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S98CA7-SE...
In-Line Slip-Ease Clutches
pg. 13-2



S98CA6-MEC...
In-Line Slip Clutches
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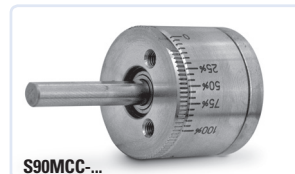
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In-Line Slip Clutches
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S9940Y...
Spring-Wrapped Slip Clutches
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Magnetic Particle Clutches
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S90MPA-B...
Magnetic Particle Brakes
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IN-LINE SLIP-EASE CLUTCHES



MULTIPLATE DESIGN
ADJUSTABLE TORQUE
FOR SMALL DESIGN ENVELOPES

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM

► **MATERIAL:**

- Housing** - Aluminum
- Plates** - Brass
- Friction Pads** - Proprietary (Non asbestos)

► **FEATURES:**

- 2° Backlash.
- Long life.
- Fully adjustable within rating limits.
- Low stick/slip ratio.
- Continuous slip within dissipation limit.

► **SPECIFICATIONS:**

Fig. 2 has a bronze bearing in the hub end so that a gear, pulley, etc. can be mounted on hub D.

Other bores and keyways available on special order.



Fig. 1



Fig. 2

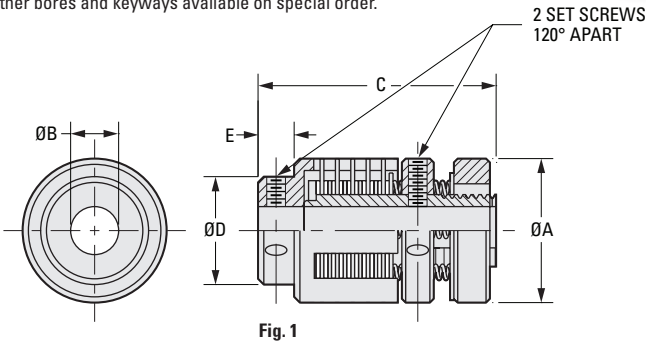


Fig. 1

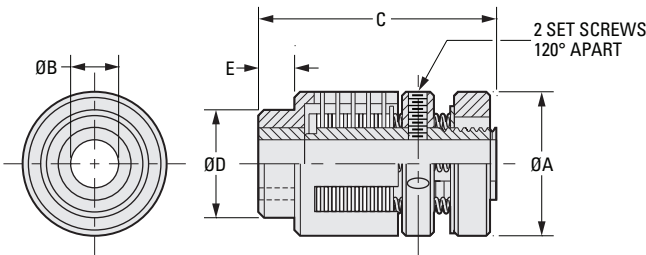


Fig. 2

Catalog Number		A Dia.	B Bore	Max. Bore	C	D Dia.	E	Torque* Range ozf in. @ 50 rpm	Dissip.* Power Watts	Friction Surfaces
Shaft to Shaft Fig. 1	Thru Shaft Fig. 2									
S98CA7-SES075125	S98CA7-SET075125	.75	.125	.250	1.25	.562	.188	24-136	4.5	10
S98CA7-SES075187	S98CA7-SET075187		.187							
S98CA7-SES100187	S98CA7-SET100187	1.00 Δ	.250	.375	1.50	.750	.250	48-256	9	12
S98CA7-SES100250	S98CA7-SET100250		.375							
S98CA7-SES137250	S98CA7-SET137250	1.375	.500	.250	2.50	1.000	.375	80-400	15	12
S98CA7-SES137375	S98CA7-SET137375		.375							

* See Technical Applications page 13-3.

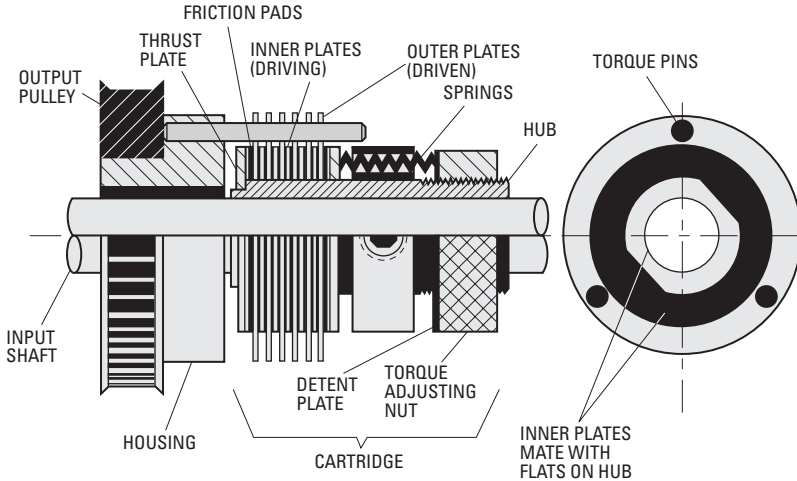
Δ Housing is black anodized.

NEW



> **FUNCTION:**

Multiplate slip clutches control torque for intermittent, continuous, or overload slip. It will drive in both directions, slip when the torque setting is reached, and resume driving as the load is reduced. These clutches are excellent as continuous or intermittent drag brakes, protection against overloads, for "soft starts," slip at the end of a stroke, as friction hinges, for screwing on container caps, etc.



> **CONSTRUCTION:**

The clutch consists of two assemblies: a cartridge and a housing (see cutaway above). The cartridge is set-screwed or keyed to the input shaft. The housing is either set-screwed or keyed to the output shaft or, as shown, is attached to the output gear or pulley with a bronze bearing to allow relative motion between the input shaft and the output gear/pulley. Torque is transmitted from the flats on the hub to the mating flats on the inner plates, through the friction pads to the outer plates, through the torque pins to the housing and the output gear/pulley. The torque level is controlled by compressing the springs with the adjusting nut. For a fixed torque clutch, a collar is attached to the hub in a fixed position instead of the adjusting nut. In operation, either the input shaft or the housing can be the input member, with the other member being driven.

> **CAPACITY:**

The clutch capacity as noted in the catalog is based on continuous operation at 50 rpm for over 25 million cycles. Torque, rpm, duty cycle and life are interdependent. A reduction of any of these will allow an increase in any other. Running at 25 rpm will allow twice the torque, or running for only 10% of the cycle will allow higher rpm, etc. The limit is based on heat buildup measured in watts:

English Unit Watts = Torque (lbf) x rpm x 0.0118 x % Duty Cycle

Metric Unit Watts = Torque (Nm) x rpm x 0.104 x % Duty Cycle

For typical applications, see examples on page 13-5.

MULTIPLATE DESIGN
ADJUSTABLE TORQUE

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› MATERIAL:

- Fig. 1 - Housing - Zinc Plated Steel
Plates - Brass
Friction Materials - Proprietary (Non asbestos)
- Fig. 2 - Housing - Aluminum
Plates - Brass
Friction Materials - Proprietary (Non asbestos)

› FEATURES:

- Fully adjustable within rating limits.
- Low stick / slip ratio.
- Continuous slip within dissipation limit.
- Available with bronze bearing in hub end so that gear, pulley, etc. can be mounted on hub "D".

Available with other bores as special order.

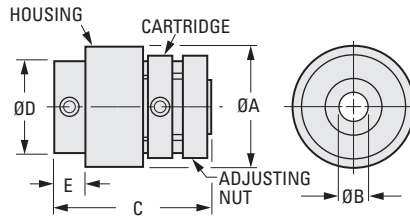


Fig. 1

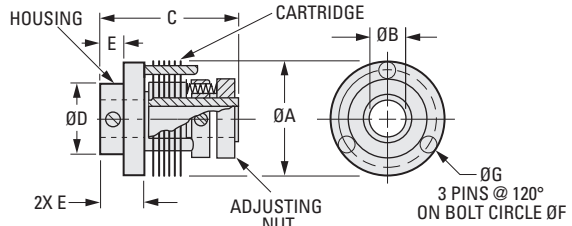


Fig. 2

INCH COMPONENT

Catalog Number	A Body Dia. ± .02	B Bore		C Length ± .02	D Hub Dia. ± .02	E Hub Length	Bore Depth		Torque* Range ozf in. @ 50 rpm	Dissip.* Power Watts	Friction Surfaces
		Std. +.002 -.000	Max. Bore Spec.				Hub End	Cart. End			
Fig. 1											
S98CA6-MEC160417	1.000	.250	.375	1.06 1.31	.76	.25	.31	.75 1.00	.3 to 32 1.6 to 160	1.0 5.8	2 8

Catalog Number	A Body Dia. ± .02	B Bore		C Lgth. ± .02	D Hub Dia. ± .02	E Hub Lgth.	Bore Depth		F Dia.	G Dia.	Torque* Range ozf in. @ 50 rpm	Dissip.* Power Watts	Friction Surfaces
		Std. +.002 -.000	Max. Bore Spec.				Hub End	Cart. End					
Fig. 2													
S98CA6-MOC200424	1.250	.250	.375	1.50	.76	.25	.50	1.00	1.062	.094	1.6 to 192	6.0	8
S98CA6-MOC240640	1.500	.375	.500	2.50	1.01	.37	.75	1.75	1.312	.125	8 to 400	14.5	12
S98CA6-MOC320846	2.000	.500	.625	2.87	1.38	.50	1.00	1.88	1.672	.188	12.8 to 800	29.0	12
S98CA6-MOC440846	2.750			1.63	2.375								

* See Technical Applications page 13-3.

