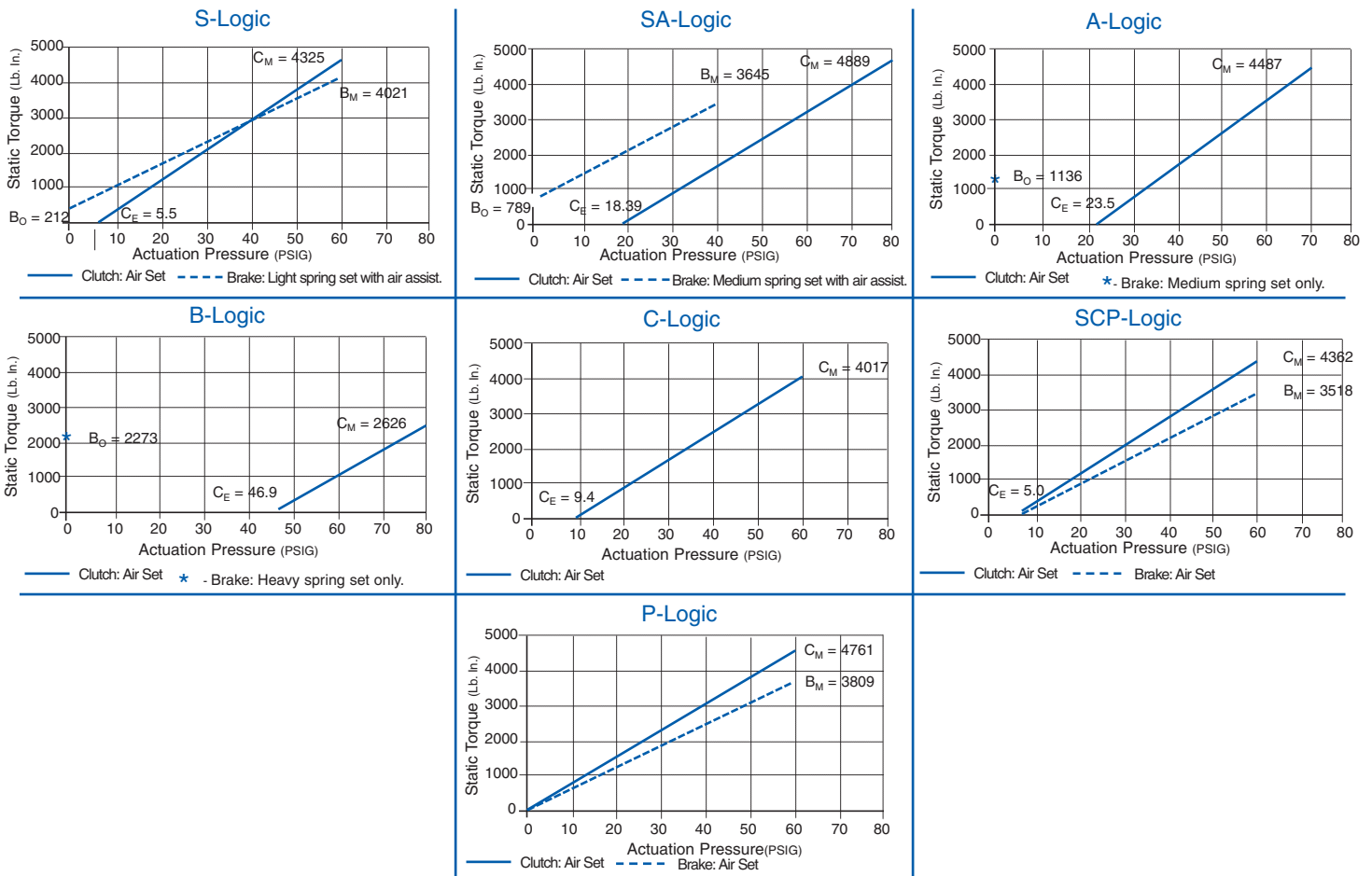
SCP-Logic is for applications that require a neutral position where neither the clutch or the brake is engaged.

Example: Lathe, where the chuck must be manually rotated to insert or remove the part.

P-Logic has an absence of spring bias. Both the clutch and brake are only engaged when air pressure is applied. This P Logic has the longest life since there are no springs that can fatigue and fail.

Example: Horizontal indexing belt conveyor and other applications where the torque control range is very low.

Sample Pressure vs. Torque Curves for 05 Posidyne.



Step 2 Static Torque

Static torque is the torque which can be transmitted by a clutch or brake without slipping. The static torque rating can be used to make a preliminary unit size selection using the **Quick Selection Table** following these four simple steps.

1. Determine Control Logic Type.
2. Determine Motor Horsepower.
3. Determine Speed (RPM) @ **Posidyne**.
4. Select preliminary unit size under required logic type using Horsepower vs. RPM Selection Tables below.

EXAMPLE:

- 15 HP Drive Motor.
- 1800 RPM @ **Posidyne** input.
- Adjustable Torque Control for both the clutch and brake is required.

A preliminary selection can be made from the chart under "S" Logic, 15 Horsepower and 1800 RPM. A size 03 is found.

For applications under 900 RPM and over 1800 RPM input consult the Force Control factory.

Quick Reference Posidyne Selection Tables

S, C, P and SCP Logic					B Logic					A and SA Logic				
HP	Input RPM				HP	Input RPM				HP	Input RPM			
	900	1200	1500	1800		900	1200	1500	1800		900	1200	1500	1800
1/3	X1	X1	X1	X1	1/3	---	---	---	---	1/3	X1	X1	X1	X1
1/2	X1, X2	X1	X1	X1	1/2	---	---	---	---	1/2	X1, X2	X1	X1	X1
3/4	X2, 1.5, 02	X1, X2	X1	X1	3/4	1.5	---	---	---	3/4	X2, 1.5, 02	X1, X2	X1	X1
1	X3, 1.5, 02	X2,1.5, 02	X2,1.5,02	X1, X2	1	1.5, 02	1.5, 02	1.5, 02	1.5, 02	1	X3, 1.5, 02	X2,1.5,02	X2,1.5,02	X1, X2
1 1/2	X3, 1.5, 02	X2,X3,02	X2,1.5,02	X2,1.5,02	1 1/2	1.5, 02	1.5, 02	1.5, 02	1.5, 02	1 1/2	X3, 1.5, 02	X2,X3,02	X2,1.5,02	X2,1.5,02
2	X3, 1.5, 02	X3,1.5,02	X3,1.5,02	X2,1.5,02	2	2.5	1.5, 02	1.5, 02	1.5, 02	2	X3,1.5, 02	X3,1.5,02	X3,1.5,02	X2,1.5,02
3	2.5	X3,X4,2.5	X3,1.5,02	X3,1.5,02	3	2.5	X4,2.5	2.5	1.5, 02	3	2.5	X3,X4,2.5	X3,1.5,02	X3,1.5,02
5	2.5	X4,2.5	2.5	X3, 2.5	5	03	X4,2.5	2.5	2.5	5	2.5	X4,2.5	2.5	X3, 2.5
7 1/2	03	2.5	2.5	X4,2.5	7 1/2	03	03	2.5	X4,2.5	7 1/2	03	2.5	2.5	X4,2.5
10	03	03	2.5	X4,2.5	10	05	03	03	X4,03	10	03	03	2.5	X4,2.5
15	05	03	03	03	15	10	05	05	03	15	05	03	03	03
20	10	05	05	03	20	10	10	05	05	20	10	05	03	03
25	10	05	05	05	25	11	10	10	10	25	10	05	05	05
30	10	10	05	05	30	11	10	10	10	30	10	10	05	05
40	10	10	10	10	40	14	11	11*	10	40	10	10	10	10
50	11	10	10	10	50	14	14	11*	11*	50	11	10	10	10
60	11	11	10	10	60	20	14	11*	11*	60	11	11	10	10
75	11	11	11*	10	75	20	20	14*	14*	75	14	11	11*	10
100	14	11	11*	11*	100	---	20	20	14*	100	20	14	11*	11*
125	20	14	11*	11*	125	---	---	20	20	125	30*	20	14*	14*
150	30*	20	14*	11*	150	---	---	---	20	150	30*	20	20	14*
200	30*	30*	20	14*	200	---	---	---	---	200	30*	30*	20	20
250	30*	30*	---	20	250	---	---	---	---	250	30*	30*	---	---

* Requires external cooling system.

* Requires external cooling system.

* Requires external cooling system.

Selections on the above Tables are based on static torque only and were calculated from the following Formula:

$$\text{Static Torque} = \frac{\text{HP} \times 63,000}{\text{N}} \times 3.00$$

Where: Torque = In. Lbs.

HP = Rated motor horsepower.

N = RPM @ **Posidyne** input

3.00 = Approximate stall torque of motor.

Step 3 Dynamic Torque

Dynamic Torque is the torque required during engagement to accelerate or decelerate the rotating mass (Inertia) and overcome friction (Efficiency) and load torque within a specified time period. Each of these can have a positive or negative effect on the required dynamic torque capacity of the clutch or the brake and will not necessarily effect both in the same way. Therefore it is necessary to calculate both the **Clutch Dynamic Torque** and the **Brake Dynamic Torque** separately. For a complete explanation of Dynamic Torque, Load Torque and Inertia refer to Engineering Information on page 16.1.

Clutch

$$T_{dc} = \left\{ \frac{WK^2 \times N \times 12}{308 \times t_a} + T_L \right\} \times \frac{1}{E}$$

Example:

Calculate required dynamic torque for the clutch.

$$T_{dc} = \left\{ \frac{7.7 \times 1800 \times 12}{308 \times 0.75} + 330 \right\} \times \frac{1}{0.91} = 1154 \text{ lb in.}$$

Brake

$$T_{db} = \left\{ \frac{WK^2 \times N \times 12}{308 \times t_d} - T_L \right\} \times E$$

Example:

Calculate required dynamic torque for the brake.

$$T_{dc} = \left\{ \frac{7.7 \times 1800 \times 12}{308 \times 0.75} - 330 \right\} \times 0.91 = 355 \text{ lb in.}$$

Where: T_{dc} = Clutch Dynamic Torque required (Lb. In.)

T_{db} = Brake Dynamic Torque required (Lb. In.)

WK^2 = Inertia. (Lb. Ft.²)

N = RPM @ **Posidyne**.

t_a = Acceleration time. (Sec.)

t_d = Deceleration time. (Sec.)

E = Efficiency of drive train.

* T_L = Load torque. (Lb. In.)

Select a unit size with dynamic ratings exceeding the values calculated.

Step 4 Thermal Energy per Engagement

Thermal Energy per Engagement is the amount of energy to be dissipated by the Posidyne during each engagement and/ or brake. This thermal energy requirement may be calculated using the following formula only if the beginning RPM of the clutch and the ending RPM of the brake is zero (0) RPM. For additional information on all beginning and ending speeds see Engineering Information on page 16.8.

Clutch

$$TE_c = 1.7 \times WK^2 \times \left\{ \frac{N}{100} \right\}^2 \times \frac{T_{dc}}{T_{dc} - T_L}$$

Example:

Calculate total required energy per engagement capacity for the clutch.

$$TE_c = 1.7 \times 7.7 \times \left\{ \frac{1800}{100} \right\}^2 \times \frac{1144}{1144-330} = 5,961 \text{ ft lbs}$$

Brake

$$TE_b = 1.7 \times WK^2 \times \left\{ \frac{N}{100} \right\}^2 \times \frac{T_{db}}{T_{db} + T_L}$$

Example:

Calculate total required energy per engagement capacity for the brake.

$$TE_b = 1.7 \times 7.7 \times \left\{ \frac{1800}{100} \right\}^2 \times \frac{346}{346+330} = 2,171 \text{ ft lbs}$$

Where: TE_c = Clutch Thermal Energy per Engagement (Ft. Lbs.)

TE_b = Brake Thermal Energy per Engagement (Ft. Lbs.)

1.7 = Constant

WK^2 = Inertia. (Lb. Ft.²)

N = RPM @ **Posidyne**.

T_{dc} = Clutch Dynamic Torque (Lb. In.)

T_{db} = Brake Dynamic Torque (Lb. In.)

* T_L = Load torque. (Lb. In.)

(System friction, inclined or vertical loads, etc.)

NOTE: For additional information to calculate WK^2 see Engineering Information on Page 16.3.

***NOTE:** Be sure to use the proper sign (+ -). Usually it is a positive number for the clutch calculation and a negative number for the brake calculation.

Step 5 Thermal Horsepower

Posidynes are also rated on Average Thermal Horsepower capacity which is the amount of thermal energy the units can dissipate continually (1 THP = 42.2 BTU = 33,000 Ft. Lbs.) based on the type of cooling - basic, fan, water or forced lube. The average thermal horsepower rating required can be calculated using the following formula.

$$THP = \frac{[TE_b + TE_c] \times CPM}{33,000}$$

Example:

Calculate thermal horsepower capacity required.

$$THP = \frac{(5,961 + 2,171) \times 6}{33,000} = 1.48 THP$$

Where: THP = Average Thermal Horsepower

TE_c = Thermal Energy per Engagement (Clutch)

TE_b = Thermal Energy per Engagement (Brake)

CPM = Cycles per Minute

33,000 = Constant

A cooling method must be specified that provides an Average Thermal Horsepower rating exceeding the values calculated.

Step 6 Overhung Load

Overhung Load is the load attribute to the pull of the chain or belt drive on the input or output shafts. Larger diameter pulleys or sprockets will decrease overhung load but will increase the WK² in the preceding calculations. The required Overhung Load capacity can be calculated from the following formula.

$$P = \frac{126,000 \times HP \times K}{N \times D}$$

Example:

Calculate overhung load capacity required for the input shaft.

$$P = \frac{126,000 \times 15 \times 1.25}{1800 \times 4} = 328 \text{ Lbs.}$$

Where: P = Overhung Load. (Lbs.)

HP = Horsepower.

N = RPM @ **Posidyne** Input.

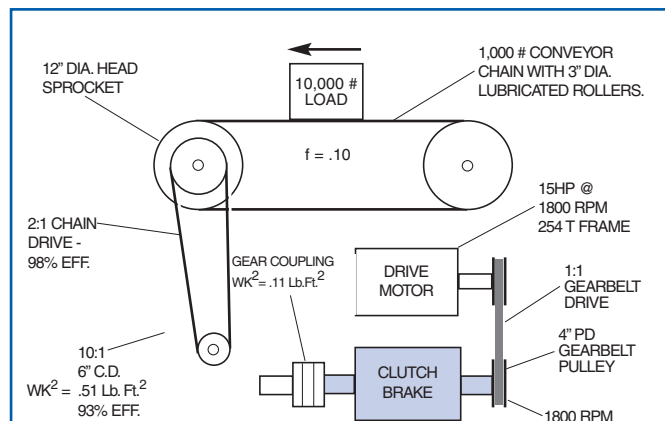
D = Pitch diameter of the Pulley or Sprocket. (In.)

K = 1.1 for the Chain.

K = 1.25 for the gearbelt.

K = 1.5 for a V-Belt.

The unit size selected must have overhung load ratings exceeding the values calculated.



Data Required for Proper Selection...

- Logic Type = S
- CPM = 6 Cycles per Minute
- t_a (Accel. Time) = .75 Seconds
- t_d (Decel. Time) = .75 Seconds
- K (Gearbelt Drive) = 1.25

Selection

Referring to the **Posidyne** selection tables we find under S- logic that the size 03 (1864 Lb.In. @ 60 PSI) is required to meet the Dynamic Torque requirements of the clutch. The rating for the brake (1485 Lb. In. @ 60 PSI) exceeds the Dynamic Brake requirement. The average Thermal Horsepower rating indicates the need for fan cooling. A check of the Overhung Load rating for the 03 (1150 Lbs.) in the Overhung Load table on page 2.16 is satisfactory.

