SPRING-WRAPPED SLIP CLUTCHES

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 ± 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:
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.

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:

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

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.

Limit Torque Ratio = \( \frac{50}{120} = 0.42 \)

From “Life Expectancy Curves” for 100 rpm & 0.42 ratio:

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

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

### Typical Element Life

(Standard Catalog Models)

<table>
<thead>
<tr>
<th>rpm</th>
<th>Torque</th>
<th>Hours of Continuous Slip in Each Direction</th>
<th>Hours of Operation Duty Cycle: 1 Sec. Slip, 1 Sec. Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1/2 Upper Limit Upper Limit</td>
<td>3,070, 1,420</td>
<td>6,500, 3,040</td>
</tr>
<tr>
<td>50</td>
<td>1/2 Upper Limit Upper Limit</td>
<td>1,420, 620</td>
<td>3,040, 1,420</td>
</tr>
<tr>
<td>100</td>
<td>1/2 Upper Limit Upper Limit</td>
<td>620, 250</td>
<td>1,420, 620</td>
</tr>
<tr>
<td>200</td>
<td>1/2 Upper Limit Upper Limit</td>
<td>250, 100</td>
<td>620, 250</td>
</tr>
</tbody>
</table>

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 \( P = 0.00074 \text{ TN} \)

Cycle Slip \( P = 0.00074 \text{ TNC} \)

where:

\[ P = \frac{T}{N} \times \frac{C}{1} \]

\[ T = \text{Slip Torque [ozf in.]} \]

\[ N = \text{Average Slip Speed [rpm]} \]

\[ C = \text{Duration of Slip / Cycle} \]

\[ \text{Duration of Cycle} \]
**UNWIND TENSION CONTROL**

Brake mounted on shaft of unwind spool or bobbin.

Information required: (Example)
- **Full diameter** = 6 in.
- **Empty core diameter** = 3 in.
- **Average tension** = 1 lbf
- **Velocity** = 150 ft./min.

How to size:
- Avg. radius = (Full roll dia. + Empty dia.) / 4
  
  = (6 + 3) / 4 = 2.25 in.
- Avg. torque (lbf in.) = avg. tension (lbf) x avg. radius
  
  (in.) = 1 x 2.25 = 2.25 lbf in.

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 \(\pi\))
  
  = (150 ft./min.) / (0.25 feet x \(\pi\))

  = 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:
- Torque (lbf in.) = Tension x Radius
  
  = 2.5 lbf x (3 in.) / 2 = 3.75 lbf in.

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 \(\pi\)) = 382 rpm
   - 382 rpm is too high for continuous duty on the S90MCC-MTL37505 unit.
3. Select Catalog Number S90MCC-MTL62510

Film Tensioning - Constant tensioning supplied by hysteresis unit.
**CYCLING**

Bottle Capping - Constant torque provided by a hysteresis clutch.

**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:
- Torque (lbf in.) = (Motor hp x 63000) / Motor rpm
  = (1/10 hp x 63000) / 900 = 7 lbf in.

**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.
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.

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.
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.
### INCH COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>B Shaft Dia.</th>
<th>A Shaft Length</th>
<th>Torque Range lbf in.</th>
<th>Weight lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90MCC-5130151</td>
<td>3/16</td>
<td>.51</td>
<td>.003 – .018</td>
<td>.16</td>
</tr>
<tr>
<td>S90MCC-5130198</td>
<td>3/16</td>
<td>.98</td>
<td>.003 – .018</td>
<td>.16</td>
</tr>
<tr>
<td>S90MCC-5130651</td>
<td>3/16</td>
<td>.51</td>
<td>.010 – .060</td>
<td>.16</td>
</tr>
<tr>
<td>S90MCC-5130698</td>
<td>3/16</td>
<td>.98</td>
<td>.010 – .060</td>
<td>.16</td>
</tr>
<tr>
<td>S90MCC-5131351</td>
<td>3/16</td>
<td>.51</td>
<td>.010 – .130</td>
<td>.16</td>
</tr>
<tr>
<td>S90MCC-5131398</td>
<td>3/16</td>
<td>.98</td>
<td>.010 – .130</td>
<td>.16</td>
</tr>
</tbody>
</table>