> UNLIMITED APPLICATIONS:*

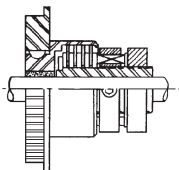
- Intermittent motion
- Indexing
- Phase adjustment
- Feeding
- Torque limiting
- Hinging
- Many more

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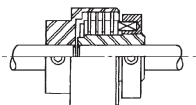


*The ingenuity of engineering has led to applications with labelers, indexing, film transport, instrumentation, business machines, computer peripherals, packaging, mailing, plotters, paper feeds and many more. We supply stock clutches or we work with you to develop units for your specific applications.

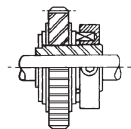
> TYPICAL MULTIPLATE SLIP CLUTCH APPLICATIONS:



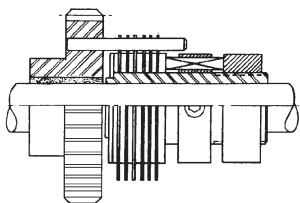
TIMING BELT ON HOUSING
Timing belt drives housing. Torque transmitted through adjustable pressure plates to shaft. Also operates as shaft input to timing belt.



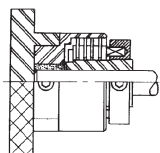
SHAFT-TO-SHAFT CONTROL
Either shaft as input. Fixed torque transmitted through pressure plates. Shafts must be journaled. Also can be adjustable torque.



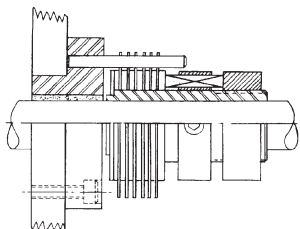
SLIP CARTRIDGE WITH GEAR
Pressure pads transmit torque directly to gear for space saving package.



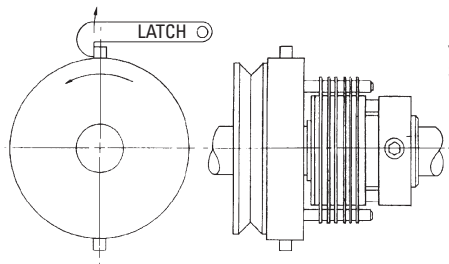
CLUTCH WITH A MODIFIED GEAR
Torque transmitted directly from gear through pins to adjustable pressure plates.



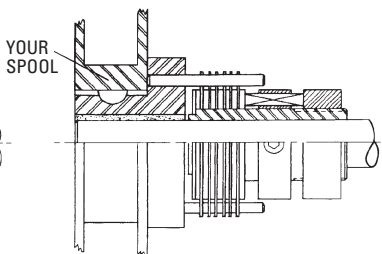
KNOB WITH TORQUE PROTECTION
Knob connected directly to housing. Fixed torque transmitted to shaft. Will slip above preset torque.



BRAKE TO FRAME OF MACHINE
Outer pressure plates held to machine frame. Adjustable braking pressure transmitted to shaft.



"SINGLE" REVOLUTION CLUTCH
Input shaft turns continuously. Output shaft turns when latch is disengaged. Single revolution, partial revolution, or multi-revolutions can be designed.



CONSTANT TORQUE - SUPPLY OR REWIND SPOOL
Slip clutch mounted directly to spool will give constant torque. Mounted directly to constant diameter cylinder will give constant tension. Many variations available to control wire supply system.



› FEATURES:

- Long life under continuous slip conditions.
- Unidirectional or bidirectional operation.
- Same or different clockwise and counterclockwise torques.
- Precise and stable limit torque calibration (range: 1.0 to 480 ozf in.).
- Same torque at breakaway as at high slip velocities.
- Mounting provisions for gear, sprocket or pulley.
- Corrosion-resistant materials.

› APPLICATIONS:

- Tension control of film or tape drives
- Transmission overload protection

› SPECIAL DESIGNS:

- The standard line of slip elements provides a wide selection of limit torques, sizes and coupling arrangements. In addition, our engineers will modify designs to meet your specific requirements in such areas as:
 - Configuration
 - Driving arrangement
 - Limit torques from a fraction of an ozf in. to several lbf ft.
 - Calibration of torque to a tolerance of $\pm 5\%$
 - Different limit torques for the two directions of rotation
 - Spring windup and limit torque combination. The spring action of the slip element is useful for tensioning of tape and prevention of slack loops.

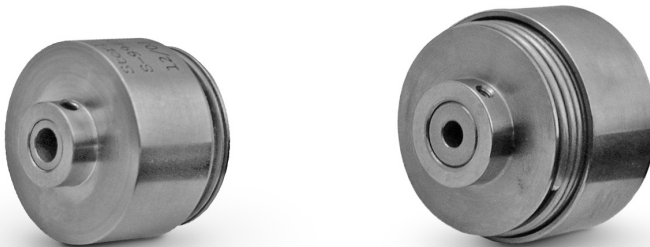
* Stock units are calibrated with equal clockwise and counterclockwise slip torques corresponding to the tabulated Upper Limit Torques. Other torques are readily available from full, down to 1/8 of the Upper Limit Torque for each model. Torque values are independent of each other for clockwise and counterclockwise rotation, and may be specified the same or different for the two directions.

** All clutches in this series have a pilot diameter "K" and three tapped holes "N" for mounting a gear, sprocket or pulley on the input hub. Screw penetration into the clutch housing must not exceed the depth specified in column "N". Concentricity of pilot diameter "K" to bore "C" is .001 T.I.R. max.

All slip clutches are designed for long life under continuous slip conditions. The useful life of these elements is a function of the transmitted torque and slip speed.

The life of the slip couplings & clutches is defined as the number of hours of continuous slip required to cause a deviation of 10% from the initial calibrated torque value. Extensive life tests have been performed on a number of standard units. The "Life Expectancy Curves" are designed for approximating the life span of standard slip clutches and couplings.

Continued on the next page



> EXAMPLE:

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If a slip clutch is to provide a torque limit of 50 ozf in. at a continuous slip speed of 100 rpm for 500 hours, the smallest item which can be calibrated is from the S9940Y-SWC15A.. series.

The upper limit torque for this unit is 80 ozf in.

$$\text{Limit Torque Ratio} = \frac{\text{Required Torque}}{\text{Upper Limit Torque}} = \frac{50}{80} = 0.63$$

From "Life Expectancy Curves" 100 rpm & 0.63 ratio:

$$\text{Life} = 2,800,000 \text{ Rev} = \frac{2,800,000 \text{ Rev}}{100 \text{ Rev / Min.} \times 60 \text{ Min. / Hour}} = 466.7 \text{ Hrs.}$$

The 466.7 hours life value is less than desired 500 hours.
The next larger slip clutch belongs to the S9940Y-SWC18A series.
The upper limit torque for this unit is 120 ozf in.

$$\text{Limit Torque Ratio} = 50/120 = 0.42$$

From "Life Expectancy Curves" for 100 rpm & 0.42 ratio:

$$\text{Life} = 4,800,000 \text{ Rev} = \frac{4,800,000 \text{ Rev}}{100 \text{ Rev / Min.} \times 60 \text{ Min. / Hour}} = 800 \text{ Hrs.}$$

A S9940Y-SWC18A.. series clutch will provide the desired life.



TYPICAL ELEMENT LIFE (STANDARD CATALOG MODELS)			
rpm	Torque	Hours of Continuous Slip in Each Direction	Hours of Operation Duty Cycle: 1 Sec. Slip, 1 Sec. Rest
25	1/2 Upper Limit	3,070	6,500
	Upper Limit	1,420	3,040
50	1/2 Upper Limit	1,420	3,040
	Upper Limit	620	1,420
100	1/2 Upper Limit	620	1,420
	Upper Limit	250	620
200	1/2 Upper Limit	250	620
	Upper Limit	100	250

The table entitled "Typical Element Life" provides life in hours of operation for some typical slip speeds and torques of standard slip elements. The torque is presented in terms of 1/2 and full upper limit torque rating of a given slip element.

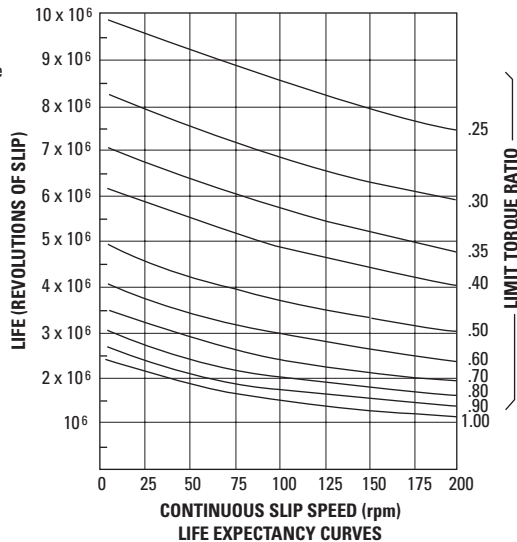
AVERAGE POWER DISSIPATION (P)

Continuous Slip **P = .00074 TN**

Cycle Slip **P = .00074 TNC**

where:

- T** = Slip Torque [ozf in.]
- N** = Average Slip Speed [rpm]
- C** = $\frac{\text{Duration of Slip / Cycle}}{\text{Duration of Cycle}}$



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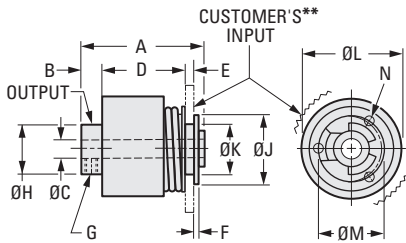