Example: Indexing Conveyor Drive

Cyclic WK²

$$\begin{aligned} \text{Reflected Load WK}^2 &= \text{Load} \times (\text{Radius})^2 \times \left(\frac{1}{\text{Ratio}}\right)^2 \div 144 \\ &= 10,000 \times (6'')^2 \times \left(\frac{1}{2 \times 10}\right)^2 \div 144 = 6.25 \text{ Lb. Ft.}^2 \end{aligned}$$

$$\text{Reflected Conveyor} = \text{Chain} \times (\text{Radius})^2 \times \left(\frac{1}{\text{Ratio}}\right)^2 \div 144$$

$$\text{Chain WK}^2 = 1,000 \times (6'')^2 \times \left(\frac{1}{2 \times 10}\right)^2 \div 144 = 0.63 \text{ Lb. Ft.}^2$$

$$\text{Reducer WK}^2 = \text{Vendor Information} = 0.51 \text{ Lb. Ft.}^2$$

$$\text{Coupling WK}^2 = \text{Vendor Information} = 0.11 \text{ Lb. Ft.}^2$$

$$03 \text{ Posidyne WK}^2 = \text{From Table on Page 1-11} = 0.20 \text{ Lb. Ft.}^2$$

$$\text{Total Cyclic WK}^2 @ \text{Posidyne} = 7.7$$

Efficiency of Drive Train

$$E = \text{Chain Drive Efficiency} \times \text{Reducer Efficiency} = .98 \times .93 = .91 \text{ Efficiency}$$

Total Load Torque

$$T_L = [(10,000 \text{ Lbs.} + 1,000 \text{ Lbs.}) \times .1f] \times 6'' \text{ Rad.} \div 20:1 = 330 \text{ Lb. In.}$$

The proper **Posidyne** selection is a size 03, fan cooled and S-logic. Using the Ordering System Chart in Section 2 page 2.17 the Ordering Number is developed.

03-1S1-H-5

If a piggyback is required the Ordering Number becomes:

03-7S7-H-5 (254 T-Frame)

Posidyne® Logic Specifications

Pressure vs. Static Torque Chart

(X Class Posidyne Clutch/Brake)

Size	Logic	Clutch				Brake				
		C _M		C _E	C _T	B _O	B _M		B _S	B _T
		Max. Clutch Static Torque (Lb.In.)	Max. Air Actuation Pressure (PSIG)	Clutch Engmt. Air Pr. Req'd. (PSIG)	Clutch Net Torque (Lb. In./ PSIG)	Spring Set Only-Torque w/o Air Assist (Lb.In.)	Max. Brake Static Torque (Lb.In.)	Max. Brake Actuation Pressure (PSIG)	Brake Spring Bias (PSIG)	Brake Net Torque (Lb. In./ PSIG)
X1	S	99	70	16	1.83	24	106	45	13.1	1.83
	SA	90	80	31		49	104	30	26.8	1.83
	A	90	80	31		49	-----		----	-----
	C	99	70	16		----	-----		----	-----
	P	110	60	3		----	110	60	-----	1.83
X2	S	198	70	16	3.86	48	213	45	13.1	3.66
	SA	179	80	31		98	208	30	26.8	3.66
	A	179	80	31		98	-----		----	-----
	C	198	70	16		----	-----		----	-----
	P	220	60	3		----	220	60	-----	3.66
X3	S	468	80	16	7.32	93	531	60	12.6	7.32
	SA	359	80	31		189	480	40	25.6	7.72
	A	359	80	31		189	-----		----	-----
	C	468	80	16		----	-----		----	-----
	P	512	70	3		----	512	70	-----	7.32

NOTES:

1. For Dynamic torque ratings multiply static torque ratings above by .846 for all X Class Posidyne Clutch/Brakes.
2. "S", "SA" and "C" logics are not standard.

Posidyne® Logic Specifications

Pressure vs. Static Torque Chart

(Sizes 1.5-05 Posidyne Clutch/Brake)

Size	Logic	Clutch				Brake				
		C _M		C _E	C _T	B _O	B _M		B _S	B _T
		Max. Clutch Static Torque (Lb.In.)	Max. Air Actuation Pressure (PSIG)	Clutch Engmt. Air Pr. Req'd. (PSIG)	Clutch Net Torque (Lb. In./ PSIG)	Spring Set Only-Torque w/o Air Assist (Lb.In.)	Max. Brake Static Torque (Lb.In.)	Max. Brake Actuation Pressure (PSIG)	Brake Spring Bias (PSIG)	Brake Net Torque (Lb. In./ PSIG)
1.5	S	427	60	4.2	7.6	32	484	60	3.3	7.6
	SA	387	70	18.8		110	492	70	15.0	7.6
	A	387	70	18.8		110	-----	-----	-----	-----
	B	240	70	37.6		220	-----	-----	-----	-----
	C	427	60	4.2		----	-----	-----	-----	-----
	P	464	70	3.0		----	464	70	0	7.6
02	S	518	60	7.30	9.8	48	553	60	5.7	8.4
	SA	542	80	24.9		164	501	40	19.5	8.4
	A	503	80	20.0	8.4	126	-----	-----	-----	-----
	B	386	80	40.0		252	-----	-----	-----	-----
	C	335	60	20.0		----	-----	-----	-----	-----
	P	590	60	3.0	9.8	----	505	60	0	8.4
2.5	S	1,331	60	6.6	25	113	1,396	60	5.3	21.4
	SA	1,482	80	21.9		512	1,663	40	18.0	28.5
	A	1,451	80	20.6		476	-----	-----	-----	-----
	B	968	80	41.2		952	-----	-----	-----	-----
	C	1,270	60	9.1		----	-----	-----	-----	-----
	SCP	1,234	60	2.5		----	1,051	60	-3.5	21.4
	P	1,497	60	3.0		----	1,283	60	0	21.4
03	S	2,574	60	6.0	47.6	144	2,049	60	4.5	31.7
	SA	2,790	80	21.4		651	2,238	40	16.4	39.7
	A	2,852	80	20.0		602	-----	-----	-----	-----
	B	1,895	80	40.2		1203	-----	-----	-----	-----
	C	2,474	60	8.0		----	-----	-----	-----	-----
	SCP	2,668	60	4.0		----	1,833	60	-2.0	31.7
	P	2,857	60	3.0		----	1,905	60	0	31.7
05	S	4,325	60	5.5	79.4	212	4,021	60	3.3	63.5
	SA	4,889	80	18.4		789	3,645	40	11.0	71.42
	A	4,487	80	23.5		1,196	-----	-----	-----	-----
	B	2,626	80	46.9		2,273	-----	-----	-----	-----
	C	4,017	60	9.4		----	-----	-----	-----	-----
	SCP	4,362	60	5.0		----	3,518	60	-4.6	63.5
	P	4,761	60	3.0		----	3,809	60	0	63.5

NOTE: For Dynamic torque ratings multiply static torque ratings above by .846.

Pressure vs. Static Torque Chart

(Sizes 10-30 Posidyne Clutch/Brake)

Size	Logic	Clutch				Brake				
		C _M		C _E	C _T	B _O	B _M		B _S	B _T
		Max. Clutch Static Torque (Lb.In.)	Max. Air Actuation Pressure (PSIG)	Clutch Engmt. Air Pr. Req'd. (PSIG)	Clutch Net Torque (Lb. In./ PSIG)	Spring Set Only-Torque w/o Air Assist (Lb.In.)	Max. Brake Static Torque (Lb.In.)	Max. Brake Actuation Pressure (PSIG)	Brake Spring Bias (PSIG)	Brake Net Torque (Lb. In./ PSIG)
10	S	9,832	60	7.3	186.6	691	10,489	60	4.2	163.3
	SA	9,471	80	29.2		2,766	9,297	40	16.9	163.3
	A	10,031	80	26.3		2,797	-----	-----	-----	-----
	B	5,097	80	52.7		5,593	-----	-----	-----	-----
	C	9,228	60	10.5		-----	-----	-----	-----	-----
	SCP	9,936	60	6.7		-----	8,621	60	-7.3	163.3
	P	11,197	60	3.0		-----	9,797	60	0	163.3
11	S	18,045	80	8.0	250.7	888	14,926	80	5.0	175.5
	SA	13,358	80	27.0		2,961	9,980	40	16.9	175.5
	A	14,036	80	24.0		2,661	-----	-----	-----	-----
	B	8,019	80	48.0		5,322	-----	-----	-----	-----
	C	18,045	80	8.0		-----	-----	-----	-----	-----
	SCP	17,833	80	9.0		-----	17,833	80	-4.6	175.5
	P	20,054	80	3.0		-----	14,038	80	0	175.5
14	S	22,989	80	9.4	325.8	1,681	23,737	80	6.0	275.7
	SA	16,484	80	29.4		5,237	16,264	40	19.0	275.7
	A	17,576	80	26.0		4,660	-----	-----	-----	-----
	B	10,783	80	47.0		8,352	-----	-----	-----	-----
	C	23,453	80	8.0		-----	-----	-----	-----	-----
	SCP	26,066	80	8.8		0	20,793	80	-4.6	275.7
	P	24,279	80	4.3		0	22,056	80	-----	275.7
20	S	31,082	80	8.0	432.2	2,018	32,274	80	5.3	378.2
	SA	25,837	80	20.2		5,045	20,173	40	13.3	378.2
	A	26,332	80	19.0		4,759	-----	-----	-----	-----
	B	18,087	80	38.0		9,518	-----	-----	-----	-----
	C	30,455	80	9.5		-----	-----	-----	-----	-----
	SCP	32,737	80	4.8		-----	28,115	80	-6.2	378.2
	P	34,578	80	3.0		-----	30,256	80	0	378.2
30	S	78,857	50	7.9	1871.7	8,010	72,185	40	5.0	1604.4
	SA	75,478	60	19.7		20,026	68,157	30	12.5	1604.4
	A	75,478	60	19.7		20,026	-----	-----	-----	-----
	C	78,857	50	7.9		-----	-----	-----	-----	-----
	SCP	76,600	45	4.0		-----	65,657	45	4.1	1604.4
	P	74,871	40	3.0		-----	64,175	40	0	1604.4

NOTE: For Dynamic torque ratings multiply static torque ratings above by .846 for all sizes.

To find Torque Developed at a given Actuation Pressure.

To find Actuation Pressure needed for Req'd. Torque.

$$\text{Clutch Torque} = (\text{PSI} - C_E) \times C_T$$

$$\text{Brake Torque} = (\text{PSI} + B_S) \times B_T$$

$$\text{Clutch PSI} = (T_R / C_T) + C_E$$

$$\text{Brake PSI} = (T_R / B_T) - B_S$$

How to Select the Correct Posistop

Selecting the correct **Posistop Brake** is very similar to the selection procedures used for the brake component selection of the **Posidyne**. **Note:** One major difference is that Torque Ratings are in **Lb. Ft.** rather than **Lb. Ins.**

Selection of the **Posistop** products vary slightly with the different types.

Motor Mounted

The **Motor Mounted Posistop** is spring set, air release. The initial selection for a motor brake should be made based on the frame size of the motor. It is important to check the shaft diameter, shaft length, pilot diameter and bolt circle to select the proper size **Posistop**. This selection should be checked against the Torque and Thermal Requirements. The formulas are provided for this purpose.

Flange Mounted

The **Flange Mounted Posistop** is spring set, air release and comes in the same Torque Ratings as the Motor Mounted Brakes. The flanges and hubs are typically designed to fit various machine faces and shaft extensions.

Foot Mounted

The **Foot Mounted Posistop** comes both as spring set, air release (Type A and B Logics) and as an adjustable unit with air set, spring release (Type S Logic). The Control Logic must be determined before a selection can be made.

The following formulas can be used to calculate the required Torque and Thermal Ratings.

Static Torque

The **Static Torque Ratings** of the **Posistop** units represent the **Holding Torque Capacity** with the actuation pressure noted in the "S" Logic units or when zero release pressure is supplied, i.e., multiple springs fully engaging the brake stack in the "A" or "B" Logic units.

Static Torque may be determined by the following formula:

$$T_s = \frac{HP \times 5250 \times 2}{N}$$

Where: T_s = Torque (Lb. Ft.)
 HP = Horse Power of Motor
 N = RPM @ Brake
 2 = Constant for moderate inertial loads.
 (Consult factory for hoist type applications)

Select a motor brake with a Static Torque Rating equal to or greater than the Torque Value determined above.

Dynamic Torque

For applications requiring precise stopping action, it becomes necessary to consider the torque available to decelerate the load.

$$T_{db} = \text{Torque (Lb. Ft.)} = \left\{ \frac{WK^2 \times N}{308 \times t} + T_L \right\} \times E$$

WK^2 = Lb. Ft.² (Total Cyclic Inertia)

N = RPM

t = Stopping Time required in seconds

308 = Constant

T_L = Load Torque (Lb. Ft.)

E = Efficiency

The Torque figure in the preceding formula is considered to be average torque available during deceleration. Select a Brake with a Dynamic Torque Rating equal to or greater than the Torque determined above.

Thermal Dissipation-Cyclic Drive

The considerations for Heat Dissipation requirements are based on the following formula:

$$TE_b = 1.7 \times WK^2 \times \left\{ \frac{N}{100} \right\}^2 \times \frac{T_{db}}{T_{db} - T_L}$$

TE_b = Thermal Energy per Engagement (Ft. Lbs.)

1.7 = Constant

WK^2 = Total Cyclic Inertia (Lb. Ft.²)

N = RPM @ Brake

T_{db} = Dynamic Torque (Lb. Ft.)

T_L = Load Torque (Lb. Ft.)

This formula gives the **Thermal Energy absorbed by the brake in any one engagement**, providing all factors remain constant for the application. **Force Control Posistop** units are rated thermally in terms of **Horsepower / Seconds per Minute**.

$$1 \text{ HP Sec. /Min.} = 0.7 \text{ BTU} = 550 \text{ Ft. Lbs./Min.}$$

Horsepower Seconds per Minute is a continuous rating based on the cyclic rate of the application and the kinetic energy to be absorbed per stop.

$$\text{HP Sec. /Min.} = \frac{TE_b \times CPM}{500}$$

HP Sec./Min. = Thermal Load (Continuous)

CPM = Cycles per Minute

500 = Constant

Select a **Posistop Brake** with a Thermal Rating equal to or greater than the Thermal Load (Continuous) determined above.

How to Select Your Positorq Absorber Brake

Dynamometer Application

In a **Dynamometer Application** normally a **Positorq Brake** is used to resist rotation of a shaft at some torque load. It can be used to absorb energy continuously as in product life testing, or for a short time for maximum load carrying capability. It can also be used to lock-up the shaft for destructive testing.

The **Positorq Brake** size is based primarily on torque and thermal horsepower. Sizing of the **Positorq Brake** should be done by application engineers at **Force Control**, however the following information will be required for sizing and determining cooling systems.

1. The first step is to determine the **maximum continuous slip torque** required at any speed. This is the torque at which the **Positorq Brake** is required to slip, absorbing energy continuously.

2. The next step is to determine the **lock-up or holding torque** required. This could be used for destructive testing or maximum load carrying ability.

3. Next determine the **maximum heat load (Thermal Horsepower)** to be dissipated. This can usually be determined by the maximum horsepower of the input driver. It can also be calculated by using torque and speed.

4. Determine the **maximum speed** in RPM required at the **Positorq Brake**.

5. Determine the **minimum torque** required at the maximum speed. Due to residual drag in the **Positorq Brake**, zero torque is not available depending on speed and **Positorq** size. Minimum torque is affected by brake size, number of discs, RPM, fluid flow and temperature.

<p>BASIC FORMULA TORQUE (Lb. Ft.)</p> $TORQUE = \frac{(HP) (5250)}{RPM}$ $THP = \frac{(Torque) (RPM)}{5250}$ $RPM = \frac{(THP) (5250)}{Torque}$	<p>HP = Prime mover horsepower less efficiency and work losses in system or device being tested.</p> <p>RPM = Speed at brake shaft.</p> <p>THP = Thermal horsepower to be dissipated. (Continuous)</p> <p>Torque = Lb. Ft.</p>
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NOTE: Please consult factory for your particular application. There are many options available that are not shown in this catalog.

How to Select Your *Positorq* Absorber Brake

Tension Application

The *Positorq* can be used for two major types of applications:

- (1) To supply constant tension for unwind applications in industries such as paper, foil, steel, coating, plating, etc.
- (2) As an energy absorber (Dynamometer) to create a known controlled load on a system, usually for testing purposes.

The selection of a *Positorq* for a tension control application will vary depending on the type of tension application. The most common types of applications are:

- (1) **Constant Rewind** - The parent roll is continuously unwound as for plating, coating, laminating, etc.
- (2) **Rewinding in Sets** - The parent roll is wound onto several smaller rolls. In this application the parent roll will need to be stopped several times during the operation to change the smaller rolls.

For a Constant Rewind application the two Torque Requirements to be considered are:

- (1) The Torque to maintain constant tension.
- (2) The Torque to stop the inertia of the roll for a **panic stop**.

When Rewinding in Sets, there are three Torque Requirements to be considered.

- (1) The Torque to maintain constant tension.
- (2) The Torque to stop the roll Inertia only, (E-Stop).
- (3) The Total Torque to stop the roll Inertia and overcome tension at the first set stop.

The Total Torque Required when stopping at the first set stop is: (1) the total of the torque to maintain tension plus (2) the torque to stop the roll.

The larger of (1) The Total Torque required at set stop or (2) The Torque required for a Panic Stop, should be used for selection purposes.

Determining Torque Capacity...