Fig. 1

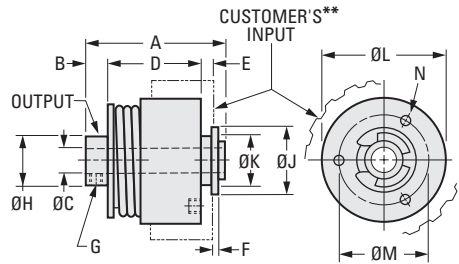


Fig. 2

INCH COMPONENT

Catalog Number	Fig. No.	C Bore +.0010 -.0000	A	B	D	E	F	G	H Dia. Max.	J Dia. Max.	K Dia. +.000 -.001	L Dia.	M Dia.	N	Upper* Limit Torque ozf in.	Max. Dissip. Power Watts
S9940Y-SWC06A02	1	.1248	1.05	.18	.72	.080	.03	#2-56	.51	.45	.374	.63	.500	#0-80 .08 DP.	9 ± 1	1.0
S9940Y-SWC06A03		.1873								.33						
S9940Y-SWC10A03		.1873														
S9940Y-SWC10A04	2	.2498	1.24	.21	.85	.095	.04	#4-40	.88	.68	.499	1.00	.650	#1-72 .10 DP.	20 ± 2	2.4
S9940Y-SWC10A05		.3123														
S9940Y-SWC13A04		.2498	1.39	.23	.94	.130	.04	#6-32	1.01	.68	.499	1.25	.925	#2-56 .11 DP.	48 ± 5	5.7
S9940Y-SWC13A05	1	.3123														
S9940Y-SWC15A04		.2498	1.39	.23	.94			#6-32	1.26	.68	.499	1.50	.925		80 ± 8	9.5
S9940Y-SWC15A05		.3123														
S9940Y-SWC18A04	1	.2498	1.67	.25	1.20				1.51	.68	.499	1.87	.780		120 ± 12	14
S9940Y-SWC18A05		.3123				.130	.04									
S9940Y-SWC19A05		.3748	1.88	.29	1.34			#8-32	1.51	.74	.749	1.87	1.170		150 ± 15	18
S9940Y-SWC19A06	2	.4998														
S9940Y-SWC19A08		.2498	1.88	.29	1.34	.130	.04	#8-32	2.01	.74	.749	2.25	1.170	#4-40 .17 DP.	240 ± 24	28
S9940Y-SWC22A04		.3123														
S9940Y-SWC22A05	1	.3748	1.88	.32	1.31	.130	.04	#10-32	2.01	.74	.749	2.62	1.170		360 ± 36	43
S9940Y-SWC22A06		.4998														
S9940Y-SWC22A08		.3123														
S9940Y-SWC26A05	1	.6250	2.30	—	1.975	.225	.046	1/4-20 2 @ 120°	3.01	1.10	1.124	3.00	1.480	#8-32 .210 DP.	480 ± 50	57
S9940Y-SWC30A10		.7500														
S9940Y-SWC30A12		.8750														
S9940Y-SWC30A14																

* or ** See page 13-6

> FEATURES:

- Long life under continuous slip conditions.
- Unidirectional or bidirectional operation.
- Same or different clockwise and counterclockwise torques.
- Precise and stable limit torque calibration (range: 1/2 to 88 ozf in.).
- Same torque at breakaway as at high slip velocities.
- Corrosion-resistant materials.

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> APPLICATIONS:

- Tension control of film or tape
- Transmission overload protection
- Friction loads for testing components

> RECOMMENDED MOUNTING PROCEDURE:

- Coupling is slipped over one shaft and applicable screws tightened.
- Second shaft is inserted into other end of coupling.
- Pull loose end of coupling back about .02 in. and tighten applicable screws.

The slip coupling serves as a torque limiter as well as a coupling for two colinear shafts. This coupling is equipped with hubs at both ends for pinning to the two shafts. When the load exceeds the limit torque of a slip coupling, the two shafts rotate relative to each other at the full limit torque. The standard coupling is designed to operate with 3° angular or linear misalignments of up to .010 in. between the two shafts. The mounting hole diameters of the slip couplings can differ for the two ends, so that different diameters of “in-line” shafts can be coupled together.

* Stock units are calibrated with equal clockwise and counterclockwise slip torques corresponding to the tabulated Upper Limit Torques. Other torques are readily available from full, down to 1/8 of the Upper Limit Torque for each model. Torque values are independent of each other for clockwise and counterclockwise rotation, and may be specified the same or different for the directions.

This series of slip couplings is designed for long life under continuous slip conditions. The useful life of these elements is a function of the transmitted torque and slip speed.



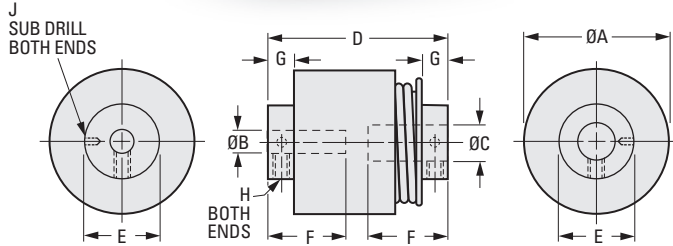
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SPRING-WRAPPED SLIP COUPLINGS



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INCH COMPONENT

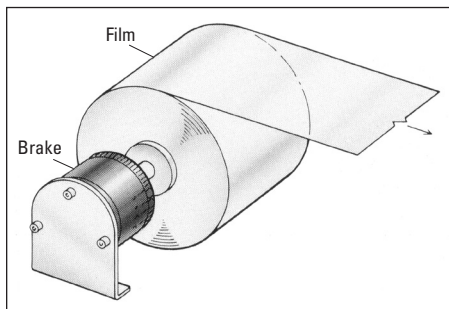
Catalog Number	B Bore +.0010 -.0000	C Bore +.0010 -.0000	A Dia. ± .02	D ± .03	E Max.	F	G ± .02	J Sub Drill	Upper Limit Torque ozf in.	Max. Dissip. Power watts	Unit Weight oz.					
H Set Screw #2-56																
S9941Y-SWC05A22	.1250	.1250	.50	.89	.50	.43	.17	.029	5 ± .7	.6	.6					
S9941Y-SWC05A23	.1250	.1875														
S9941Y-SWC05A33	.1875	.1875														
S9941Y-SWC06A22	.1250	.1250	.62	.98	.51	.46			8 ± 1.0	1.0	.9					
S9941Y-SWC06A23	.1250	.1875														
S9941Y-SWC06A33	.1875	.1875														
H Set Screw #4-40																
S9941Y-SWC08A33	.1875	.1875	.75	1.11	.63	.50	.19	.040	12 ± 1.2	1.5	1.2					
S9941Y-SWC08A34	.1875	.2500														
S9941Y-SWC08A44	.2500	.2500														
S9941Y-SWC10A33	.1875	.1875	1.00	1.26	.76	.55			20 ± 2.0	2.4	2.6					
S9941Y-SWC10A34	.1875	.2500														
S9941Y-SWC10A44	.2500	.2500														
H Set Screw #6-32																
S9941Y-SWC13A44	.2500	.2500	1.25	1.43	1.01	.62	.25	.055	48 ± 5.0	5.7	3.8					
S9941Y-SWC13A45	.2500	.3125														
S9941Y-SWC13A46	.2500	.3750														
S9941Y-SWC13A55	.3125	.3125							1.50	1.56	1.26	.73		88 ± 9.0	10.5	6.5
S9941Y-SWC13A56	.3125	.3750														
S9941Y-SWC13A66	.3750	.3750														
S9941Y-SWC15A55	.3125	.3125	1.50	1.56	1.26	.73		88 ± 9.0	10.5	6.5						
S9941Y-SWC15A56	.3125	.3750														
S9941Y-SWC15A58	.3125	.5000														
S9941Y-SWC15A66	.3750	.3750														
S9941Y-SWC15A68	.3750	.5000	1.50	1.56	1.26	.73		88 ± 9.0	10.5	6.5						
S9941Y-SWC15A88	.5000	.5000														

* See preceding page.



UNWIND TENSION CONTROL

Brake mounted on shaft of unwind spool or bobbin.



Film Unwind - Tension provided by hysteresis units.

Information required: (Example)

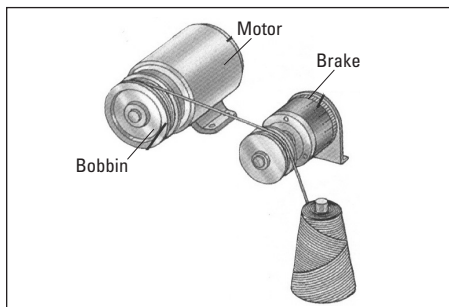
- Full diameter** = 6 in.
- Empty core diameter** = 3 in.
- Average tension** = 1 lbf
- Velocity** = 150 ft./min.

How to size:

$$\begin{aligned} \text{Avg. radius} &= [\text{Full roll dia.} + \text{Empty dia.}] / 4 \\ &= (6 + 3) / 4 = 2.25 \text{ in.} \\ \text{Avg. torque (lbf in.)} &= \text{avg. tension (lbf)} \times \text{avg. radius (in.)} \\ &= 1 \times 2.25 = 2.25 \text{ lbf in.} \end{aligned}$$

1. Select Catalog Number **S90MCC-MTL37505** based on 2.25 lbf in.
2. Check Operating Curve
The Max. rpm occurs at the min. radius
Max. rpm = Velocity / (Empty dia. x π)
= (150 ft./min.) / [(0.25 feet) x π]
= 191 rpm
2.25 lbf in. at 191 rpm is okay.

NIP ROLL OR PULLEY TENSION CONTROL



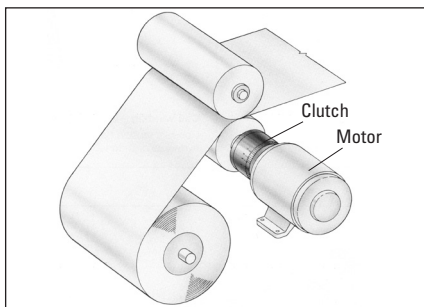
Coil Winding - Constant tension provided by hysteresis unit.

Information required: (Example)

- Pulley diameter or nip roll** = 3 in.
- Tension** = 2.5 lbf
- Velocity** = 300 ft./min.

How to size:

$$\begin{aligned} \text{Torque (lbf in.)} &= \text{Tension} \times \text{Radius} \\ &= 2.5 \text{ lbf} \times [(3 \text{ in.}) / 2] = 3.75 \text{ lbf in.} \end{aligned}$$



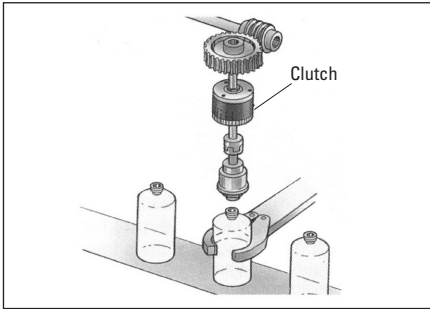
Film Tensioning - Constant tensioning supplied by hysteresis unit.

1. Select Catalog Number **S90MCC-MTL37505** based on 3.75 lbf in.
2. Check Operating Curve
Max. rpm = (300 ft./min.) / (0.25 ft. x π) = 382 rpm
382 rpm is too high for continuous duty on the **S90MCC-MTL37505** unit.
3. Select Catalog Number **S90MCC-MTL62510**

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CYCLING



Bottle Capping - Constant torque provided by a hysteresis clutch.

Information required: (Example)

Slip rpm = 350 rpm

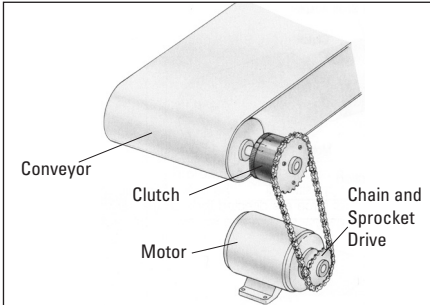
Torque = 8 lbf in.

Duty cycle (% slip time of total cycle time) = 25%

How to size:

1. Select Catalog Number **S90MCC-MTL62510** based on 8 lbf in.
2. Check Operating Curve
350 rpm is high, but as the duty cycle is only 25%, the Catalog Number **S90MCC-MTL62510** is okay.

OVERLOAD PROTECTION TORQUE LIMITING SOFT START (Motor Horsepower Method)



Torque Limiting - Hysteresis clutch provides overload protection.

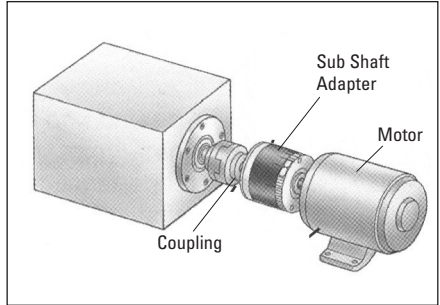
Information required: (Example)

Motor hp = 1/10 hp

Motor rpm = 900 rpm

How to size:

$$\begin{aligned} \text{Torque (lbf in.)} &= (\text{Motor hp} \times 63000) / \text{Motor rpm} \\ &= [1/10 \text{ hp} \times 63000] / 900 = 7 \text{ lbf in.} \end{aligned}$$



Material Handling - Hysteresis clutch can provide overload protection and soft start.

1. Select Catalog Number **S90MCC-MTL62525** based on 7 lbf in.
2. Check Operating Curve
7 lbf in. is at the upper limit of safe continuous operation, but is okay.

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> **ADVANTAGES:**

- No electricity
- No breakaway torque
- Constant torque independent of shaft (rotor) speed
- No contacting or wearing parts
- No friction elements – same smooth torque year after year
- No magnetic particles to leak or contaminate end product
- Operable in some of the most difficult environments
- Brake (with shaft) and clutch (with hollow shaft) available
- Custom designs available

> **APPLICATIONS:**

Fig. 1 As a Coupling

This is for load protection or torque limiting. The coupling style unit is directly connected to a motor and turns at the same speed as the motor until the torque is reached. At this point it will slip and still generate the maximum torque.

Fig. 2 As a Clutch

The unit is connected to a motor by a timing belt or gear. The housing is driven and the shaft is the output end.

Fig. 3 As a Payout Brake

Brake is stationary and the reel or material is fitted to the output shaft. The tension on the material will vary with the diameter.

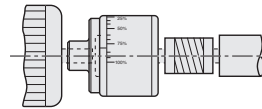


Fig. 1

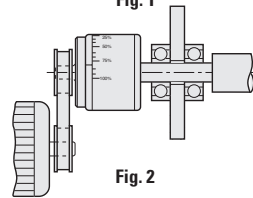


Fig. 2

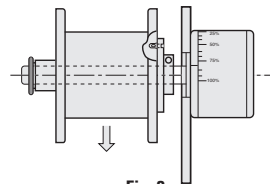


Fig. 3

> **HOW THEY OPERATE:**

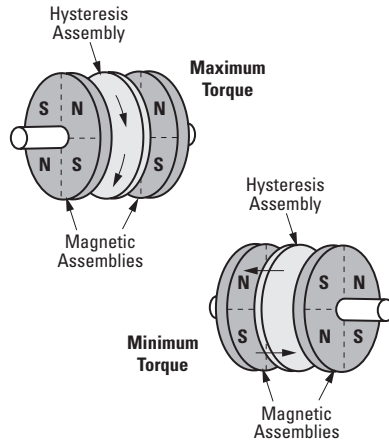
For Maximum Torque

All important internal clearances are ground to tolerances of less than .001 in. (0.025 mm). Magnet assemblies surround hysteresis assembly. When like poles face each other, they produce maximum magnetic saturation of the hysteresis disc, forcing lines of flux to travel circumferentially through the hysteresis disc.

For Minimum Torque

When opposite poles face each other they produce minimum saturation of the hysteresis disc. The lines of flux travel through the hysteresis disc.

Combinations of adjustment angles between the two extremes give infinite adjustability. Because there are no contacting surfaces, the setting can be maintained indefinitely.



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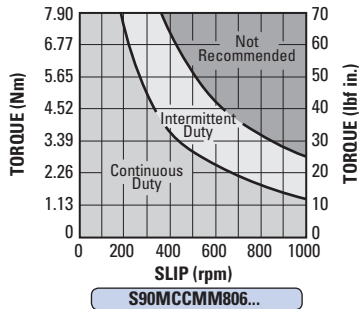
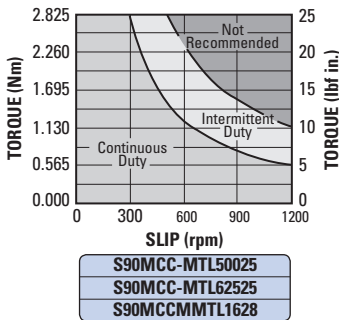
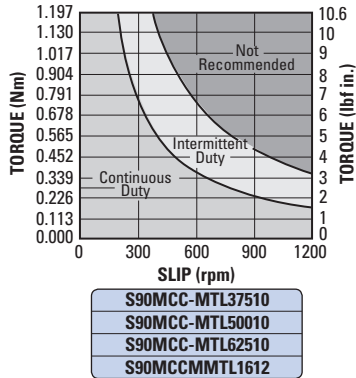
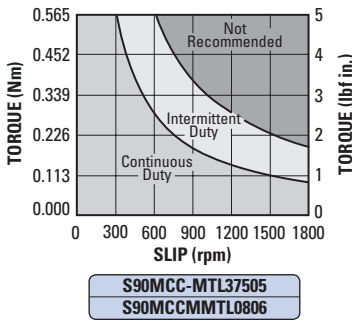
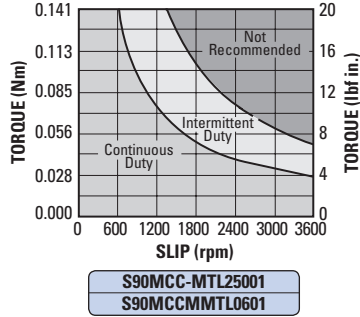
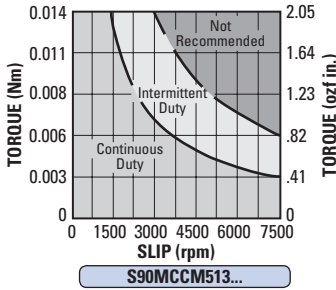
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HOW TO USE THE CURVES:

Find the slip rpm on the X-axis and the torque on the Y-axis. Notice the areas that represent safe, continuous duty; intermittent duty, such as five minutes on, five minutes off; and the area which is not recommended. Operating above that line for any period of time will cause overheating and possible damage to the unit.