The following formulas are used to find the required torque capacity. Calculating the torque of a full roll and that at set stop is the same except for the difference in WK^2 and RPM.

<p>(1) Tension Torque</p> <p>1. Torque required to maintain constant tension.</p> $T_t = \frac{D \times W \times (PLI) \text{ or } (PSI \times t)}{2 \times 12}$ <p>T_t = Torque (Lb.Ft.) to maintain tension. D = Dia. of Roll. (Inches) W = Width of Roll. (Inches) PLI = Tension (Lb./Linear Inch) PSI = Tension (Lb./Sq. Inch) t = Thickness</p>	<p>(2) Stopping Torque</p> <p>2. Torque required to stop roll.</p> $T_s = \frac{WK^2 \times RPM}{308 \times t}$ <p>T_s = Torque for panic or set stop. (Lb.Ft.) WK^2 = Inertia of roll when stopping. RPM = Speed of roll when stopping. 308 = Constant t = Time to decelerate.</p>	<p>(3) Total Torque</p> <p>3. Total Torque required at set stop.</p> $TT = T_t + T_s$ <p>TT = Total Torque at set stop. (Lb.Ft.) T_t = Constant Tension Torque at set stop. (Lb.Ft.) T_s = Stopping Torque at set stop. (Lb.Ft.)</p>
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Thermal Horsepower to maintain tension

$$THP_t = \frac{W \times PLI \times FPM}{33,000}$$

THP_t = Thermal Horsepower (Tension)
 W = Width (Inches)
 PLI = Tension (Lb. per Linear Inch)
 FPM = Feet per Minute
 $33,000$ = Constant

The correct *Positorq* unit is then selected based on the highest torque requirement and thermal horsepower rating. The Cooling Unit is selected based on Thermal Horsepower.

Thermal Horsepower relates to the amount of energy that must be absorbed, and is used to size the cooling system. Usually the thermal horsepower absorbed to maintain tension is satisfactory for calculating **Cooling System Capacity**, however in some cases where a very small PLI is required the thermal energy to stop the roll may be the limiting factor. The following formula can be used to determine the Thermal Horsepower. Refer to the Engineering Section for further information if selection of Stopping Thermal Horsepower is required.

*** **Tension Brake Selection for Unwind Applications**

The primary function of the *Positorq* unit in **Unwind Applications** is to provide a controlled resistance to the parent roll so the web tension remains constant as the roll diameter changes. Constant web tension is required to produce a satisfactory roll that has uniform hardness. For this to occur the torque reaction of the Brake will vary proportionally to the change in roll size as it unwinds. The angular

velocity of the roll, however, varies inversely to the change in its size when web speed is held constant. These requirements produce a constant horsepower condition. In other words, as the torque requirement for the brake decreases, the speed of the roll increases such that the product of the torque and speed is a constant.

Unwind Applications can be broken down into two typical categories.

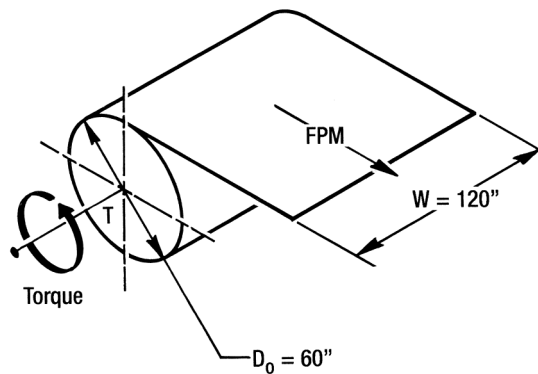
1. Constant Rewind Applications

When the Parent Roll is being rewound for processing or storage and the process is not interrupted. This condition is common to applications found in the steel industry

2. Rewind Applications with Multiple Sets

When a parent roll is being rewound into several smaller rolls for shipment or storage. This condition is common to applications found in the paper industry.

There are small but important differences between the applications. The following example is used to illustrate them. **The two parameters on which the proper selection is made in both applications is torque and horsepower requirements**



Unwind Example

Required Information

- 1. Web Speed = FPM = 6000
- 2. Web Tension = PLI = 5
- 3. Web Width = W = 120 Inches
- * 4. Specific Weight of Paper = 45 Lbs./Ft.³ (80 Lb. paper x .007" thick)
- 5. Max. Diameter = D_0 = 60 Inches
- **6. Number of Set = 4
- 7. Deceleration Time between Sets = t_s = 30 Sec.
- 8. Panic Stop Time = t_p = 15 sec.
- 9. Core Diameter = D_c = 10 Inches

NOTES:

* Paper is normally specified by a "base weight" (i.e. 500 sheets having an area of 6 Ft.² equals a certain weight.) In order to determine the specific weight of the paper the thickness or caliper of the paper has to be obtained

Example: 80 Lb. paper that is .007" Thick

$$\text{Specific Weight} = \frac{80 \text{ Lbs.}}{[3000] \times [.007/12]} = 45 \text{ Lbs. Ft.}^3$$

** Sets - Number of rolls that the parent roll will be wound.

*** The above selection procedure is valid for applications of web speeds no greater than 6000 FPM and with web tension of 5 PLI or greater.

Consult our Factory Sales Engineering Department for applications outside these limits.

Torque Requirements...Tension Brake (Positorq) Selection

The Maximum Torque Requirement for an Unwind Tension Application can be determined by evaluating the following (3) categories:

1. Torque Required at Constant Speed Operation

For **Steady State Operation** this value is simply found by using the following equation:

$$T_C = \frac{D \times W \times PLI}{2} \times \frac{1}{12}$$

Using the example on the previous page.

$$T_C = \frac{60 \times 120 \times 5}{2} \times \frac{1}{12} = \mathbf{1500 \text{ Ft. Lbs.}}$$

A torque reaction of 1500 Ft. Lbs. is required for Steady State Operation at full roll.

2. Torque Required for Panic Stop

The **Required Torque for a Panic Stop** is a maximum when the roll is at its largest diameter. The following equations are used to determine this required torque:

A. Determine Weight of Roll

$W_t = \text{Volume} \times \text{Specific Weight}$

$$W_t = \left[\frac{\pi D_2^2}{4} \times L \right] \times \left[\frac{1}{1728} \right] \times \text{Specific Weight}$$

$$W_t = \left[\frac{\pi 60^2}{4} \times 120 \right] \times \left[\frac{1}{1728} \right] \times 45 \text{ Lbs./Ft.}^3 = \mathbf{8835 \text{ Lbs.}}$$

B. Determine WK^2 of Roll @ Max. Dia.

$$WK^2 = \frac{WR^2}{2} \left[\frac{1}{144} \right] \text{ [Lb. Ft.}^2 \text{]}$$

$$WK^2 = \frac{8835 [30]^2}{2} \left[\frac{1}{144} \right] = \mathbf{27,609 \text{ Lb. Ft.}^2}$$

C. Determine RPM @ Max. Dia.

$$\text{RPM} = \frac{\text{FPM} \times 12}{\pi \times D}$$

$$\text{RPM} = \frac{[6000] \times [12]}{\pi \times [60]} = \mathbf{382 \text{ RPM}}$$

D. Torque Requirement

$$T_p = \frac{WK^2 \times \text{RPM}}{308 \times t_p}$$

$$T_p = \frac{27,609 \times 382}{308 \times 15} = \mathbf{2283 \text{ Lb. Ft.}}$$

3. Torque Required Between Sets

The **Maximum Torque Required between Sets** is the first set. This torque is determined as follows:

A. Determine Weight of Roll @ First Set

$$W_{t1} = W_o \left[1 - \frac{1}{N} \right] \text{ where } N = \text{Number of Sets}$$

$$W_{t1} = 8835 \left[1 - \frac{1}{4} \right] = 6,626.25 \text{ Lbs.}$$

B. Determine Dia. of Roll @ First Set

$$D_1 = \sqrt{[D_o^2 - D_c^2] \left[1 - \frac{1}{N} \right]}$$

$$D_1 = \sqrt{[60^2 - 10^2] \left[1 - \frac{1}{4} \right]} = \mathbf{51.2 \text{ Inches}}$$

C. Determine WK^2 @ First Set

$$WK^2 = \frac{WR^2}{2} \left[\frac{1}{144} \right] = \text{Lb. Ft.}^2$$

$$WK^2 = \frac{[6626][25.6]^2}{2} \left[\frac{1}{144} \right] = \mathbf{15,078 \text{ Lb. Ft.}^2}$$

D. Determine RPM @ First Set Dia.

$$\text{RPM} = \frac{\text{FPM} \times 12}{\pi \times D}$$

$$\text{RPM} = \frac{[6000] \times [12]}{\pi \times 51.2} = 448 \text{ RPM}$$

E. Determine Stopping Torque (Inertia Only)

$$T_s = \frac{WK^2 \times \text{RPM}}{308 \times t_s}$$

$$T_s = \frac{15,078 \times 448}{308 \times 30} = 731 \text{ Lb. Ft.}$$

F. Total Torque Requirement

$$T_T = \left(T_c \times \frac{D_1}{D_o} \right) + T_s$$

$$T_T = \left(1500 \times \frac{51.2}{60} \right) + 731 = 2011 \text{ Lb. Ft.}$$

From this application the torque requirement at constant speed is the limiting requirement. Model 8245 Positorq is tentatively selected based on maximum torque. See next page for sizing Thermal Horsepower Requirements.

Thermal Horsepower...Tension Brake (Positorq) Selection

The next parameter to evaluate in selecting the correct Positorq is the Thermal Horsepower Requirement. Each of the three modes of operation analyzed under Torque Requirements will have a different thermal demand. To make a proper selection each mode needs to be evaluated.

1. Thermal Power - Constant Speed

The Thermal Horsepower Requirement during this mode of operation can be determined from the following equation:

$$THP = \frac{W \times PLI \times FPM}{33,000}$$

$$THP = \frac{(120) (5) (6000)}{33,000} = 109 \text{ THP}$$

2. Thermal Power - Panic Stop

$$THP_p = \frac{T_p}{550} \left[(.1047) \text{ RPM} - \frac{T_p}{WK^2} (t) \right]$$

$$THP_p = \frac{2283}{550} \left[(.1047 \times 382) - \frac{2283}{27,609} (0) \right] = 166 \text{ THP}$$

T_p = Panic Stopping Torque = 2283 Ft. Lbs.

WK^2 = @ Maximum Diameter = 27,609 Lb. Ft.²

RPM = @ Maximum Diameter = 382

t = Time

NOTE: Thermal load is maximum at $t = 0$ and decreases linearly to zero when the system has come to rest.

3. Thermal Power - Set Stop

$$THP = \frac{T_T}{550} \left[(.1047) \text{ RPM} - \frac{T_T - T_C}{WK^2} (t) \right]$$

$$THP = \frac{2011}{550} \left[(.1047 \times 448) - \frac{2011 - 1500}{15,078} (0) \right] = 171 \text{ THP}$$

T_T = Total Torque between Sets = 2011 Lb. Ft.

WK^2 = First Set Diameter = 15,078 Lb. Ft.²

RPM = @ First Set Diameter = 448

t = Time

NOTE: Once again the Maximum Thermal Load is at the beginning of deceleration and goes to zero as the system comes to rest.

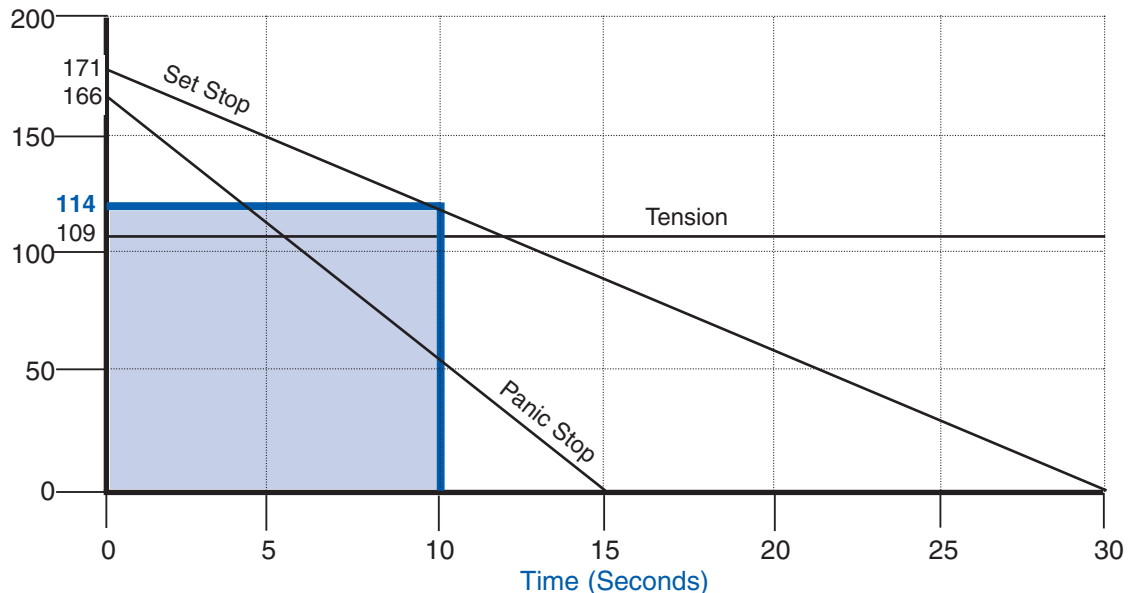
Since the thermal demand deceleration between sets is relatively transient, it would not be necessary to purchase a 200 THP Cooler. The optimum selection for the unit under consideration would be determined by finding the Thermal Capacity at which the transient load would not exceed the unit rating for more than 10 seconds.

$$THP = THP \text{ Peak} \left[1 - \frac{10}{\text{Decel Time}} \right]$$

$$= 171 \left[1 - \frac{10}{30} \right] = 114 \text{ THP}$$

15

Thermal Horsepower



Section 16 General Engineering Information

The following section is provided to furnish additional information that will increase the confidence level and understanding of the designer and engineer in applying the formulas published in previous sections. This section concentrates on working definitions and illustrations of the concepts governing the application of clutches and brakes.

There are three steps to successfully complete the selection of the proper size of clutch and brake.

1. Calculate the Required Dynamic Torque Capacity for both the clutch and the brake.
2. Determine the Thermal Horsepower per engagement for both the clutch and the brake.
3. Determine the Required Average Thermal Horsepower Capacity for both the clutch and the brake.

Dynamic Torque

Objective:

Determine the Dynamic Torque Capacity required at the Clutch/Brake Output Shaft.

To accurately determine the Torque Requirements during an acceleration or deceleration operation, the total inertia, component efficiency and total load torque must be determined and reflected back to the Clutch/Brake output shaft. A major consideration is the proper application of the inefficiencies to the individual drive components during an acceleration or deceleration period. The total inertial torque is the sum of all the individual torques associated with each drive component. The load torque is considered next and again the proper efficiency factor must be applied. The dynamic torque is then found by adding the total inertial torque and the load torque together.

Three distinct terms make up the equation for the dynamic torque.

1. Inertial Torque $\frac{WK^2 \times N}{307.2 \times t}$
2. Drive Efficiency E
3. Load Torque T_L

Terms #2 and #3 are always present in the system while the Inertial term #1 is only applicable during acceleration or deceleration.

Inertial Torque

Objective:

Determine the Reflected Inertia of the Drive System with Respect to the Output Shaft of the Clutch/Brake.

The first step in determining the dynamic torque is to determine the inertia in the system to be accelerated or decelerated. Inertia is the measure of resistance an object possesses to a change in its state of motion. The term used to quantify this property is WK^2 . The units for this term are **Lb. Ft.²**. There are

two primary activities required to obtain the WK^2 in a form that can be used.

1. Determine the inertia of each component in the system that will be cycled.
2. Reflect the inertia of each cycled component back to the clutch and brake

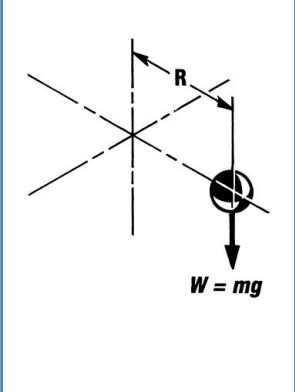
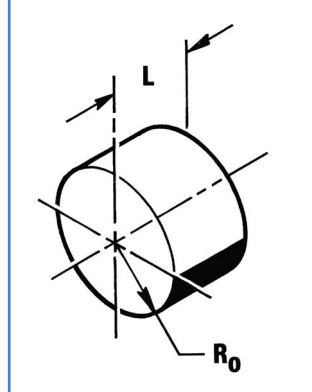
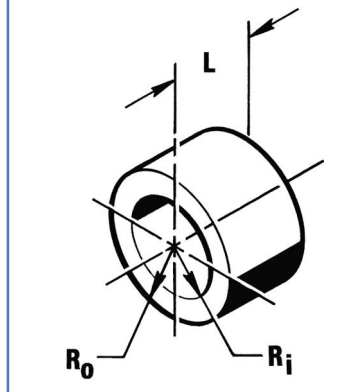
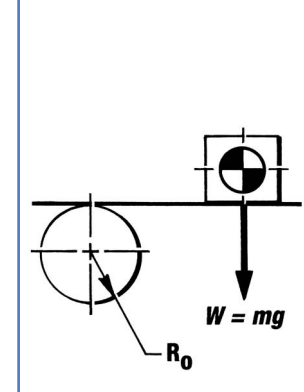
1. Determining the Inertia of an Object

The rotational inertia an object has is a function of its mass and how that mass is distributed about the rotating axis. The effective radius is where the entire mass of the object can be thought to be concentrated. This effective radius is called the *Radius of Gyration* and is designated by the symbol **K**. The **WK²** is found by squaring **K** and multiplying it by the entire weight of the object.

The steps to find the **WK²** of any object are:

1. Determine the weight of the object.
2. Determine **K²** from the geometry of the object.
3. Multiply the two terms together.

The following formulas can be used to calculate the **Weight** and **K²** of various objects.

				
	Concentrated Weight	Uniform Disc	Hollow Cylinder	Translating Weight
Weight	$W = W$	$W = \frac{\pi D^2}{4} \times L \times Lb/l_n^3$	$W = \frac{\pi(D_0^2 - D_1^2)}{4} \times L \times Lb/l_n^3$	$W = W$
K²	$K^2 = R^2$	$K^2 = \frac{R_0^2}{2}$	$K^2 = \frac{R_0^2 + R_1^2}{2}$	$K^2 = R_0^2$

2. Reflecting the Inertia of an Object back to the Clutch and Brake.

The objective is to obtain an equivalent **WK²** that can be attached to the output of the Clutch/Brake and represents the inertia of all cycled components in the system. The procedure to obtain the equivalent or reflected inertia is based on the principle that the total energy in the system is conserved. (*This means that the reflected inertia of an object*

is equal to the actual kinetic energy it possesses in the drive system.) Since the kinetic energy varies with the square of the speed the reflected inertia is the object's actual inertia affected by the square of the ratio of the operating speed to the speed of the Clutch/ Brake. The total reflected inertia is the sum of the reflected inertia of each individual component. The following example, on the next page, will be used to help clarify selection of the correct Clutch/Brake.

Calculating the Inertia and Reflecting it to the Clutch/Brake

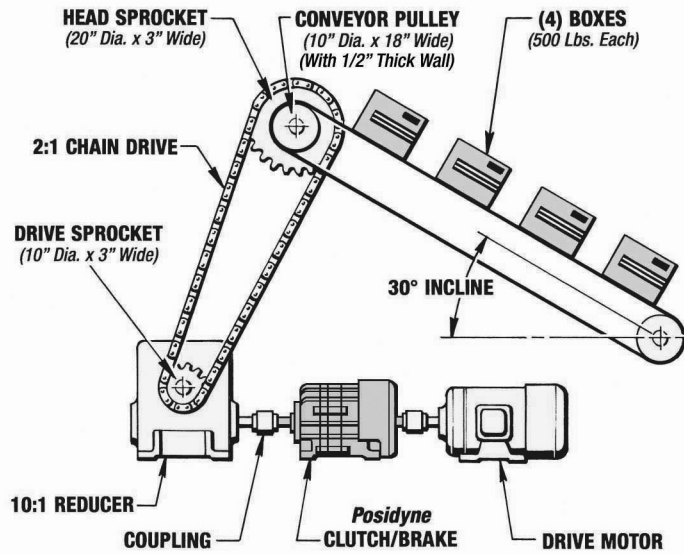
Example:

Required:

- Acceleration Time4 Sec.
- Deceleration Time13 Sec.
- Cycles per Minute 10
- Logic Type A
- Clutch/Brake Size 03

Posidyne

- Conveyor Efficiency8
- Chain Drive Efficiency9
- Reducer Efficiency8
- Max. Pressure 60 PSIG



Boxes

Weight = 500 Lbs.

← Weight of each box

$WK^2 = \text{Weight} \times R_o^2 \times \text{No. of Boxes}$

← Total inertia of the 4 boxes

$$= 500 \times \left(\frac{5''}{12}\right)^2 \times 4 = 347.20 \text{ Lb. Ft.}^2$$

$R_o = \text{Radius of Conveyor Pulley}$

$WK^2 @ \text{Posidyne} = WK^2 \times \left(\frac{1}{\text{Total Ratio}}\right)^2$

← Inertia reflected thru the drive ratio from the box to the Clutch/Brake

$$= 347.20 \times \left(\frac{1}{10 \times 2}\right)^2 = .87 \text{ Lb. Ft.}^2$$

Conveyor Pulleys

$\text{Weight} = \pi \left(\frac{D_o^2}{4} - \frac{D_i^2}{4}\right) \times L \times .283 \text{ (Lb.In.}^3\text{)}$

← Total volume x .288 Lb.In.³ (Specific weight of steel)

$$= 3.1416 \left(\frac{10^2}{4} - \frac{9^2}{4}\right) \times 18 \times .283 = 76.02 \text{ Lbs.}$$

$D_o = \text{OD of Conveyor Pulley (In.)}$

$D_i = \text{ID of Conveyor Pulley (In.)}$

$L = \text{Length of Conveyor Pulley (In.)}$

$WK^2 = \text{Weight} \times \left(\frac{R_o^2 + R_i^2}{12}\right) \times \text{No.}$

← Total inertia of both pulleys

$$= 76.02 \times \frac{1}{2} \times \left[\left(\frac{5''}{12}\right)^2 + \left(\frac{4.5''}{12}\right)^2\right] \times 2 = 23.89 \text{ Lb.Ft.}^2$$

No. = Number of Pulleys

$R_o = \text{Outside Radius (Feet)}$

$R_i = \text{Inside Radius (Feet)}$

$WK^2 @ \text{Clutch/Brake} = WK^2 \left(\frac{1}{\text{Total Ratio}}\right)^2$

← Inertia reflected to the Clutch/Brake

$$= 23.89 \left(\frac{1}{10 \times 2}\right)^2 = .06 \text{ Lb.Ft.}^2$$

20" Diameter Sprocket, 3" Wide

$$\begin{aligned} \text{Weight} &= \pi \frac{D_o^2}{4} \times L \times .283 \text{ (Lb.In.}^3\text{)} && \longleftarrow \text{Weight calculated from total volume times .283 Lb. In.}^3 \text{ for steel.} \\ &= 3.1416 \times \frac{20^2}{4} \times 3 \times .283 = 266.72 \text{ Lbs.} && D_o = \text{OD of Sprocket (In.)} \\ \\ \text{WK}^2 &= \frac{WR^2}{2} = \frac{W \times (R_o)^2}{2} && \longleftarrow \text{WK}^2 \text{ calculated using } K^2 = \frac{R^2}{2} \\ &= \frac{266.72 \times (10"/12)^2}{2} = 92.61 \text{ Lb. Ft.}^2 && R_o = \text{Radius of Sprocket (Feet)} \\ \\ \text{WK}^2 @ \text{ Clutch/Brake} &= \text{WK}^2 \left(\frac{1}{\text{Total Ratio}} \right)^2 && \longleftarrow \text{WK}^2 \text{ reflected to the Clutch/ Brake through the chain drive and reducer.} \\ &= 92.61 \times \left(\frac{1}{10 \times 2} \right)^2 = .23 \text{ Lb.Ft.}^2 \end{aligned}$$

10" Diameter Sprocket, 3" Wide

$$\begin{aligned} \text{Weight} &= \pi \frac{D_o^2}{4} \times L \times .283 \text{ (Lb.In.}^3\text{)} && \longleftarrow \text{Weight calculated from total volume times .283 Lb. In.}^3 \text{ for steel.} \\ &= 3.1416 \times \frac{10^2}{4} \times 3 \times .283 = 66.68 \text{ Lbs.} && D_o = \text{OD of Sprocket (In.)} \\ \\ \text{WK}^2 &= \frac{WR^2}{2} = \frac{W \times (R_o)^2}{2} && \longleftarrow \text{WK}^2 \text{ calculated using } K^2 = \frac{R^2}{2} \\ &= \frac{66.68 \times (5"/12)^2}{2} = 5.79 \text{ Lb. Ft.}^2 && R_o = \text{Radius of Sprocket (Feet)} \\ \\ \text{WK}^2 @ \text{ Clutch/Brake} &= \text{WK}^2 \left(\frac{1}{\text{Total Ratio}} \right)^2 && \longleftarrow \text{WK}^2 \text{ reflected to the Clutch/ Brake through the chain drive and reducer.} \\ &= 5.78 \times \left(\frac{1}{10} \right)^2 = .06 \text{ Lb.Ft.}^2 \end{aligned}$$

10:1 Reducer	Coupling	Posidyne Clutch/Brake
WK ² = .17 Lb. Ft. ² (Information from Vendor)	WK ² = .78 Lb. Ft. ² (Information from Vendor)	03 WK ² = .20 Lb. Ft. ² (Information from Vendor)

Total System Reflected Inertial Torque

$$\text{WK}^2 = .87 + .06 + .23 + .06 + .17 + .78 + .20 = \mathbf{2.37 \text{ Lb. Ft.}^2}$$

16 Procedure to Determine the Required Dynamic Torque Capacity for the Clutch and the Brake.

To make a seemingly complex procedure easily understandable use the **Dynamic Torque Analysis Table** shown below. Using the previous example will help you follow the steps to proper Clutch and Brake Selection by filling in the Table on the next page.

Dynamic Torque Analysis Table

1	2	3	4	5	6	7	8	CLUTCH		BRAKE	
								9	10	11	12
Component	Speed Ratio @ Input	Inertia WK ² (Lb. Ft. ²)	Component Efficiency	Accumulated Efficiency Factor %	Reflected Inertia WK ² (Lb. Ft. ²)	Load Torque (Lb. In.)	Reflected Load Torque T _L (Lb. In.)	Reflected Inertial Torque T _{ic} (Lb. In.)	Dynamic Torque T _{dc} (Lb. In.)	Reflected Inertial Torque T _{ib} (Lb. In.)	Dynamic Torque T _{db} (Lb. In.)
Posidyne	1	0.20	1.0	1.000	0.20			35.16		-108.17	
Coupling	1	0.78	1.0	1.000	0.78			137.11		-421.88	
10:1 Reducer	1	0.17	0.8	1.000	0.17			29.88		-91.95	
10" Dia. Sprocket	10	5.79	0.9	0.800	0.06			13.18		-25.96	
20" Dia. Sprocket	20	92.61	1.0	0.720	0.23			56.15		-89.57	
Conveyor Pulley	20	23.89	0.8	0.720	0.06			14.65		-23.37	
Boxes	20	347.20	1.0	0.576	0.87	6732.0	584.38	265.50		-271.04	
Summation					2.37	6732.0	584.38	551.63	1136.01	-1031.94	-447.56

Dynamic Torque (Clutch)

- List all of the Cycled Components in Column 1 starting at the Clutch/Brake and proceeding to the Load.
- List the Input Gear Ratio for each Component in Column 2. Notice that the 10:1 Reducer is assigned a ratio of 1 because the input shaft is connected directly to the clutch/brake and runs at 1800 RPM. The 10" Sprocket is assigned a ratio of 10 because it turns at 180 RPM. The 20" Sprocket is assigned a ratio of 20 because it turns at 90 RPM.,etc.
- List the Rotational Inertia for each component in Column 3. These values were calculated on pages 16.3 and 16.4.
- List the Component Efficiency in Column 4. These values can be obtained from vender information or by using engineering judgement.
- Determine the Efficiency Factor for each Component and list it in Column 5. The Efficiency Factor at the Posidyne Clutch/Brake is 1. The remaining efficiency factors are determined by multiplying all the Efficiency Values together that are listed in Column 4 above the component considered in the table.
 Posidyne: =1
 Coupling: (1) = 1
 Reducer: (1) x (1) = 1
 10" Dia. Sprocket: (1) x (1) x (.8) = .8
 20" Dia. Sprocket: (1) x (1) x (.8) x (.9) = .72
 Conveyor Pulley: (1) x (1) x (.8) x (.9) x (1) = .72
 Boxes: (1) x (1) x (.8) x (.9) x (1) x (.8) = .576
- Compute the Reflected Inertial Torque Requirements for each Component and list it in Column 6 using the gear ratio and rotational inertia listed in Columns 2 and 3.
- Determine the Load Torque Requirement for the Drive and list it in Column 7 for the component with which it is associated. Load Torque is the torque required to maintain a system at constant velocity. This Torque can be found by solving for Static Equilibrium. T_L is computed for the boxes on the next page. Enter 6732.0 in column 7 for the boxes.

- Apply the associated Efficiency Factor to T_L and reflect it back to the Clutch/Brake. The Torque at the Clutch/Brake varies inversely to the speed reduction between the Clutch/Brake and the Conveyor Head Pulley. Determine the Reflected Load Torque and list it in column 8.

$$\text{Reflected Load Torque} = T_L = \frac{T_L \text{ (column 7)}}{\text{Eff. factor (column 5) x ratio}}$$

$$T_L = \frac{6732}{.576 \times 20} = 584.4 \text{ Lb. In.}$$

- Determine the Reflected Inertial Torque Requirement for each component and list it in column 9. The sum of this column is the Total Reflected Inertial Torque Requirement. The two conversion constants in the following equations are (12 Inches / foot) in the numerator and (307.2 foot revolution/minute second) in the denominator.

$$\text{Reflected Inertial Torque } T_i = \frac{WK^2 \text{ (col. 6)} \times N \text{ (change in speed)} \times 12}{307.2 \times t \text{ (time)} \times Ef \text{ (Efficiency factor col. 5)}}$$

$$\text{Boxes: } T_i = \frac{(.87) \times (1800 - 0) \times 12}{307.2 \times (.4) \times .576} = 265.5 \text{ Lb. In.}$$

$$\text{Conveyor Pulley } T_i = \frac{(.06) \times (1800 - 0) \times 12}{307.2 \times (.4) \times .72} = 14.65 \text{ Lb. In.}$$

Etc.....

- The sum of the Total Reflected Inertial Torque and the Reflected Load Torque is the Dynamic Clutch Torque Required.