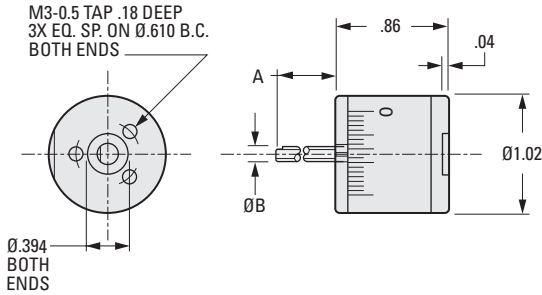
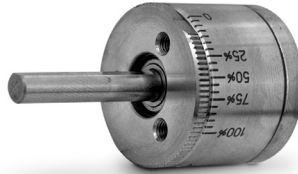
.130 lbf in. TORQUE
 NONELECTRIC
 NO WEARING PARTS
 NO FRICTION

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM



> MATERIAL:

Housing and Shaft - Stainless Steel



INCH COMPONENT				
Catalog Number	B Shaft Dia. +.000 -.001	A Shaft Length	Torque Range lbf in.	Weight lb.
S90MCC-5130151	3/16	.51	.003 - .018	.16
S90MCC-5130651			.010 - .060	
S90MCC-5131351			.010 - .130	

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25 lbf in. TORQUE
 NONELECTRIC
 NO WEARING PARTS
 NO FRICTION
 HOLLOW BORE

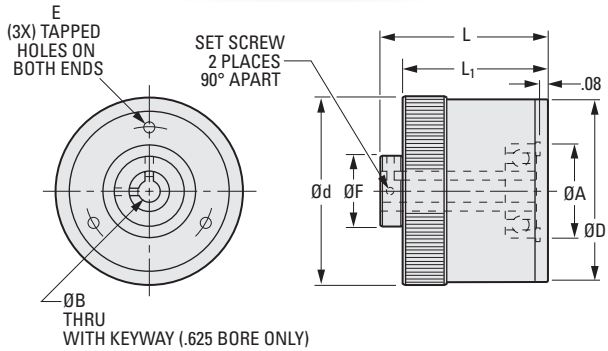
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MATERIAL:

Housing - Aluminum, Black Anodized Finish

Dial - Steel, Black Oxide Finish



INCH COMPONENT

Catalog Number	B Bore +.001 -.000	L Length	L ₁	D Dia.	d Dia.	A Dia.	Torque Range lbf in.
S90MCC-MTL25001	.250	1.65	1.42	1.87	1.95	.866	.06 – 1.25
S90MCC-MTL37505	.375	2.44	2.12	2.71	2.76	1.378	.18 – 5.00
S90MCC-MTL37510	.375	2.52	2.20	3.23	3.31	1.850	.50 – 10.60
S90MCC-MTL37525	.375	3.11	2.67	4.57	4.68	2.441	1.00 – 25.00
S90MCC-MTL50010	.500	2.52	2.20	3.23	3.31	1.850	.50 – 10.60
S90MCC-MTL50025	.500	3.11	2.67	4.57	4.68	2.441	1.00 – 25.00
S90MCC-MTL62510	.625	2.52	2.20	3.23	3.31	1.850	.50 – 10.60
S90MCC-MTL62525	.625	3.11	2.67	4.57	4.68	2.441	1.00 – 25.00

Catalog Number (Ref.)	F Hub Dia.	Set Screw	E			Keyway	Approx. Weight lb.
			Thread	Depth	Bolt Circle		
S90MCC-MTL25001	.75	M4	M4	.31	1.260	—	.73
S90MCC-MTL37505	1.06			.39	1.890		2.28
S90MCC-MTL37510	.99			.39	2.375		3.57
S90MCC-MTL37525	1.38	M5	M5	.47	3.000	—	8.95
S90MCC-MTL50010	.99			.39	2.375		3.57
S90MCC-MTL50025	1.38	M5	M5	.47	3.000	1/8	8.95
S90MCC-MTL62510	1.46			.39	2.375		3.57
S90MCC-MTL62525	1.38	M5	M5	.47	3.000	3/16	8.95
				.39	2.375		3.57

ROLLER CLUTCHES



FOR 1/8 TO 3/4 HARDENED SHAFTS
UNIDIRECTIONAL DRIVE

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> MATERIAL:

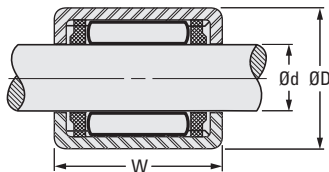
- Roller Cup** - Case-Hardened Steel
- Needle Bearing** - 52100 Hardened Chrome Steel
- Springs** - Stainless Steel
- Cage** - Nylon 66 (or Equivalent)

> OPERATING TEMPERATURE:

Grease +50°F to +160°F

> FEATURES:

- Ideal for indexing, backstopping or overrunning operations.
- Free rolling one way, drives in opposite direction.
- Lightweight, low profile.
- High indexing frequency, up to 4 CPS.
- Minimum backlash.

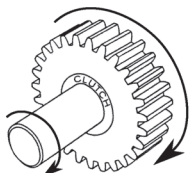


> SHAFT REQUIREMENTS:

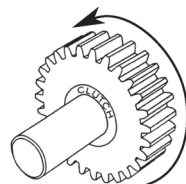
Shaft surface hardness must be Rc 58 min.

WHAT IT DOES:

Transmits torque load in one direction.
Overruns freely in opposite direction.
Either shaft or housing can be driving member.



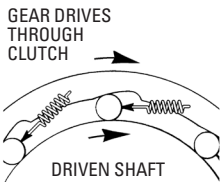
GEAR DRIVES
SHAFT CLOCKWISE



GEAR OVERRUNS
SHAFT COUNTERCLOCKWISE

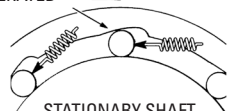
HOW IT WORKS:

Rollers wedge between shaft and outer race. Positive wedging forces prevent slipping. Springs position rollers for instantaneous lockup.



DRIVEN SHAFT

GEAR OVERRUNS
COUNTERCLOCKWISE
CLEARANCE
EXAGGERATED



STATIONARY SHAFT
CAUSES ROLLER TO MOVE
OUT OF WEDGE TO RELEASE
CLUTCH WHEN OVERRUNNING

INCH COMPONENT

Catalog Number	Bore	D O.D.	W Clutch Width +.00 -.01	Max. Torque lbf in.	d Recom. Shaft Dia. +.0000 -.0005	Housing Bore +.001 -.000	Max. Rotating Overrun Speed rpm	
							Shaft	Housing
*S99NH3-URC0204	1/8	9/32	.250	2.86	.1250	.2812	5000	30000
S99NH3-URC0408	1/4	7/16	.500	18.60	.2500	.4370	21000	12000
S99NH3-URC0608	3/8	5/8	.500	50.40	.3750	.6245	14000	12000
S99NH3-URC0808	1/2	3/4	.500	85.90	.5000	.7495	11000	9000
S99NH3-URC1010	5/8	7/8	.625	175.20	.6250	.8745	8500	5000
S99NH3-URC1210	3/4	1	.625	206.00	.7500	.9995	12000	7000

* Plastic Springs

ROLLER CLUTCHES • WITH BEARING SUPPORT



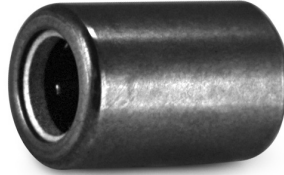
FOR 3/8 TO 5/8 HARDENED SHAFTS
UNIDIRECTIONAL DRIVE

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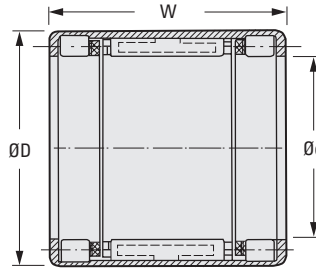
› **MATERIAL:**

- Roller Cup** - Case-Hardened Steel
- Needle Bearing** - 52100 Hardened Chrome Steel
- Springs** - Stainless Steel
- Cage** - Plastic
- Bearing Support** - Sintered Bronze Bearings



› **SHAFT REQUIREMENTS:**

Shaft surface hardness must be Rc 58 min.



INCH COMPONENT

Catalog Number	d Shaft Dia. +.0000 -.0003	D O.D.	W Width	Max. Torque lbf in.	Max. Rotating Overrun Speed rpm		Load Ratings lbf		Recommended Housing Bore Tolerance	
					Shaft	Housing	Dynamic	Static	Steel	Aluminum
S99NH4-URC1228	.375	.625	.875	50.4	14000	12000	1350	1240	±.0005	±.0001/- .0009
S99NH4-URC2032	.625	.875	1.000	175.2	8500	5000	1720	1890	±.0005	±.0000/- .0010



> INERTIA AND TORQUE VALUES

Calculate load inertia (WR²)

Use the inertia chart to determine the inertia of the application components. To determine WR² of a given shaft or disc, multiply the WR² from the chart by the length of shaft or thickness of disc in inches.

NOTE: For hollow shafts, subtract WR² of the I.D. from the WR² of the O.D. and multiply by length.

In order to calculate the inertias of components which are made of material other than steel, use the multipliers found in the conversion chart (below) to establish the inertias of these components.

Inertia Conversion Chart

In order to determine the inertia of a rotating member (shaft, disc, etc.) of a material other than steel, multiply the inertia of the appropriate steel diameter from the chart by:

Material	Multiplier
Bronze	1.05
Steel	1.00
Iron	.92
Powdered Metal Bronze	.79
Powdered Metal Iron	.88
Aluminum	.35
Nylon	.17

Determine clutch or brake torque value

With the inertia value calculated, determine the torque requirement for the function.

A) For Overrunning and Start-Stop (random start-stop)

$$T = \frac{WR^2 \times \text{rpm}}{3700 \times t} + \text{friction torque}^*$$

Where:

T = Torque required from wrap spring, lbf in.

WR² = load inertia, lbf in.²

rpm = shaft speed at clutch location

t = time to engagement (.003 for clutch), sec.

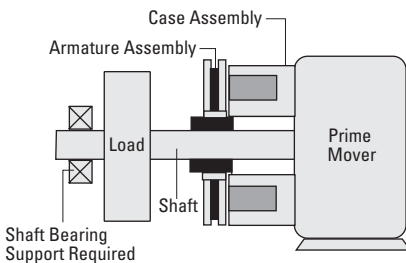
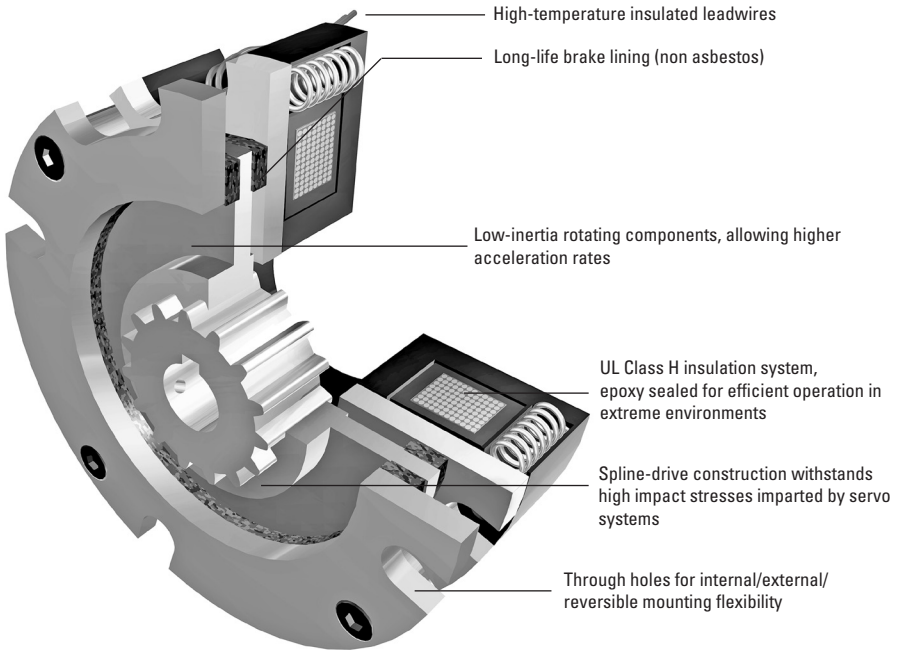
*Frictional (drag) torque is the torque necessary to overcome static friction. It may be measured by a spring-scale or by dead-weights, applied to a known moment arm so gradually as to make inertia negligible. It is that torque found just sufficient to induce motion.

INERTIA OF STEEL SHAFTING (Per Inch of Length or Thickness)					
Dia. in.	WR ² lbf in. ²	Dia. in.	WR ² lbf in. ²	Dia. in.	WR ² lbf in. ²
1/4	.00011	7	66.816	13	803.52
3/8	.00055	7-1/4	77.04	13-1/4	858.24
1/2	.00173	7-1/2	87.984	13-1/2	924.48
3/4	.00864	7-3/4	100.656	13-3/4	995.04
1	.0288	8	113.904	14	1068.48
1-1/4	.072	8-1/4	128.88	14-1/4	1147.68
1-1/2	.144	8-1/2	144.00	14-1/2	1229.75
1-3/4	.288	8-3/4	162.72	14-3/4	1317.60
2	.432	9	182.88	15	1404.00
2-1/4	.72	9-1/4	203.04	16	1815.84
2-1/2	1.152	9-1/2	223.20	17	2314.08
2-3/4	1.584	9-3/4	252.00	18	2910.24
3	2.304	10	277.92	19	3611.52
3-1/2	4.176	10-1/4	306.72	20	4433.76
3-3/4	5.472	10-1/2	338.40	21	5389.92
4	7.056	10-3/4	371.52	22	6492.96
4-1/4	9.072	11	407.52	23	7757.28
4-1/2	11.376	11-1/4	444.96	24	9195.84
5	17.28	11-1/2	486.72	25	10827.36
5-1/2	25.488	11-3/4	529.92	26	12666.24
6	36.00	12	576.00	27	14731.20
6-1/4	42.624	12-1/4	626.40	28	17036.64
6-1/2	49.68	12-1/2	679.68	29	19604.16
6-3/4	57.888	12-3/4	735.84	30	22452.48

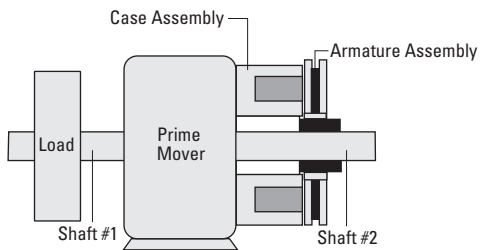


Power-Off Brake – S90SB9- series

Used to stop or hold a load in the absence of power. The case assembly is mounted or fastened to a bulkhead. The armature assembly is attached to the rotating load.



Option 1: Single Output Shaft



Option 2: Double Output Shaft

SIMPLE INSTALLATION
ECONOMICAL COST
ENERGY EFFICIENT
SPLINED HUB

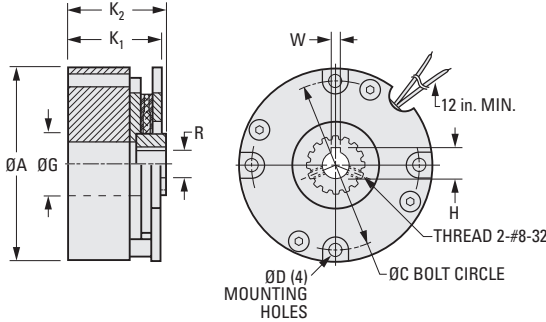
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> COIL DATA:

Voltage: 24V DC

Other voltages available on special order.



Keyway Dimensions				
R Bore	.250	.312	.375	.500
W Width	.062	.094	.094	.125
H Height	.286	.364	.425	.564

INCH COMPONENT

Catalog Number	Static Torque lbf in.	Max. watts	R Hub Bore	G Case Inside Dia.	A Dia.	C Dia.	D Dia.	K ₁ OAL Short Hub	K ₂ OAL Long Hub
S90SB9-15A04S	5	7	.250	.53	1.50	1.31	.125	1.06	—
S90SB9-15A04L			—					1.18	
S90SB9-15A05S			1.06					—	
S90SB9-15A05L			—					1.18	
S90SB9-15A06S			1.06					—	
S90SB9-15A06L	—	1.18	—	—	—	—	—		
S90SB9-17A04S	10	10	.250	.58	1.79	1.64	.093	1.19	—
S90SB9-17A04L			—					1.32	
S90SB9-17A06S			1.19					—	
S90SB9-17A06L			—					1.32	
S90SB9-17A08S			1.19					—	
S90SB9-17A08L	—	1.32	—	—	—	—	—		
S90SB9-19A04S	18	12	.250	.43	2.00	1.77	.146	1.19	—
S90SB9-19A04L			—					1.38	
S90SB9-19A06S			1.19					—	
S90SB9-19A06L	—	1.38	—	—	—	—	—		

Catalog Number (Ref.)	Thread	Nom. Resistance ohms	Armature		Rotor Inertia lbf in. sec ²	Energy Dissipation lbf ft./min.	Weight lb.
			Engagement msec	Disengagement msec			
S90SB9-15A...	#2-56	96	20	10	4.38 x 10 ⁻⁶	500	.3
S90SB9-17A...		64	20		1.87 x 10 ⁻⁵	700	.7
S90SB9-19A...	#6-32	54	35	2.36 x 10 ⁻⁵	900		

* Typical torque after burnishing; units shipped burnished.

Continued on the next page

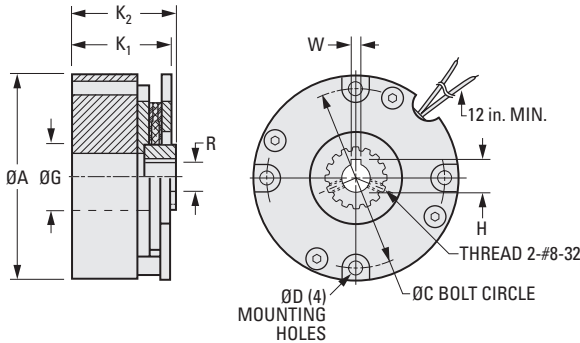
SIMPLE INSTALLATION
ECONOMICAL COST
ENERGY EFFICIENT
SPLINED HUB

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM



> COIL DATA:
Voltage: 24V DC

Other voltages available on special order.