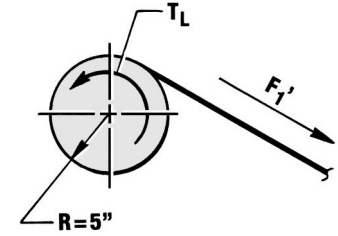
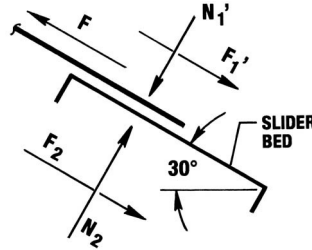
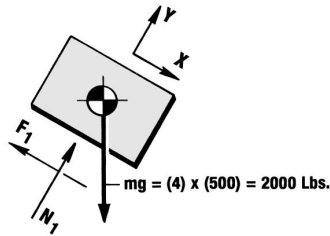
$$\text{Required Dynamic Clutch Torque} = T_{dc} = T_L + T_{ic}$$

$$T_{dc} = 584.38 + 551.63$$

$$T_{dc} = 1136.0 \text{ Lb. In.}$$

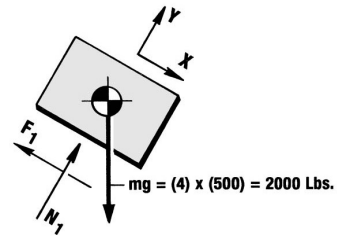
Solving for Static Equilibrium

Example - FBD #1 - Box	Example - FBD #2 - Slider Bed & Belt	Example - FBD #3 - Head Pulley
------------------------	--------------------------------------	--------------------------------



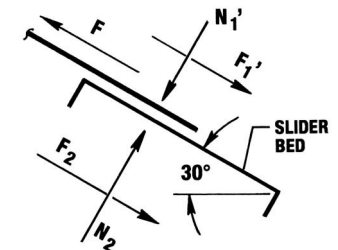
FBD #1 - Box

$$\begin{aligned} \Sigma F_x &= 0 \\ 0 &= W \times \sin 30^\circ - F_1 \\ \text{EQ. 11.1} \longrightarrow F_1 &= W \times \sin 30^\circ \text{ (Assuming no slippage between belt and boxes)} \\ \Sigma F_y &= 0 \\ 0 &= N_1 - W \times \cos 30^\circ \\ \text{EQ. 11.2} \longrightarrow N_1 &= W \times \cos 30^\circ \end{aligned}$$



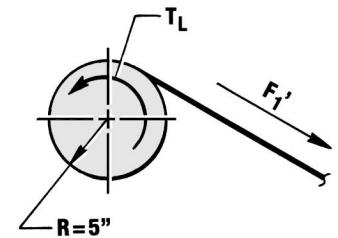
FBD #2 - Slider Bed & Belt

$$\begin{aligned} \text{EQ. 11.3} \longrightarrow \Sigma F_x &= 0 \\ F_1' + F_2 &= F \\ \Sigma F_y &= 0 \\ \text{EQ. 11.4} \longrightarrow N_1' &= N_2 \\ \text{EQ. 11.5} \longrightarrow F_2 &= N_2 \mu = N_1' \mu \\ \mu &= .2 \text{ (Between slider bed and belt)} \end{aligned}$$



FBD #3 - Head Pulley

$$\text{EQ. 11.6} \longrightarrow \Sigma M_o = T_L = F_1' \times (5'')$$



Substitute EQ. 11.1 into 11.3 - Substitute EQ. 11.2 into 11.5 - Substitute EQ. 11.5 into 11.3

$$\begin{aligned} \text{EQ. 11.7} \longrightarrow F &= W \times \sin 30^\circ + W \times \cos 30^\circ \mu \\ F_1 &= 2000 \times (.5) + 2000 \times (.866) \times (.2) = 1346.4 \text{ Lbs.} \end{aligned}$$

$$\text{Substitute 11.7 into 11.6} \quad T_L = 1346.4 \times (5) = 6732 \text{ Lb. In.}$$

*** NOTES:** T_{dc} is the torque required during acceleration.
 T_L is the torque required during constant velocity.
 N (Change in Speed) = $N_2 - N_1$
 Where N_2 = Final Speed
 N_1 = Initial Speed

16 Dynamic Torque (Brake)

11. Determine the Reflected Inertial Torque Requirements for each component and list them in Column 11. The sum of this column is the Total Reflected Inertial Braking Torque Requirement. The two conversion constants in the equations are (12 inches / foot) in the numerator and (307.2 foot revolution / minute second) in the denominator.

$$\begin{aligned} \text{Reflected Inertial Torque} &= T_i = \frac{WK^2 \text{ (col. 6)} \times N \text{ (speed change)} \times 12 \times \text{Eff. factor (col.5)}}{307.2 \times t \text{ (time)}} \\ \text{Boxes} &= T_i = \frac{(.87) \times (0 - 1800) \times 12 \times (.576)}{307.2 \times .13} = -271.04 \text{ Lb. In.} \\ \text{Conveyor Pulley} &= T_i = \frac{(.06) \times (0 - 1800) \times 12 \times (.72)}{307.2 \times .13} = -23.37 \text{ Lb. In.} \\ \text{Etc.....} & \end{aligned}$$

Dynamic Torque Analysis Table

1	2	3	4	5	6	7	8	CLUTCH		BRAKE	
								9	10	11	12
Component	Speed Ratio @ Input	Inertia WK ² (Lb. Ft. ²)	Component Efficiency	Accumulated Efficiency Factor %	Reflected Inertia WK ² (Lb. Ft. ²)	Load Torque (Lb. In.)	Reflected Load Torque T _L (Lb. In.)	Reflected Inertial Torque T _{ic} (Lb. In.)	Dynamic Torque T _{dc} (Lb. In.)	Reflected Inertial Torque T _{ib} (Lb. In.)	Dynamic Torque T _{db} (Lb. In.)
Posidyne	1	0.20	1.0	1.000	0.20			35.16		-108.17	
Coupling	1	0.78	1.0	1.000	0.78			137.11		-421.88	
10:1 Reducer	1	0.17	0.8	1.000	0.17			29.88		-91.95	
10" Dia. Sprocket	10	5.79	0.9	0.800	0.06			13.18		-25.96	
20" Dia. Sprocket	20	92.61	1.0	0.720	0.23			56.15		-89.57	
Conveyor Pulley	20	23.89	0.8	0.720	0.06			14.65		-23.37	
Boxes	20	347.20	1.0	0.576	0.87	6732.0	584.38	265.50		-271.04	
Summation					2.37	6732.0	584.38	551.63	1136.01	-1031.94	-447.56

12. The total of columns 8 and 11 equals the Dynamic Brake Torque Required. **NOTE:** If this value has the same sign as the Clutch Torque it indicates that the system will decelerate in less time than assumed.

$$T_{db} = T_L + T_{ib}$$

$$T_{db} = 584.38 - 1031.94$$

$$T_{db} = -447.56 \text{ Lb. In.}$$

Holding Torque (Brake)

Dynamic Brake Torque is the torque during deceleration and is not necessarily the Holding Torque (*i.e. torque required for static equilibrium after the system has come to rest*). First of all the inertial torque disappears after the system is stopped. Also the Reflected Load Torque is likely to change.

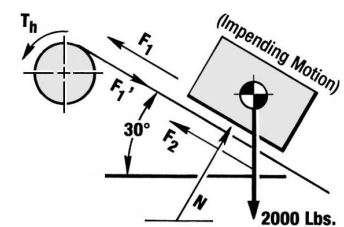
During deceleration the load torque is the same as for the acceleration phase. This is because friction always opposes the motion of the box. Once the box has stopped the friction force (F₂) acts in the other direction and therefore the Holding Torque will be different than the Load Torque. Compute the holding torque as shown below. The Holding Torque is not entered in the Dynamic Torque Analysis Table shown above.

FBD #4 (For Holding Torque)

$$F_1 = 2000 \times \sin 30^\circ - 2000 \times \cos 30^\circ \mu$$

$$F_1 = 653.6 \text{ Lbs.}$$

$$T_h = \frac{653.6 \times (5) \times .576}{20} = 94.1 \text{ Lb. In.}$$



Sign Convention: The following is an explanation for the **Sign Convention** used in the **Dynamic Torque Analysis Procedure** presented in this Engineering Section. The procedure is set up so that the Inertial and Load Torques are considered separately. The Load Torque in this procedure is found from solving for **Static Equilibrium**. Since this is the case the sign for the Load Torque does not change sign during the analysis. In order not to arbitrarily change the sign on the Load Torque to obtain the correct Dynamic Torque the following convention has been used:

1. The direction of Torque required to accelerate the mass of the system is always considered positive.
2. Next, a Static **Free Body Diagram (FBD)** is generated to determine the Load Torque. If this torque acts in the direction of the acceleration or inertial torque then it is considered to be positive. If not, then the Load Torque is negative.
3. The Sign of the Deceleration Inertial Torque is opposite the Sign for the Acceleration Torque.

Equation 1		
Dynamic Torque	=	Inertial Torque + Load Torque
T _d	=	T _i + T _L

During acceleration the **Clutch Inertial Torque** will be positive by definition. The **Load Torque** will generally be positive, especially if the load is predominately a friction or inertia load. It is possible for the **Load Torque** to be negative in some cases. This could happen if the weight of the load, or some other kind of stored energy like a compressed spring, is helping to accelerate the load. During acceleration the **Dynamic Torque** should be positive. If the **Clutch Dynamic Torque** is negative then it means that your load is capable of accelerating by itself faster than you are trying to accelerate it with the clutch.

During deceleration the **Brake Inertial Torque** will be negative by definition. The **Load Torque** will be the same as it was during acceleration unless something physically changed about the load during the process. The computed **Brake Dynamic Torque** should be negative. If the Brake Dynamic Torque turns out positive then it means that your load will stop by itself faster than the braking time you have used for the calculations.

Thermal Energy

The **Thermal Energy** required to be dissipated by the Clutch and Brake is the heat generated by the stack slipping during the engagement process. Heat transfer from the Clutch and Brake occurs by conduction through the drive plates and convection with the oil. The durability of the friction material is a function of the thermal load imposed on it. The wear rate of the material is low relatively independent of the heat generated up to a certain critical energy level, above which excessive wear will occur at a very rapid rate and limits the useful life of the drive.

The thermal load on the Clutch is different than the thermal load the Brake has to dissipate. The reason for this difference is that the Clutch is a mechanism which does work. (*i.e. the input torque acts through an angular displacement.*) The Brake on the other hand takes a torsional reaction but has no displacement. Therefore work is not done by the brake. **Thermal Energy** is also sometimes called **Kinetic Energy per Engagement**.

Clutch Kinetic Energy per Engagement

Thermal Energy = $(.436)T_{dc} \times \left[\frac{N \text{ (Speed Change)}}{100} \right] \times T \text{ (Time) Ft. Lbs.}$

$TE_C = (.436) \times (1136.01) \times \left[\frac{1800}{100} \right] \times .4 = \mathbf{3566 \text{ Ft. Lbs.}}$

Brake Kinetic Energy per Engagement

Thermal Energy = $(.436)T_{db} \times \left[\frac{N \text{ (Speed Change)}}{100} \right] \times T \text{ (Time) Ft. Lbs.}$

$TE_B = (.436) \times (-447.56) \times \left[\frac{-1800}{100} \right] \times .13 = \mathbf{457 \text{ Ft. Lbs.}}$

The units of the conversion factor are .436 (Ft.Min) / (In. Revolution Sec.)

Average Thermal Horsepower

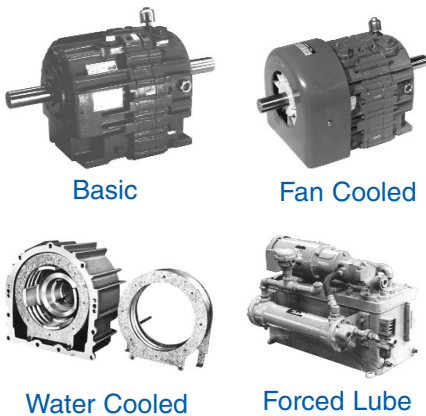
The objective of considering the **Average Thermal Horsepower** is to determine if the steady state power level is approaching the dissipation capacity of the unit. If the **Average Thermal Horsepower** exceeds the capacity for free convection, additional cooling such as a Fan or Water Cooling is required.

$$\text{Average Thermal HP} = \frac{(TE_C + TE_B) \times \text{CPM}}{33,000}$$

$$\text{THP} = \frac{(3566 + 457) \times 10}{33,000} = \mathbf{1.22 \text{ Thermal HP}}$$

Cooling Options

Force Control provides the designer with four different **Cooling Options** to select from for most sizes of the **Posidyne** product group. The **Posistop** group features the basic or conduction cooling method as standard. The **Positorq** group is usually equipped with **Forced Oil Lubrication** for cooling under constant slip conditions.



Posidyne Clutch/Brake Selection

Use the Tables on Page 2.10 to select a fan cooled 03 *Posidyne* clutch/brake with "A" logic. The required dynamic clutch torque determines the selection in this example. In many cases, thermal horsepower will be the determining factor.

The max. dynamic clutch torque of the "A" Logic 03 *Posidyne* is 2,413 Lb. In. at the max. clutch air pressure of 80 psi. The required conveyor dynamic clutch torque of 1,136 Lb. In. is obtained by reducing the clutch air pressure with a regulator.

The dynamic brake torque of the "A" Logic *Posidyne* is 509 Lb. In. which nearly matches the calculated conveyor dynamic brake torque of 448 Lb. In. The conveyor in this example stops quickly by itself because of the 30° incline and friction. In this case it is possible to reduce cost and complexity by using "A" or "B" logic clutch/brakes which have spring set brakes. The .13 sec. stopping time produced by the "A" logic *Posidyne* is acceptable. If the stopping time needs to be controllable, then either "S" or "SA" logic would have been selected.

The static brake torque of the clutch/brake (602 Lb.In.) needs to exceed the calculated holding torque of the conveyor (94.1Lb. In.), and it does.

The max. RPM of the *Posidyne* (1800 RPM for fan cooled) matches the motor speed in the example.

The max. kinetic energy per engagement of the *Posidyne* (21,494 Ft. Lbs.) needs to exceed the value calculated for the conveyor. For the example the clutch KE per engagement is 3,566 Ft. Lbs. and the brake KE per engagement is 457 Ft. Lbs.

The average thermal horsepower of the clutch/brake needs to exceed the value calculated for the conveyor. For the example the average thermal horsepower is 1.22 HP, so the 03 *Posidyne* can be mounted either horizontally (2.8 HP) or vertically (1.4 HP). Horizontal mounting will let the clutch/brake run cooler and provide a greater margin of safety for extra boxes on the conveyor, etc.

Technical Data

English-Metric Conversion Factors

Multiply the Base Unit by the Factor shown to obtain the desired Conversion.

Measurement	Base Unit	Factor	Conversion
Length	Inch (In.)	25.4	Millimeter (mm)
	Millimeter (mm)	.03937	Inch (In.)
Torque	Pound-Feet (Lb. Ft.)	1.355818	Newton-Meter (Nm)
	Newton-Meter (Nm)	.73756	Pound-Feet (Lb. Ft.)
	Ounce-Inch (Oz. In.)	.007062	Newton-Meter (Nm)
	Newton-Meter (Nm)	141.603	Ounce-Inch (Oz. In.)
Moment of Inertia	Pound-Feet Squared (Lb. Ft. ²)	.042	Kilogram-Meter Squared (kgm ²)
	Kilogram-Meter Squared (kgm ²)	23.81	Pound-Feet Squared (Lb. Ft. ²)
Energy	Foot-Pound (Ft. Lb.)	1.355818	Joule (J)
	Joule (J)	.73756	Foot-Pound (Ft. Lb.)
Force	Pound (Lb.)	4.448222	Newton
	Newton	.224808	Pound (Lb.)
Power	Horsepower (HP)	.7457	Kilowatt (kW)
	Kilowatt (kW)	1.341	Horsepower (HP)
Thermal Capacity	Horsepower-Seconds per Minute (hp-sec./min.)	12.42854	Watts (W)
	Watts (W)	.08046	Horsepower-Seconds per Minute (hp-sec./min.)
Temperature	Degrees Fahrenheit (°F)	(°F-32) x 5/9	Degrees Celsius (°C)
	Degrees Celsius (°C)	(°C x 9/5) + 32	Degrees Fahrenheit (°F)

Conversion Factors

Base Unit	Multiply by	To Obtain
Horsepower	60.0	hp-sec./min.
Ft.-Lb./Sec	.109	hp-sec./min.
Ft.-Lb./Min.	.0018	hp-sec./min.
In.-Lb./Sec.	.009	hp-sec./min.
In.-Lb./Min.	.00015	hp-sec./min.