Keyway Dimensions			
R Bore	.375	.500	.625
W Width	.094	.125	.188
H Height	.425	.564	.709

INCH COMPONENT

Catalog Number	Static Torque lbf in.	Max. watts	R Hub Bore	G Case Inside Dia.	A Dia.	C Dia.	D Dia.	K ₁ OAL Short Hub	K ₂ OAL Long Hub
S90SB9-28A06S	80	20	.375	1.18	3.03	2.76	.177	1.22	—
S90SB9-28A06L			—					1.45	
S90SB9-28A08S			1.22					—	
S90SB9-28A08L			—					1.45	
S90SB9-28A10S			1.22					—	
S90SB9-28A10L			—					1.45	

Catalog Number (Ref.)	Thread	Nom. Resistance ohms	Armature		Rotor Inertia lbf in. sec ²	Energy Dissipation lbf ft./min.	Weight lb.
			Engagement msec	Disengagement msec			
S90SB9-28A...	#8-32	36	50	40	1.06 x 10 ⁻⁴	1800	1.8

* Typical torque after burnishing; units shipped burnished.

Continued from the previous page

POWER-ON FLANGE-MOUNTED BRAKES



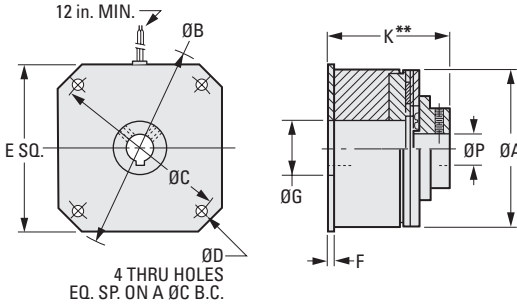
ZERO DRAG WHEN DE-ENERGIZED
ANTI-BACKLASH WHEN ENERGIZED

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM

> COIL DATA:

Voltage: 24V DC

Other voltages available on special order.



Keyway Dimensions			
Bore	.250	.375	.500
Width	.062	.094	.125
Height	.286	.425	.564

INCH COMPONENT

Catalog Number ^Δ	Static Torque lbf in.	Nom. Resist. ohms	Max. wattage	Armature Inertia lbf in. sec ²	Energy Dissipation lbf ft./min.	Armature		P Bore
						Engagement msec	Disengagement msec	
S90BF9-11A04	5	128	5	3.4 x 10 ⁻⁵	175	5	18	.250
S90BF9-17A04	15	108	6	8.1 x 10 ⁻⁵	420	10	27	
S90BF9-22A06	40	75	8.5	33.1 x 10 ⁻⁵	1400	12	32	
S90BF9-26A08	80	66	9.5	81.0 x 10 ⁻⁵	2600	15	35	.375

Catalog Number (Ref.)	A Dia. Max.	B Dia.	C Dia.	D Dia.	E Max.	F	G Dia.	K** Max.	Weight lb.
S90BF9-11A04	1.25	1.498	1.31	.125	1.17	.05	.53	1.14	.2
S90BF9-17A04	1.78	2.436	2.13	.187	1.82	.06	.75	1.27	.5
S90BF9-22A06	2.26	2.873	2.50	.166	2.33		.88	1.74	.9
S90BF9-26A08	2.63	3.499	3.13	.187	2.63		1.06	1.84	1.2

* Typical torque after burnishing; units shipped burnished.

** For Catalog Number:

-11A04, initial working air gap at installation shall be .004/.009.

-17A04, -22A06, -26A08 initial working air gap at installation shall be .006/.013.

^Δ To be discontinued when current stock is depleted.

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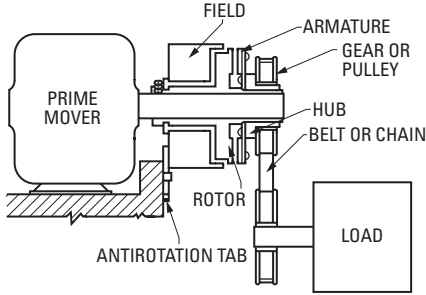
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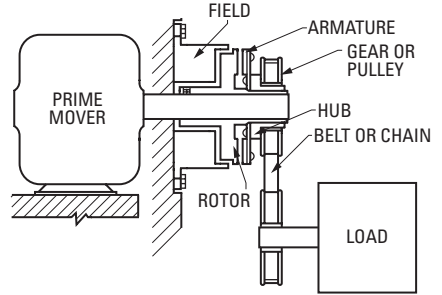
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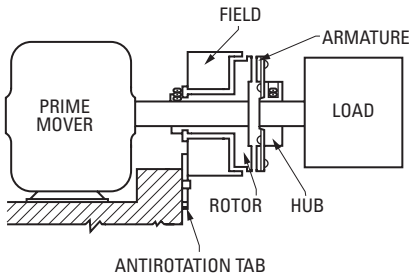
**Shaft-Mounted Clutches
S90CS9 Series**



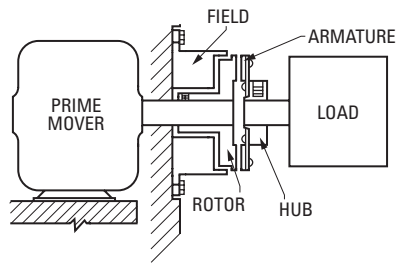
**Flange-Mounted Clutches
S90CF9 Series**



**Shaft-Mounted Clutch Couplings
S90CSC Series**



**Flange-Mounted Clutch Couplings
S90CFC Series**



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SHAFT-MOUNTED CLUTCH COUPLINGS

SDP/SI

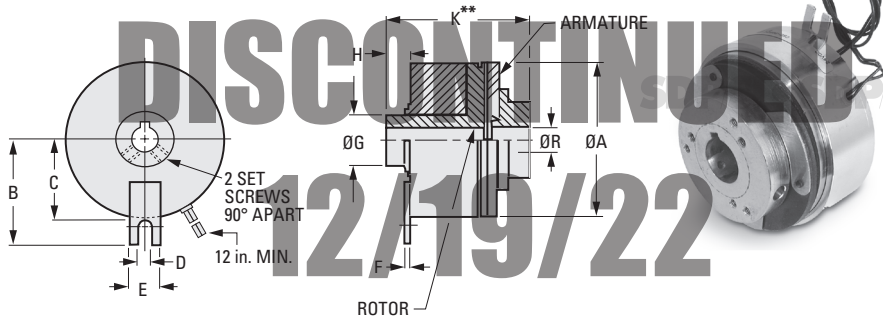
ZERO-BACKLASH ARMATURE
FOR IN-LINE LOADS

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM

> COIL DATA:

Voltage: 24V DC

Other voltages and dissimilar bore combinations are available on special order.



Keyway Dimensions	
Bore	.375
Width	.094
Height	.425

INCH COMPONENT

Catalog Number	Static* Torque lbf in.	Nom. Resist. ohms	Max. wattage	Armature Inertia lbf in. sec ²	Rotor Inertia lbf in. sec ²	Energy Dissipation lbf ft./min.	Armature	
							Engagement msec	Disengagement msec
△ S90CSC-22A0606	40	75	8.5	33.1 x 10 ⁻⁵	32.3 x 10 ⁻⁵	1400	12	32

Catalog Number (Ref.)	R Bore	A Dia.	B	C	D	E	F	G Dia.	H	K**	Weight lb.
S90CSC-22A0606	.375	2.26	1.52	1.16	.19	.44	.06	.750	.36	2.06	1.1

* Typical torque after burnishing; units shipped burnished.
** For Catalog Number:
-22A0606 initial working air gap at installation shall be .006/.013.

△ To be discontinued when current stock is depleted.

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PIN TYPE

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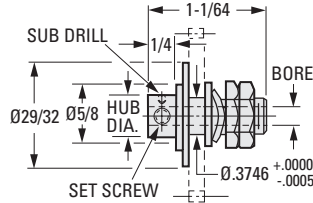
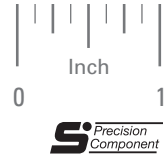
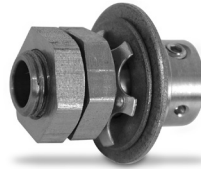
› **MATERIAL:**

Housing - 303 Stainless Steel
 Brake - Oil-Impregnated Steel

› **TORQUE:**

5-50 ozf in.

Other bores available on special order.



INCH COMPONENT

Catalog Number	Bore +.0005 -.0000	Hub Diameter	Set Screw	Sub Drill
S9906A-G150S-1	.1200	.312	#2-56	.029
S9906A-G150S-2	.1248			
S9906A-G150S-3	.1873	.375	#4-40	.040
S9906A-G150S-4	.2498	.500	#6-32	.070

NOTE: Use with Hubless Gears of .125 FW. and .3750 bore.

CLAMP TYPE

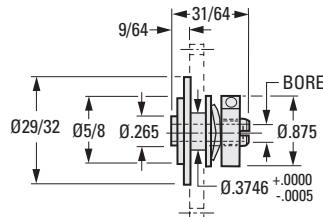
› **MATERIAL:**

Housing - 303 Stainless Steel
 Brake - Oil-Impregnated Steel

› **TORQUE:**

5-50 ozf in.

Other bores available on special order.



INCH COMPONENT

Catalog Number	Bore +.0005 -.0000
S9906A-G150-1	.1200
S9906A-G150-2	.1248
S9906A-G150-3	.1873
S9906A-G150-4	.2498

NOTE: Use with Hubless Gears of .125 FW. and .3750 bore.

PIN TYPE

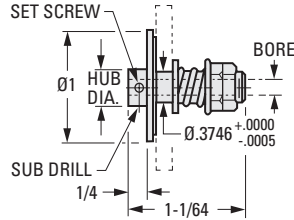
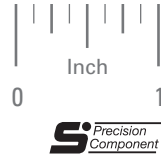
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> MATERIAL:

Housing - 303 Stainless Steel
Brake - Cork

> TORQUE:

5-50 ozf in.



INCH COMPONENT

Catalog Number	Bore +.0005 -.0000	Hub Diameter	Set Screw	Sub Drill
S9906A-MM2-02	.1248	.312	#2-56	.029
S9906A-MM2-03	.1873	.375	#4-40	.040
S9906A-MM2-04	.2498	.500	#6-32	.070

NOTE: Use with Hubless Gears of .125 F.W. and .3750 bore.

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> FEATURES:

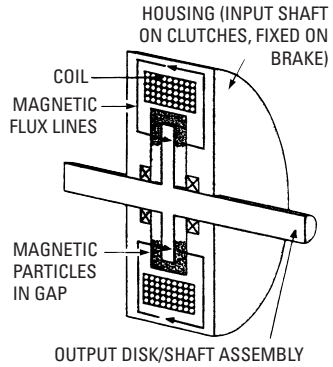
- Magnetic engagement without movement of mechanical parts.
- Smooth and silent.
- No backlash.
- Nearly linear torque vs. current.
- No friction surface to wear out.
- Ultrafast response.
- Low output inertia.
- High torque-to-size ratio.
- Infinitely adjustable torque.

> APPLICATIONS:

- Tensioning
- Stepping and Indexing
- Overload Protection
- Motor Testing
- Controlled Start / Stop

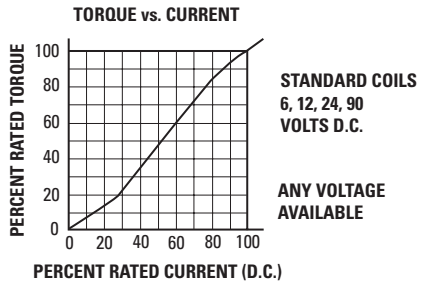
> HOW THE UNITS WORK:

The output disk/shaft assembly does not touch the housing. The gap in between is filled with a fine, dry stainless steel powder. The powder is free flowing, until a magnetic field is applied from the stationary coil. The powder particles form chains along the magnetic field lines, linking the disk to the housing. The torque is proportional to the magnetic field and, therefore, to the applied D.C. input current. Output torque is controlled by varying the D.C. input current. The torque vs. current curve is essentially linear, with a slight "S" shape.



While the input torque is less than the output torque, the brake or clutch won't slip. For brakes, the output shaft won't rotate. For clutches, the input shaft will be coupled to the output shaft, with no slip.

When the input torque is increased, the brake or clutch will slip smoothly at the torque level set by the coil input current. Output torque is independent of slip rpm.



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MAGNETIC PARTICLE CLUTCHES



ULTRAFAST RESPONSES
SOFT OR FAST START

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM

> COIL DATA:

Voltage: 24V DC

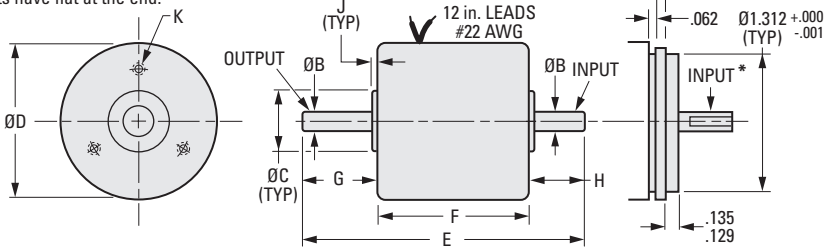
Voltagess other than 24 Volts DC available on special order.

> APPLICATIONS:

- Tensioning
- Overload Protection
- Torque Limiting Drives
- Controlled Starts (and stops with a separate brake)

The shaft becomes coupled to the output shaft with electrical excitation.

All shafts have flat at the end.



INCH COMPONENT

Catalog Number	B Shaft O.D. ±.0002	D Dia. ±.015	E Nom.	F ±.03	G ±.02	H ±.02	C Dia. +.000 -.001	J ±.01	K
* S90MPA-C14D19A	.1872	1.437 1.434	2.88	1.66	.59	.63	*.750	*.60	3 #3-48 1.140 B.C.
S90MPA-C23D31	.3122	2.250	4.40	2.50	1.07	.83	1.125	.08	2x3 #6-32 2.031 B.C.
S90MPA-C28D37	.3745	2.850	5.07	2.80	1.27	1.00	1.125	.09	2x3 #8-32 2.000 B.C.
S90MPA-C34D50	.4995	3.380	5.53	3.38	1.08	1.08	1.375	.08	2x4 #10-32 3.000 B.C.

* For input side see View A, threaded mount holes "K" are at output end only. This assembly is supplied with housing solder terminals with leads attached and with 3 mounting clamps for #4-40 screws on Ø1.72 B.C.

Catalog Number (Ref.)	Torque Range lbf in.	Elect. Power watts	Shaft Inertia lbf in. sec ²	Max. Speed rpm	Mech. Heat Dissipation watts	Max. Overhung Load lbf	Unforced Response msec.	Weight lb.
S90MPA-C14D19A	.06 – 2	3	26 x 10 ⁻⁷	2000	6	4	9	.7
S90MPA-C23D31	.12 – 5	5	13 x 10 ⁻⁶	2000	10	20	18	3.0
S90MPA-C28D37	.4 – 15	6	33 x 10 ⁻⁶	1400	20	35	25	5.0
S90MPA-C34D50	.6 – 35	10	15 x 10 ⁻⁵	1000	30	50	70	9.0

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MAGNETIC PARTICLE BRAKES

SDPSI

ZERO BACKLASH
LOW INERTIA
NO FRICTION SURFACE

PHONE: 516.328.3300 • FAX: 516.326.8827 • WWW.SDP-SI.COM

> COIL DATA:

Voltage: 24V DC

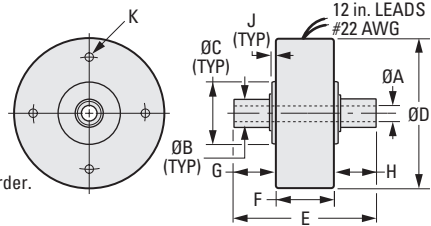
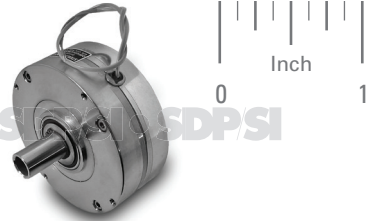
Voltagess other than 24 Volts DC available on special order.

> APPLICATIONS:

- Tensioning
- Controlled Stops
- Positioning
- Locking
- Motor Testing

The shaft becomes coupled to the housing with electrical excitation. The torque is proportional to the DC input current.

All models are available with the shaft on one end, on special order.



INCH COMPONENT

Catalog Number	A Dia. +.001 -.000	B Dia. ±.0002	C Dia. +.000 -.001	D Dia. ±.015	E ±.01	F ±.03	G ±.02	H ±.02	J ±.01	K
S90MPA-B28D37H38	.375	.4980	1.125	2.87	2.10	1.37	.47	.27	.08	3 ea. #8-32 on 2.000 B.C.
S90MPA-B34D50S	Solid	.4995	1.125	3.37	3.72	1.47	1.12	1.12	.09	4 ea. #10-32 on 3.000 B.C.
S90MPA-B34D50H38	.375	.4980	1.125	3.37	2.20	1.47	.47	.25	.09	4 ea. #10-32 on 3.000 B.C.
**S90MPA-B45D75S	Solid	.7495	1.875	4.50	3.53	1.77	1.42	.33	.11	4 ea. #10-32 on 4.228 B.C.
S90MPA-B45D75H50	.501	.7480	1.875	4.50	2.63	1.77	.52	.33	.11	4 ea. #10-32 on 4.228 B.C.
S90MPA-B47D75S	Solid	.7495	1.875	4.71	3.53	1.77	1.41	.33	.11	4 ea. #10-32 on 4.228 B.C.
S90MPA-B47D75H50	.501	.7480	1.875	4.71	2.63	1.77	.52	.33	.11	4 ea. #10-32 on 4.228 B.C.

** 3/16 keyway & flat, 90° oriented in respect to the keyway on the end of the shaft.

Catalog Number (Ref.)	Torque Range lbf in.	Elect. Power watts	Shaft Inertia lbf in. sec ²	Max. Speed rpm	Mech. Heat Dissipation watts	Max. Overhung Load lbf	Unforced Response msec.	Weight lb.
S90MPA-B28D37H38	.3 – 15	6	34 x 10 ⁻⁶	2000	20	25.0	25	2.5
S90MPA-B34D50S	.6 – 35	9	12 x 10 ⁻⁵	1800	30	50.0	35	4.0
S90MPA-B34D50H38	.6 – 35	9	12 x 10 ⁻⁵	1800	30	50.0	35	4.0
S90MPA-B45D75S	1 – 60	8	45 x 10 ⁻⁵	1800	50	100.0	85	7.0
S90MPA-B45D75H50	1 – 60	8	45 x 10 ⁻⁵	1800	50	100.0	85	7.0
S90MPA-B47D75S	2.5 – 115	13	61 x 10 ⁻⁵	1800	55	120.0	90	8.0
S90MPA-B47D75H50	2.5 – 115	13	61 x 10 ⁻⁵	1800	55	120.0	90	8.0