Torque & Rotary Inertia Conversion Factors

TORQUE CONVERSION TABLE
(Multiply by entry in table to convert from A to B)

	B							
BASE UNIT	dyne-cm	gm-cm	oz-in	Kg-cm	lb-in	Newton-m	lb-ft	Kg-m
dyne-cm	1	1.01972 $\times 10^{-3}$	1.41612 $\times 10^{-5}$	1.01972 $\times 10^{-6}$	8.85073 $\times 10^{-7}$	10 ⁻⁷	7.37561 $\times 10^{-8}$	1.01972 $\times 10^{-8}$
gm-cm	980.665	1	1.38874 $\times 10^{-2}$	10 ⁻³	8.67960 $\times 10^{-4}$	9.80665 $\times 10^{-5}$	7.23300 $\times 10^{-5}$	10 ⁻⁵
oz-in	7.06157 $\times 10^4$	72.0079	1	7.20079 $\times 10^{-2}$	6.25 $\times 10^{-2}$	7.06157 $\times 10^{-3}$	5.20833 $\times 10^{-3}$	7.20079 $\times 10^{-4}$
Kg-cm	9.80665 $\times 10^5$	1000	13.8874	1	0.867960	9.80665 $\times 10^{-2}$	7.23300 $\times 10^{-2}$	10 ⁻²
lb-in	1.12985 $\times 10^6$	1.15213 $\times 10^3$	16	1.15213	1	0.112985	8.33333 $\times 10^{-2}$	1.15213 $\times 10^{-2}$
Newton-m	10 ⁷	1.01972 $\times 10^4$	141.612	10.1972	8.85073	1	0.737561	0.101972
lb-ft	1.35582 $\times 10^7$	1.38255 $\times 10^4$	192	13.8255	12	1.35582	1	0.138255
Kg-m	9.80665 $\times 10^7$	10 ⁵	1.38874 $\times 10^3$	100	86.7960	9.80665	7.23300	1

ROTARY INERTIA CONVERSION TABLE
(Multiply by entry in table to convert from A to B)

	B										
BASE UNIT	gm-cm²	oz-in²	gm-cm-sec²	Kg-cm²	lb-in²	oz-in-sec²	lb-ft²	Kg-cm-sec²	lb-in-sec²	lb-ft-sec² or slug-ft²	Kg-m²
gm-cm²	1	5.46745 $\times 10^{-3}$	1.01972 $\times 10^{-3}$	10 ⁻³	3.41716 $\times 10^{-4}$	1.41612 $\times 10^{-5}$	2.37303 $\times 10^{-6}$	1.01972 $\times 10^{-6}$	8.85073 $\times 10^{-7}$	7.37561 $\times 10^{-8}$	10 ⁻⁷
oz-in²	182.901	1	0.186507	0.182901	0.0625	2.59009 $\times 10^{-3}$	4.34028 $\times 10^{-4}$	1.86507 $\times 10^{-4}$	1.61880 $\times 10^{-4}$	1.34900 $\times 10^{-5}$	1.82901 $\times 10^{-5}$
gm-cm-sec²	980.665	5.36174	1	0.980665	0.335109	1.38874 $\times 10^{-2}$	2.32714 $\times 10^{-3}$	10 ⁻³	8.67960 $\times 10^{-4}$	7.23300 $\times 10^{-5}$	9.80665 $\times 10^{-5}$
Kg-cm²	1000	5.46745	1.01972	1	0.341716	1.41612 $\times 10^{-2}$	2.37303 $\times 10^{-3}$	1.01972 $\times 10^{-3}$	8.85073 $\times 10^{-4}$	7.37561 $\times 10^{-5}$	10 ⁻⁴
lb-in²	2.92641 $\times 10^3$	16	2.98411	2.92641	1	4.14414 $\times 10^{-2}$	6.94444 $\times 10^{-3}$	2.98411 $\times 10^{-3}$	2.59009 $\times 10^{-3}$	2.15840 $\times 10^{-4}$	2.92641 $\times 10^{-4}$
oz-in-sec²	7.06157 $\times 10^4$	386.088	72.0079	70.6155	24.1305	1	0.167573	7.20079 $\times 10^{-2}$	6.25 $\times 10^{-2}$	5.20833 $\times 10^{-3}$	7.06155 $\times 10^{-3}$
lb-ft²	4.21403 $\times 10^5$	2304	429.711	421.401	144	5.96756	1	0.429711	0.372972	3.10810 $\times 10^{-2}$	4.21401 $\times 10^{-2}$
Kg-cm-sec²	9.80665 $\times 10^5$	5.36174 $\times 10^3$	1000	980.665	335.109	13.8874	2.32714	1	0.867960	7.23300 $\times 10^{-2}$	9.80665 $\times 10^{-2}$
lb-in-sec²	1.12985 $\times 10^6$	6.17740 $\times 10^3$	1.15213 $\times 10^3$	1.12985 $\times 10^3$	386.088	16	2.68117	1.15213	1	8.33333 $\times 10^{-2}$	.112985
lb-ft-sec² or slug-ft²	1.35582 $\times 10^7$	7.41289 $\times 10^4$	1.38255 $\times 10^4$	1.35582 $\times 10^4$	4.63305 $\times 10^3$	192	32.1740	13.8255	12	1	1.35582
Kg-m²	10 ⁷	5.46748 $\times 10^4$	1.01972 $\times 10^4$	10 ⁴	3.41716 $\times 10^3$	141.612	23.7304	10.1972	8.85073	.737561	1

Useful Formulas

Torque

$$T = \text{Force} \times \text{Radius}$$

$$T \text{ (Lb. In.)} = \text{HP} \times \frac{63000}{N}$$

HP = Horsepower
N = Revolutions/Minute

$$T \text{ (Lb. Ft.)} = \text{HP} \times \frac{5250}{N}$$

HP = Horsepower
N = Revolutions/Minute

Dynamic Torque (Lb. Ins.)

$$\text{Clutch} = \left[\frac{WK^2 \times N \times 12}{307.2 \text{ ta}} + T_L \right] \times \frac{1}{E}$$

$$\text{Brake} = \left[\frac{WK^2 \times N \times 12}{307.2 \text{ td}} \right] \times E + \frac{T_L}{E}$$

WK² = Inertia (Lb. Ft.²)
N = Change in RPM
ta = Accel. Time (Sec.)
td = Decel. Time (Sec.)
T_L = Load Torque (Lb. In.)
E = Efficiency

Conversion Factor = 307.2 $\left(\frac{\text{Ft Rev.}}{\text{Min. Sec}} \right)$

Power

$$\text{HP} = \frac{T \times N}{63,000}$$

$$\text{HP} = \frac{T \times N}{5250}$$

T = Torque (Lb. In.)
N = Revolutions/Minute
HP = Horsepower

T = Torque (Lb. Ft.)
N = Revolutions/Minute
HP = Horsepower

Thermal Energy/Engagement

$$\text{Clutch: } TE_c \text{ (Ft. Lbs.)} = (.43633) \times T_{dc} \times \left(\frac{\Delta N}{100} \right) \times t$$

$$\text{Brake: } TE_b \text{ (Ft. Lbs.)} = (.43633) \times T_{db} \times \left(\frac{\Delta N}{100} \right) \times t$$

ΔN = Speed Change (RPM)
T_{dc} = Dynamic Clutch Torque (Lb. In.)
T_{db} = Dynamic Brake Torque (Lb. In.)
t = Time (Seconds)
Conversion Constant = .43633 $\left(\frac{\text{Ft Min.}}{\text{In. Rev. Sec.}} \right)$

Average Thermal Horsepower

$$\text{THP} = \frac{[TE_c + TE_b] \times \text{CPM}}{33,000}$$

TE_c = Thermal Energy (Clutch)
TE_b = Thermal Energy (Brake)
CPM = Cycles/Minute

Horsepower Sec./Min.

$$\text{HP Sec./Min.} = \frac{TE_b \times \text{CPM}}{550}$$

TE_b = Thermal Energy (Brake)
CPM = Cycles/Minute

Useful Formulas (Continued)

WK² (Inertia)

Concentrated Weight $WK^2 = WR^2$

W = Weight (Lbs.)
R = Radius (Inches)

Translating Weight $WK^2 = WR^2$

Uniform Disc $WK^2 = \left[\frac{\pi D^2}{4} \times L \times \text{Lb./In.}^3 \right] \times \frac{R^2}{2}$

D = Diameter (Inches)
L = Length (Inches)
R = Radius (Inches)

Hollow Cylinder $WK^2 = \left[\pi \frac{(D_o^2 - D_i^2)}{4} \times L \times \text{Lb./In.}^3 \right] \times \frac{R_o^2 + R_i^2}{2}$

D_o = Outside Diameter (Inches)
D_i = Inside Diameter (Inches)
R_o = Outside Radius (Inches)
R_i = Inside Radius (Inches)
L = Length (Inches)

Reflected $WK^2 = WK^2 \times \left(\frac{1}{\text{Ratio}} \right)^2$

WK² = Inertia

Weight of Cylinder = $\frac{\pi D^2}{4} \times L \times \text{Lb./In.}^3$

D = Diameter (Inches)
L = Length (Inches)

Specific Weight Lb./Ft³

Steel	487
Cast iron	442
Aluminum.....	169
Bronze	546

Specific Weight Lb./In.³

Steel .....	.282
Cast iron .....	.256
Aluminum.....	.098
Bronze .....	.316

Inertia Table (WK² of Steel Shafting and Discs)

To determine the **WK²** of a given shaft or disc multiply the **WK²** given below, by the length of the shaft or thickness of disc, in inches. To determine inertia of solids of greater diameter than shown below multiply the tenth of the diameter by 10⁴ or move the decimal point 4 places to the right and multiply the length as above. For hollow shafts, subtract **WK²** of the inside diameter from the **WK²** of the outside diameter and again multiply by the length.

Per Inch of Length or Thickness

Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)	Dia. (Ins.)	WK ² (Lb.Ft. ²)
0.75	0.00006	4.75	0.098	8.75	1.13	12.75	5.08	25.00	75.06	41.00	542.9	69.00	4355.3
1.00	0.0002	5.00	0.120	9.00	1.26	13.00	5.49	26.00	87.80	42.00	597.9	72.00	5163.6
1.25	0.0005	5.25	0.146	9.25	1.41	13.25	5.92	27.00	102.11	43.00	656.9	75.00	6079.5
1.50	0.001	5.50	0.176	9.50	1.57	13.50	6.38	28.00	118.10	44.00	720.2	78.00	7112.2
1.75	0.002	5.75	0.210	9.75	1.74	13.75	6.87	29.00	135.90	45.00	787.9	81.00	8271.1
2.00	0.003	6.00	0.249	10.00	1.92	14.00	7.38	30.00	155.64	46.00	860.3	84.00	9566.2
2.25	0.005	6.25	0.293	10.25	2.12	15.00	9.73	31.00	177.45	47.00	937.6	87.00	11007.8
2.50	0.008	6.50	0.343	10.50	2.34	16.00	12.59	32.00	201.48	48.00	1020.0	90.00	12606.5
2.75	0.011	6.75	0.399	10.75	2.57	17.00	16.05	33.00	227.87	49.00	1107.7	93.00	14373.2
3.00	0.016	7.00	0.461	11.00	2.81	18.00	20.17	34.00	256.77	50.00	1200.9	96.00	16319.5
3.25	0.021	7.25	0.531	11.25	3.08	19.00	25.04	35.00	288.33	51.00	1299.9	99.00	18457.1
3.50	0.029	7.50	0.608	11.50	3.36	20.00	30.74	36.00	322.73	54.00	1633.8	102.00	20798.1
3.75	0.038	7.75	0.693	11.75	3.66	21.00	37.37	37.00	360.11	57.00	2028.3	105.00	23355.0
4.00	0.049	8.00	0.787	12.00	3.98	22.00	45.01	38.00	400.64	60.00	2490.2	108.00	26140.7
4.25	0.063	8.25	0.890	12.25	4.33	23.00	53.77	39.00	444.51	63.00	3026.8	111.00	29168.5
4.50	0.079	8.50	1.00	12.50	4.69	24.00	63.75	40.00	491.88	66.00	3645.8	114.00	32452.0

WK² is given in Lb.Ft.². Multiply by 144 to get Lb. In.². Moving the decimal point one place in diameter shifts the decimal point in **WK²** value 4 places in the same direction. Table is based on steel at 487 Lbs. per Cu.Ft. For materials other than steel, divide **WK²** in table 487, and multiply by: Magnesium-109; Aluminum-169; Cast Iron-442; Brass-527; Bronze-546; Copper-555.

Motor Formulas

3 Phase	1 Phase	Direct Current	
$\text{Amps} = \frac{\text{HP} \times 746}{1.73 \times \text{V} \times \text{Eff} \times \text{pf}}$	$\frac{\text{HP} \times 746}{\text{V} \times \text{Eff} \times \text{pf}}$	$\frac{\text{HP} \times 746}{\text{V} \times \text{Eff}}$	HP = Horsepower V = Volts Eff = Efficiency pf = Power Factor A = Amps
$\text{HP} = \frac{1.73 \times \text{A} \times \text{V} \times \text{Eff} \times \text{pf}}{746}$	$\frac{\text{A} \times \text{V} \times \text{Eff} \times \text{pf}}{746}$	$\frac{\text{A} \times \text{V} \times \text{Eff}}{746}$	

The Power Factor will be 80% and the Efficiency 80-90% for most motors.

Motor Information

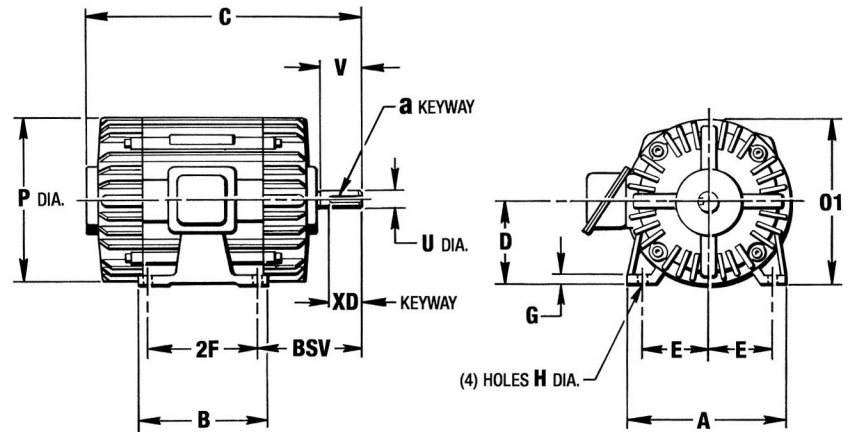
Approximate Full Load Amps				
HP	Three Phase 230 Volts	Three Phase 460 Volts	Single Phase 230 Volts	Direct Current 240 Volts
1/2	2	1	4.9	2.7
1	3.3	1.8	8	4.8
1-1/2	4.8	2.6	10	6.6
2	6.2	3.4	12	8.5
3	8.6	4.8	17	12.5
5	14.4	7.6	28	20
7-1/2	21	11	40	29
10	26	14	50	38
15	38	21	---	56
20	50	27	---	74
25	60	34	---	92
30	75	40	---	110
40	100	52	---	146
50	120	65	---	180
60	150	77	---	215
75	180	96	---	268
100	240	124	---	355
125	300	156	---	433
150	360	180	---	534
200	480	240	---	712

U-Frame			T-Frame		
HP	RPM	Frame Size	HP	RPM	Frame Size
1	1800	182	1	1800	143T
1	1200	184	1	1200	145T
1.5	1800	184	1.5	1800	145T
1.5	1200	184	1.5	1200	182T
2	1800	184	2	1800	145T
2	1200	213	2	1200	184T
3	1800	213	3	1800	182T
3	1200	215	3	1200	213T
5	1800	215	5	1800	184T
5	1200	254U	5	1200	215T
7.5	1800	254U	7.5	1800	213T
7.5	1200	256U	7.5	1200	254T
10	1800	256U	10	1800	215T
10	1200	284U	10	1200	256T
15	1800	284U	15	1800	254T
15	1200	324U	15	1200	284T
20	1800	286U	20	1800	256T
20	1200	326U	20	1200	286T
25	1800	324U	25	1800	284T
25	1200	364U	25	1200	324T
30	1800	326U	30	1800	286T
30	1200	365U	30	1200	326T
40	1800	364U	40	1800	324T
40	1200	404U	40	1200	364T
50	1800	365U	50	1800	326T
50	1200	405U	50	1200	365T

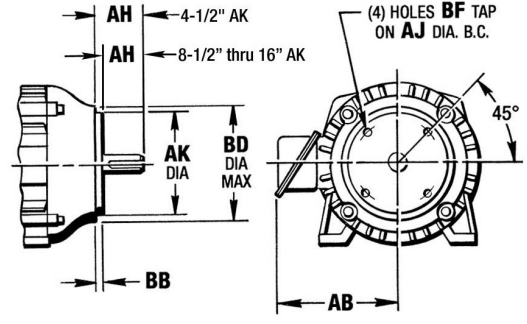
To determine Amps @ other voltages

$$V = \frac{\text{Volts} \times \text{Table}}{X} \quad (X = \text{Required Voltage})$$

Motor Dimensions



C-Face Dimensions



Frame Size	Overall Dimensions					Foot Mounting Dimensions							Shaft Extension Dim's.				C-Face Dimensions						Weight Lbs.
	AB	BSV	C	O1 Max	P	A Max	B Max	D **	E	2F	G	H	a	U	V Min.	XD	AH	AJ	AK	BB	BD Max.	BF	
56	4.91	4.63	12.50	7.50	7.44	6.50	4.00	3.50	2.44	3.00	.16	.34*	3/16 x 3/32	5/8	1.94	1.38	2.06	5.88	4.50	.16	6.50	3/8-16	25
143T	6.69	4.50	12.69	7.50	7.69	7.00	6.00	3.50	2.75	4.00	.38	.34	3/16 x 3/32	7/8	2.00	1.38	2.13	5.88	4.50	.16	6.50	3/8-16	65
145T										5.00													70
182	8.28	5.00	14.09	9.38	9.00	9.00	6.50	4.50	3.75	4.50	.44	.41	3/16 x 3/32	7/8	2.00	1.38	2.13	5.88	4.50	.16	6.50	3/8-16	70
184			15.00							70													
182T	7.63	5.50	15.19	9.63	9.00	9.00	6.50	4.50	3.75	4.50	.44	.41	1/4 x 1/8	1-1/8	2.50	1.75	2.63	7.25	8.50	.25	8.88	1/2-13	100
184T			16.19							110													
213	9.22	6.50	18.44	10.94	10.50	10.50	7.50	5.25	4.25	5.50	.50	.41	1/4 x 1/8	1-1/8	2.75	2.00	2.75	7.25	8.50	.25	9.00	1/2-13	135
215			19.94							140													
213T	8.94	6.88	18.56	11.00	10.50	10.50	7.50	5.25	4.25	5.50	.50	.41	5/16 x 5/32	1-3/8	3.13	2.38	3.13	7.25	8.50	.25	9.00	1/2-13	160
215T			20.06							175													
254U	11.25	8.00	23.50	12.90	12.62	12.50	10.75	6.25	5.00	8.25	.69	.53	5/16 x 5/32	1-3/8	3.50	2.75	3.50	7.25	8.50	.25	9.00	1/2-13	240
256U			25.25							265													
254T	11.38	8.25	23.25	13.00	12.62	12.50	10.75	6.25	5.00	8.25	.69	.53	3/8 x 3/16	1-5/8	3.75	2.38	3.75	7.25	8.50	.25	9.00	1/2-13	300
256T			25.00							340													
284U	11.84	9.62	26.88	14.00	14.00	14.00	12.50	7.00	5.50	9.50	.75	.53	3/8 x 3/16	1-5/8	4.63	3.75	4.63	9.00	10.50	.25	10.81	1/2-13	317
286U			27.88							372													
284T	12.06	9.38	26.13	14.25	14.00	14.00	12.50	7.00	5.50	9.50	.75	.53	1/2 x 1/4	1-7/8	4.38	3.25	4.38	9.00	10.50	.25	10.81	1/2-13	380
286T			27.69							410													
324U	14.31	10.88	30.06	16.19	16.00	16.00	14.00	8.00	6.25	10.50	.88	.66	1/2 x 1/4	1-7/8	5.38	4.25	5.38	11.00	12.50	.25	12.81	5/8-11	470
326U			31.56							530													
324T	14.25	10.50	29.69	16.38	16.00	16.00	14.00	8.00	6.25	10.50	.88	.66	1/2 x 1/4	2-1/8	5.00	3.88	5.00	11.00	12.50	.25	12.81	5/8-11	600
326T			31.19							625													
364U	16.44	12.25	32.63	18.09	18.00	18.00	15.25	9.00	7.00	11.25	1.00	.66	1/2 x 1/4	2-1/8	6.13	5.00	6.13	11.00	12.50	.25	13.94	5/8-11	745
365U			33.63							815													

Above Dimensions are given in Inches and are for reference only and will vary by manufacturer.

* - The mounting holes on the 56 Frame Motors are .34" slots.

** - Dimension "D" will never be greater than the above values, but it may be less so that shims are usually required for coupled or geared machines. When the exact dimension is required, shims up to 1/32" may be necessary on frame sizes where "D" dimension is 8" and less, and on larger frames shims up to 1/16" may be necessary.

Unit Weights

Posidyne Clutch/Brakes

Size	Basic Weight (Lbs.)	Add Lbs. For Options					
		Fan Cooled	Water Cooled	C-Face Input	C-Face Output	Manifold Mntd. Valve	Optical Encoder
X1	42	----	----	----	----	1	2
X2	42	----	----	----	----	1	2
X3	57	----	----	----	----	1	2
1.5	32	3	----	----	----	4	2
02	84	4	22	6	5	4	2
2.5	140	5	3	8	6	4	2
03	150	8	3	10	8	4	2
05	208	10	4	----	----	4	2
10	359	15	7	----	----	4	3
11	393	Std.	----	----	----	6	3
14	412	Std.	----	----	----	6	3
20	858	26	13	----	----	6	3
30	2156	----	----	----	----	12	3

Posistop Motor Brakes

Size	XB1	XB2	XB3	XB5	XB6	MB-056	MB-180	MB-210	MB-250	MB-280	MB-320	MB-440
Weight (Lbs.)	31	31	45	140	150	15	40	45	100	108	160	390

Posistop Coupler Brakes

Size	XB1	XB2	XB3	XB5	XB6	056	210	250	280	320
Weight (Lbs.)	31	31	45	140	150	15	45	100	108	160

MagnaShear Motor Brakes

Brake Size	MSB2	MSB4	MSB6	MSB8	MSB9	MSB10	MSB12
Weight (Lbs.)	21	50	65	141	250	270	600

Unit Weights (Continued)

Assembled Brake Motor (ABM)

Brake Size	Motor Frame	Weight (Lbs.)	Brake Size	Motor Frame	Weight (Lbs.)
MB-056	56	35	MB-250	213T	243
	143T	55		215T	258
	145T	60		254T	360
	182T	94		254U	340
	182U	85		256U	365
	184U	85		MB-280	254T	368
MB-180	143T	80	256T		413
	145T	85	284U		425
	182T	119	286U		480
	182U	110	MB-320	284T	520
	184U	110		286T	546
MB-210	182T	124		324T	632
	184T	138		326T	686
	213T	180		324U	630
	213U	188		326U	690
	215U	203		364U	905
MB-210L	213T	188	365U	975	
	215T	203			
	254T	305			
	254U	285			
	256U	310			

Electronic Controls

CONTROL	WEIGHT (Lbs.)
CLPC-LC	3.5

Foot Mounted Posistop Brakes

Size	03		05		10		11		14		20	
Type	S	T	S	T	S	T	S	T	S	T	S	T
Weight (Lbs.)	125	132	174	183	305	321	349	367	CF	CF	767	808

S - denotes a Single Unit. T - denotes a Tandem Unit.

E-Stop Brakes

BRAKE	WEIGHT (Lbs.)
ES-C	110
ES-D	128
ES-S	134
ES-L	160
ES-T	460
ES-M	500
ES-X	CF

CF = Consult Factory

Foot Mounted Positorq Absorber Brakes

Size	TB-03		TB-05		TB-10		TB-11		TB-14		TB-20	
Type	S	T	S	T	S	T	S	T	S	T	S	T
Weight (Lbs.)	125	132	174	183	305	321	349	367	CF	CF	767	808

S - denotes a Single Unit. T - denotes a Tandem Unit.

Designer's Toolbox

For over 30 years, Force Control Industries has been helping customers redesign their machinery to be more reliable, more accurate, faster and last longer. The Designer's Toolbox was developed to let you reap the benefits of our engineering efforts. We have over 100 Industry Application Notes documenting modifications to specific machinery and the benefits achieved. Visit our website at www.forcecontrol.com to see all the application bulletins.

Need Help with your application? Our Application Engineering group is ready to assist you. Our ability can be best illustrated by the wealth of applications and the loyal customers that continually comeback with more problems and applications for use to solve.

Oil Industry

APPLICATION BULLETIN

APPLICATION: Drawworks Auxiliary Brake

INDUSTRY: Oil and Gas Exploration

PRODUCT: Positorq Absorber Brake

DRAWWORKS AUXILIARY BRAKE

AB-09-01 - 3/5/2005

AB-09-01 - 3/5/2005

DRAWWORKS AUXILIARY BRAKE

WHERE THEY ARE USED: A Drawworks is used on all offshore drilling rigs and many land-based drilling rigs. The Drawworks is an integral part of the hoisting system, which raises and lowers the drill string, top drive and swivel.

HOW THEY WORK: The hoisting system consists of the Drawworks, crown block, traveling block, wire rope (drilling line) and derrick. The Drawworks consists of a revolving drum around which the drilling line is spooled and unspooled - raising or lowering the hoist. When heavy loads are raised or lowered, the Drawworks brakes absorb the momentum created. The Drawworks has two different brakes - the main brake, typically band brakes or disc-brakes, and the auxiliary brake, typically eddy-current or water brakes, used primarily during tripping operations. The main brake engages directing on the rim of the drum to stop the drum from hoisting or letting the drilling line out when making up or breaking out drill pipe and to control the Weight on Bit (WOB) while drilling. The auxiliary brake is used during tripping operations to control the decent speed of the drill string and to absorb the energy associated with the free fall of the drill string.

PROBLEM SOLVED: The primary brake has a tendency to grab and create a modulation thru intermitting starting and stopping of the brake. This modulation migrates down the drill string and causes a condition at the bit, called "Bit Bounce" resulting in premature wear on the drill bit. The auxiliary brakes are applied to try to correct or smooth this modulation with little success; they can't respond quick enough to changing conditions and provide little or no braking capability below 50 RPM - limiting the capability and performance of the Drawworks and control systems like an Autodriller systems.

The Force Control **Positorq** brake is hydraulic set for smooth continuous braking at all speeds and has the capability of full rated load at ZERO "0" RPM. The oil inside the brake shears to transmit torque while at the same time removing heat from the brake. The oil also lubricates all moving parts to prevent wear and corrosion.

IMPORTANT FEATURES:

The Positorq brake will improve rig performance and drilling capability.

- Adaptable to existing Drawworks 500 thru 5000 HP
- No battery or switch gear - freeing up space and eliminating maintenance
- Smooth continuous braking at full range of speeds extends bit life by eliminating "bit bounce" and improve the overall rate of penetration
- Full braking capability down to 0 RPM
- Net loss of over 20,000 lbs. enabling greater set back weight capabilities
- A great companion to an Autodriller system to achieve its full capability

FORCE CONTROL INDUSTRIES, INC.

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Mining Industry

APPLICATION BULLETIN

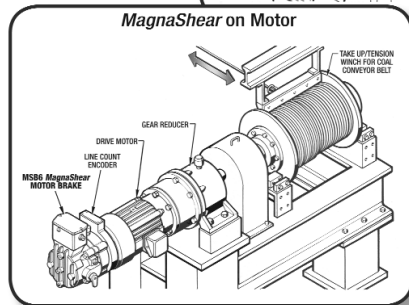
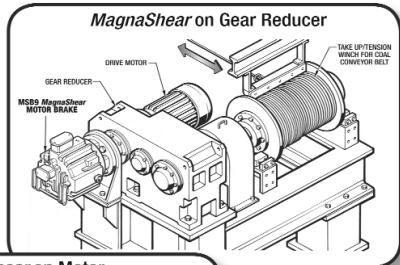


APPLICATION: Conveyor Constant Tension Winch

INDUSTRY: Mining, Tunneling

PRODUCT: MagnaShear Motor Brake

Conveyor Constant Tension Winch



AB-10-02 - 1/24/2006

AB-10-02 - 1/24/2006

CONVEYOR CONSTANT TENSION WINCH

WHERE THEY ARE USED: The Conveyor Constant Tension Winch is used extensively around the world in underground mines, underground tunnelling, and overland belt conveyors. The belt conveyors can be up to several thousand feet long and transport bulk material like coal, ore and soda.

HOW THEY WORK: The Conveyor Constant Tension Winch is used to tension the belt during startup, continuous operation, and stopping by moving an idler pulley on the slack side of the belt. The winch drive motor is controlled by an AC flux vector drive to maintain the proper belt tension. The MagnaShear Brake is released during normal operation, but is engaged when the conveyor is stopped and during the critical event of an emergency stop.

PROBLEMS SOLVED: Dry friction brakes are effected by the dust, dirt, water, oil, and other substances inherent to the underground and outdoor environments making them very susceptible to failure. The large coil of a dry friction brake is slow to respond. During an emergency stop these problems can cause the winch to go into a dangerous overspeed condition which can damage the winch, brake friction pads, and idler carriage. If this happens the idler no longer provides tension to the conveyor belt and the conveyor drive or backstop can't stop the load which then is dumped at the end of the conveyor.

The Force Control MagnaShear Brake provides smooth, reliable and quick braking under all conditions to stop the winch without losing tension in the conveyor belt during an emergency stop.

IMPORTANT FEATURES:

- Totally enclosed and sealed from outside contaminants.
- Quick response to keep winch from running away.
- Superior heat dissipation and long life friction material.
- Smooth "cushioned" stop for reduced shock to the drive system.
- Oil Shear design to provide maximum service life, with little maintenance and no adjustments.



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Packaging Industry

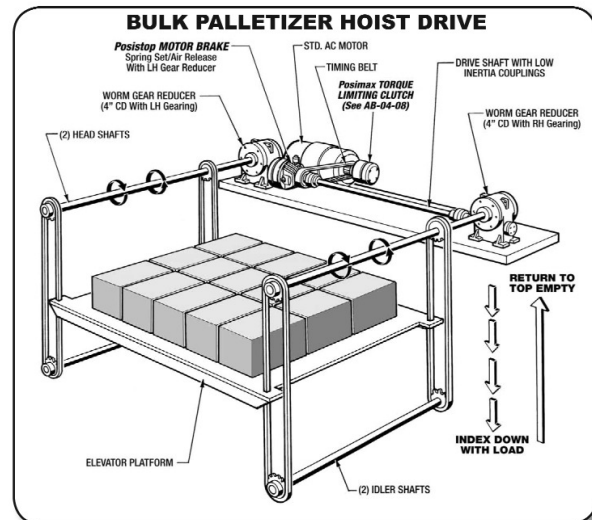
APPLICATION BULLETIN



APPLICATION: Bulk Palletizer Hoist Drive

INDUSTRY: Food, Beverage, Medical, Container and other Bulk Produced Products & Materials Palletized for Shipment

PRODUCT: Posistop Drive System - Includes Posistop Motor Brake & (2) Hollow Shaft Worm Gear Reducers plus Posimax Torque Limiting Clutch (See AB-04-08)



AB-04-07 - 2/24/2005

AB-04-07 - 2/24/2005

BULK PALLETIZER HOIST DRIVE

WHERE THEY ARE USED: Bulk material handling palletizers are used in manufacturing plants which produce soft drinks, beer, cereal, pet foods, bleach, detergent, motor oil, juice, candy, medical supplies, sugar, and other products shipped on pallets. De-palletizers are used to feed or break down the layers of palletized material. Glass, metal, or plastic containers are usually fed into a filling line or process.

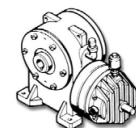
HOW THEY WORK: Material, usually packed in cases, is positioned in layers on retractable slide plates just above an empty pallet on the raised hoist platform. The slide plates retract and the product drops approximately one inch onto the pallet. The hoist drive indexes down a distance equal to the height of the product, and the slide plates close. The process is repeated until a full height of layers is obtained. The full pallet is removed by other automation. An empty pallet is placed on the full pallet. The hoist drive raises the empty pallet and platform to the top position to start forming another full pallet.

PROBLEMS SOLVED: The Posistop Drive System combines Force Control's Oil Shear technology with a careful balance of high shock capacity worm gear geometry to produce a remarkably smooth and accurate hoist positioning drive.

1. The effect of increased stopping distance with each increase in product weight per additional layer is virtually eliminated by the improved thermal capacity & dynamic torque characteristics of the Posistop Oil Shear Brake.
2. Lipping of shallow-tray products is no longer a common problem.
3. Over-stress of lift chains due to high shock engagements of dry friction brakes is eliminated by the cushioned engagements of the Posistop Oil Shear Brake.
4. Placement of the drive motor eliminates excessive loading of the high speed drive shaft between the gear reducers.
5. Worm gear sets are cut with a carefully selected helix angle to balance load back driving forces with locking angle effects. This prevents harsh stops while permitting the oil shear brake to provide a controlled and repeatable stop for each product layer.
6. Direct mechanical connection of the spring set brake to the worm reducer input shaft minimizes dependence on other power transmission components to hold the hoist load.
7. The Posimax Torque Limiting Clutch provides jam protection for the motor, drive, and lift system. See Application Bulletin AB-04-08 for details.

IMPORTANT FEATURES:

- Multiple-disc, spring-set, Oil Shear Motor Brake for long service life.
- Advanced friction material and Oil Shear design provide consistent, reliable stops.
- Worm gear geometry combined with Oil Shear Brake provides smooth, controlled, & accurate positioning at each layer stop.
- Rugged and heavy construction for long service life.



FORCE CONTROL INDUSTRIES, INC.

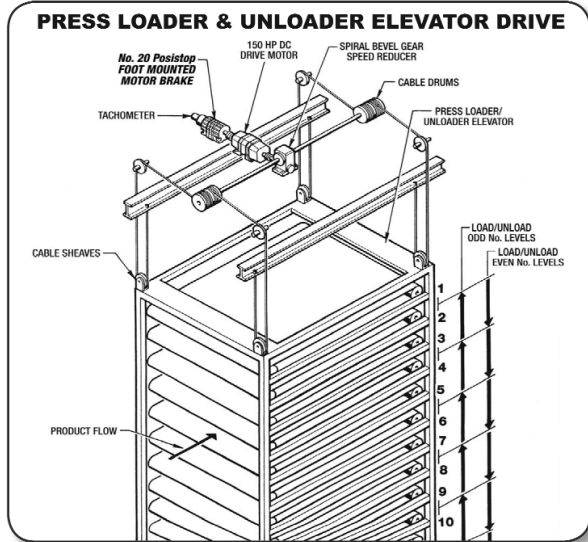
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OSB Industry

APPLICATION BULLETIN



APPLICATION: Press Loader & Unloader Elevator Drive
INDUSTRY: (OSB) Oriented Strand Board Plants
PRODUCT: Oil Shear *Posistop* Motor Brake with Tachometer



AB-02C-06 - 2/1/2005

AB-02C-06 - 2/1/2005

PRESS LOADER & UNLOADER ELEVATOR DRIVE

WHERE THEY ARE USED: The *Press Loader Lug Chain Conveyor* and the *Press Lug Chain Drive* are located in the Press area of the OSB plants. The Press Loader Lug Chain Conveyor is the first conveyor of the Press section, followed by the Press Lug Chain Drive.

HOW THEY WORK: The conveyors are driven by a DC motor with a brake and tachometer connected to auxiliary end of the motor.

Press Loader Lug Chain Conveyor: Is used to load the screens onto the Press Loader. Each time a screen exits the Pre-Load conveyor onto the Press Loader, the Press Loader Lug Chain Conveyor pulls the screen into the Loader. Then the Loader indexes to the next level to accept the next screen. There is one Press Loader Lug Chain Drive on either side of the Press Loader. One is for the "even" levels, and one is for the "odd" levels. Since the drives are mounted to the foundation, and the loader moves up and down, the drive is not directly attached to the Loader. They transfer the torque via a crank type mechanism that is engaged each time the Loader is Indexed up or down.

Press Lug Chain Drive: Is used to Load the screens into the press. This only takes place after all levels of the loader are full. When the press opens up, the Press Lug Chain Drive pulls all of the screens into the press and at the same time the Un-loader Boom pulls out all the pressed boards from the press.

PROBLEMS SOLVED: The main problem with the dry friction brakes is they mechanically fail frequently. The atmosphere around the forming line and throughout the plant is damp. The repetitive cycling of the brakes causes frequent failures. The brake and tachometer combination makes repair of the brakes difficult.

The Force Control *Posistop* Motor Brake puts an end to the monthly maintenance of the motor brakes. The *Posistop* Brakes are drop in replacement for many of the dry friction brakes that are typically used throughout the industry. The totally enclosed oil shear design of the *Posistop* Brake provides a totally enclosed brake that is immune to the damp atmosphere and there are no flimsy mechanical linkages to fail due to repetitive use.

The end result is a brake that will easily install to replace the typical dry friction electric brake to provide a very reliable, long life, brake with no maintenance other than an annual oil change.

IMPORTANT FEATURES:

- Oil Shear Technology gives the *Posistop* motor brake extremely long life, as well as consistent stopping.
- The totally enclosed design provides a brake that is not effected by harsh environments.
- Special model brakes provide drop in replacements for several of the commonly used dry friction brakes. See model FB-20-709.



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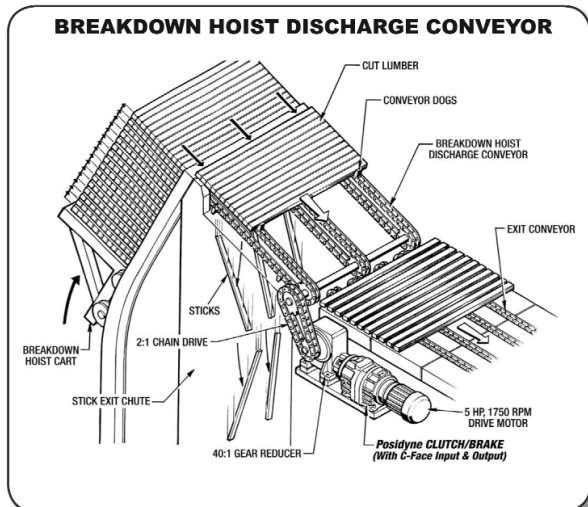
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Dimensional Lumber Industry

APPLICATION BULLETIN



APPLICATION: Breakdown Hoist Discharge Conveyor
INDUSTRY: Dimension Lumber Mills
PRODUCT: Oil Shear *Posidyne* Clutch/Brake



AB-02A-05 - 1/26/2005

AB-02A-05 - 1/26/2005

BREAKDOWN HOIST DISCHARGE CONVEYOR

WHERE THEY ARE USED: The Breakdown Hoist Discharge Conveyor is found in dimensional lumber sawmills. It is used as an integral part of the breakdown hoist to unstack lumber a layer at a time either to be sorted or to be fed into the planer infeed system.

HOW THEY WORK: The breakdown hoist indexes up until the top layer of lumber begins to slide off on to the discharge conveyor. In this fully automated arrangement, the discharge conveyor catches and controls the action of the sliding lumber to maintain a smooth orderly descent to the take away conveyors.

Unwanted piling and jamb-ups are virtually eliminated. The sticks that separate the lumber layers automatically fall to the stick exit chute below.

PROBLEMS SOLVED:

Longevity

The breakdown hoist discharge conveyor is in-line and therefore a critical part of keeping the mill running. This chain and dog style conveyor starts and stops with each new layer of lumber to be processed.

Employing a standard motor that is allowed to run constantly and a *Posidyne* Clutch/Brake to provide a smooth controlled drive engagement is a key strategy to ensure long maintenance free life in all high cycle drive components. The *Posidyne* Clutch/Brake's totally enclosed housing and patented oil cooling techniques ensure reliable service in hot, dirty, wet and generally hostile environments.

Consistent Accuracy

Consistent timing is essential and must be maintained. Catching the lumber in a timed, orderly fashion, ensures less piling or jamb-ups. The *Posidyne* exhibits negligible torque changes throughout its life, or during cold start to hot run phase shift. The result of this is consistently accurate stops and starts with no adjustments required.

IMPORTANT FEATURES:

- Totally enclosed, oil cooled unit for long service life with low maintenance in the harshest environments.
- Oil Shear technology and innovative friction material provide smooth controlled torque for quick, smooth acceleration.
- Consistently accurate starts and stops with no adjustment required.
- Continuously running standard motor for long service life and lower energy consumption.



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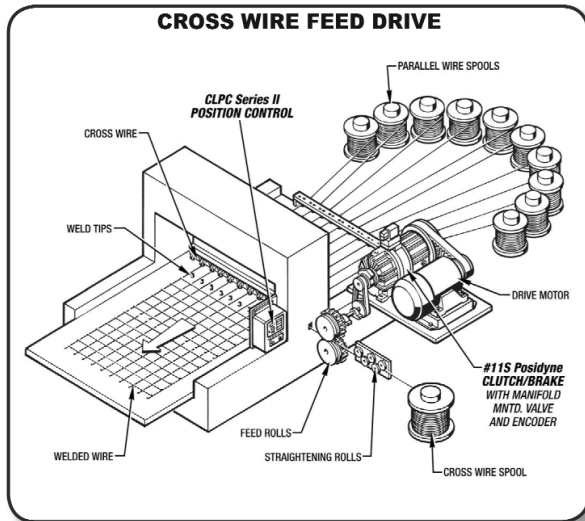
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Metal Processing Industry

APPLICATION BULLETIN



APPLICATION: Cross Wire Feed Drive
INDUSTRY: Wire Weaving and Forming
PRODUCT: Posidyne Clutch/Brake With CLPC II Control



AB-01-08 - 3/7/2005

AB-01-08 - 3/7/2005

CROSS WIRE FEED DRIVE

WHERE THEY ARE USED: A Cross Wire Feed Drive is used on wire weaving machines to shoot a wire across a number of parallel wires to be welded or woven.

HOW THEY WORK: A set of pinch rolls is used to index the wire strand across the incoming parallel wires. The rolls must index the wire the exact distance and stop. A Posidyne Clutch/Brake is used to accelerate the pinch rolls to full speed, and decelerate to a position stop. The CLPC Series II Closed Loop Positioning Control, by reading the encoder on the Posidyne Clutch/Brake, is used to set the length and position the stop consistently. The index length is easily set by setting the number of counts respective to the length on the front panel.

PROBLEMS SOLVED: A normal system uses an adjustable crank assembly pushing a rack, which turns a pinion, in turn rotating the pinch rolls. As the rack will oscillate forward and back two methods of release are used. One, the pinch rolls are set on a pneumatic or hydraulic lift, which separates the rolls from the wire on the reverse stroke. The other uses a single revolution cam clutch to overrun on the reverse stroke. The index length is adjusted by changing the length of the crank arm.

This is a very inefficient system in addition to having many mechanical parts, which wear, becoming loose causing length errors etc. Also mechanical changes must be changed to adjust the width of product.

The drive using the Posidyne Clutch/Brake and the CLPC Series II Closed Loop Positioning Control offers many advantages.

The Posidyne Clutch/Brake eliminates the reversing motion associated with the crank, starts and stops smoothly and accurately, eliminates many of the high wear items reducing maintenance and stop, and reduces noise considerably. The CLPC II Control continually monitors the stop position to adjust for changes in the machine and Clutch/Brake for accurate cut length. The length is easily entered on the front panel for quick changes in product width.

Improved wire length consistency permits reduction of trim cut length, reducing scrap produced.

IMPORTANT FEATURES:

- Oil Shear design provides high thermal and torque capacity for the heavy loads and high cycle rates required.
- Lubricated and cooled friction surfaces in a totally enclosed seal housing provide long service life.
- The CLPC Series II Closed Loop Positioning Control allows easy entry of wire length, and controls the Posidyne Clutch/Brake for accurate stop position.



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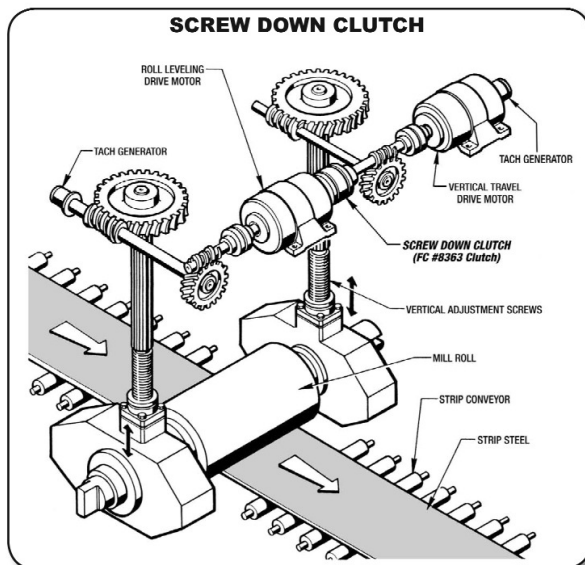
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Metal Forming Industry

APPLICATION BULLETIN



APPLICATION: Screw Down Clutch
INDUSTRY: Hot Strip Steel Mill
PRODUCT: Oil Shear Posidyne Clutch/Brake



AB-07-04 - 2/9/2005

AB-07-04 - 2/9/2005

SCREW DOWN CLUTCH

WHERE THEY ARE USED: All steel industry strip mills consist of many rough and finish rolling mills. These mills usually have two large steel rolls that are used to flatten or form the hot steel. Depending on the location and use of the mill, it may be necessary to adjust or level the large rolls. This procedure is done by using the screw down assembly located above the mill. The Screw Down Clutch is located in this assembly. The clutch can be engaged to drive both sides of the roll as one common unit, or disengaged if it is necessary to lift or lower one independent side of the roll.

HOW THEY WORK: As stated above, the clutch can be either engaged so the screw down assembly works as one unit, or disengaged if necessary to move only one side to perform the leveling procedure. The Force Control Screw Down Clutch is a thru shaft unit mounted on the common drive shaft between the two screw drive packages. With the use of a simple rotary air union, the air can be applied to release the clutch if the leveling procedure requires separate roll side adjustments.

PROBLEM SOLVED: Several different problems were solved by changing to the Force Control Screw Down Clutch. The first problem was a maintenance problem. The Force Control Clutch outlasted any other type of unit by a considerable length of time. The second problem of accuracy was solved by the Oil Shear design of the Force Control Clutch. With the unique Oil Shear design the clutch gave more accurate adjustment of the rolls throughout the life of the Force Control unit. The final problem was solved due to the unique enclosed design of the Force Control unit. Because of the design, the holding torque of the unit was not affected by the outside dirty, wet, and oily environment.

IMPORTANT FEATURES:

- Oil Shear technology provides smooth and accurate engagements throughout the lifetime of the clutch.
- The totally enclosed, sealed design protects the unit from outside contaminants.
- The Oil Shear design provides the user with a long service life with very little maintenance required.



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Special 24 Month Warranty

Force Control Limited Warranty

Upon written approval of the application by Force Control Industries, Inc. the standard Warranty period will be extended to 24 months from date of shipment.

Force Control Industries, Inc. ("Force Control") warrants its products to be free from defects in material and workmanship under normal and proper use for a period of one year from the date of shipment. Any products purchased from Force Control that upon inspection at Force Control's factory prove to be defective as a result of normal use during the one year period will be repaired or replaced (at Force Controls' option) without any charge for parts or labor. This limited warranty shall be void in regard to (1) any product or part thereof which has been altered or repaired by a buyer without Force Control's previous written consent or (2) any product or part thereof that has been subjected to unusual electrical, physical or mechanical stress, or upon which the original identification marks have been removed or altered. Transportation charges for shipping any product or part thereof that the buyer claims is covered by this limited warranty shall be paid by the buyer. If Force Control determines that any product or part thereof should be repaired or replaced under the terms of this limited warranty it will pay for shipping the repaired or replaced product or part thereof back to the buyer. EXCEPT FOR THE EXPRESS WARRANTY SET OUT ABOVE, FORCE CONTROL DOES NOT GRANT ANY WARRANTIES EITHER EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE. The warranty obligation set forth above is in lieu of all obligations or liabilities of Force Control for any damages. Force Control specifically shall not be liable for any costs incurred by the buyer in disconnecting or re-installing any product or part thereof repaired or replace under the limited warranty set out above. FORCE CONTROL EXPRESSLY

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A Return Goods Authorization (RGA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Force Control will pay the shipping costs of returning the owner parts that are covered by warranty.

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Clutch/Brake



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MagnaShear Electric Brake



Positorq Absorber Brake



CLPC-LC Position Control



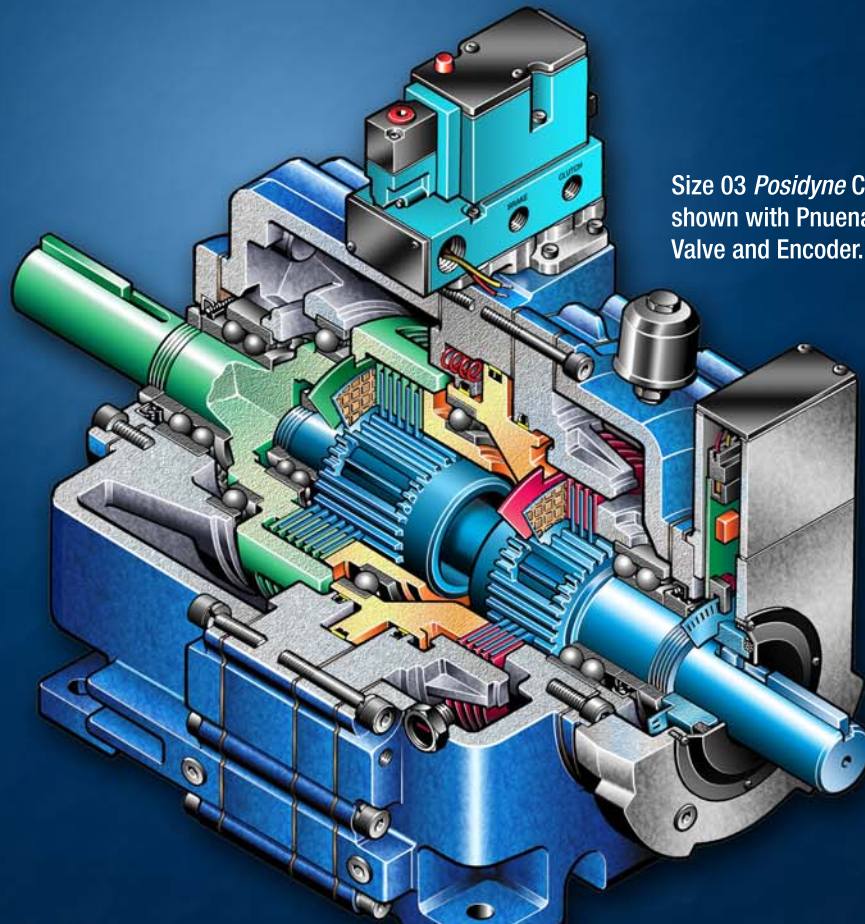
PosiDrive Servo Systems



Custom Drive Systems



Posistop Motor Brake



Size 03 Posidyne Clutch/ Brake
shown with Pnuenatic Control
Valve and Encoder.

Worldwide Leader In Oil Shear Technology