**MAGNETIC CLUTCHES & COUPLINGS**

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

**MATERIAL:**
- Housing and Shaft - Stainless Steel

---

![Image of a component with dimensions and specifications](image-url)
### MATERIAL:
- **Housing** - Aluminum, Black Anodized Finish
- **Dial** - Steel, Black Oxide Finish

#### INCH COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Bore .001 - .000</th>
<th>L</th>
<th>L₁</th>
<th>D</th>
<th>d</th>
<th>A</th>
<th>Torque Range lbf in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90MCC-MTL25001</td>
<td>.250</td>
<td>1.65</td>
<td>1.42</td>
<td>1.87</td>
<td>1.95</td>
<td>.866</td>
<td>.06 – 1.25</td>
</tr>
<tr>
<td>S90MCC-MTL37505</td>
<td>.375</td>
<td>2.44</td>
<td>2.12</td>
<td>2.71</td>
<td>2.76</td>
<td>1.378</td>
<td>.18 – 5.00</td>
</tr>
<tr>
<td>S90MCC-MTL37510</td>
<td>.375</td>
<td>2.52</td>
<td>2.20</td>
<td>3.23</td>
<td>3.31</td>
<td>1.850</td>
<td>.50 – 10.60</td>
</tr>
<tr>
<td>S90MCC-MTL37525</td>
<td>.375</td>
<td>3.11</td>
<td>2.67</td>
<td>4.57</td>
<td>4.68</td>
<td>2.441</td>
<td>1.00 – 25.00</td>
</tr>
<tr>
<td>S90MCC-MTL50010</td>
<td>.500</td>
<td>2.52</td>
<td>2.20</td>
<td>3.23</td>
<td>3.31</td>
<td>1.850</td>
<td>.50 – 10.60</td>
</tr>
<tr>
<td>S90MCC-MTL50025</td>
<td>.500</td>
<td>3.11</td>
<td>2.67</td>
<td>4.57</td>
<td>4.68</td>
<td>2.441</td>
<td>1.00 – 25.00</td>
</tr>
<tr>
<td>S90MCC-MTL62510</td>
<td>.625</td>
<td>2.52</td>
<td>2.20</td>
<td>3.23</td>
<td>3.31</td>
<td>1.850</td>
<td>.50 – 10.60</td>
</tr>
<tr>
<td>S90MCC-MTL62525</td>
<td>.625</td>
<td>3.11</td>
<td>2.67</td>
<td>4.57</td>
<td>4.68</td>
<td>2.441</td>
<td>1.00 – 25.00</td>
</tr>
</tbody>
</table>

#### SET SCREW
- (3X) TAPPED HOLES ON BOTH ENDS
- SET SCREW 2 PLACES 90° APART
- ØB THRU WITH KEYWAY (.625 BORE ONLY)

#### Keyway
- Approx. Weight lb.
  - S90MCC-MTL25001 | M4 | .31 | 1.260 | 2 | .73 |
  - S90MCC-MTL37505 | M5 | .39 | 1.890 | 2.28 |
  - S90MCC-MTL37510 | M5 | .39 | 2.375 | 3.57 |
  - S90MCC-MTL37525 | M5 | .47 | 3.000 | 8.95 |
  - S90MCC-MTL50010 | M5 | .47 | 3.000 | 3.57 |
  - S90MCC-MTL50025 | M5 | .39 | 2.375 | 8.95 |
  - S90MCC-MTL62510 | M5 | .47 | 3.000 | 3.57 |
  - S90MCC-MTL62525 | M5 | .47 | 3.000 | 8.95 |
MAGNETIC CLUTCHES & COUPLINGS

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

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

▶ MATERIAL:
Housing - Aluminum, Black Anodized Finish
Dial - Steel, Black Oxide Finish

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>B Bore</th>
<th>Torque Range</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90MCC-80610</td>
<td>.625</td>
<td>3 – 70</td>
<td>14.2</td>
</tr>
<tr>
<td>S90MCC-80612</td>
<td>.750</td>
<td>3 – 70</td>
<td>14.2</td>
</tr>
<tr>
<td>S90MCC-80614</td>
<td>.875</td>
<td>3 – 70</td>
<td>14.2</td>
</tr>
</tbody>
</table>
TECHNICAL INFORMATION

› FEATURES:
  Torque proportional to input current.
  Torque virtually independent of slip speed.
  Smooth stable, noise-free operation.
  Long-life no-wearing components.
  Maintenance-free.
  Infinitely adjustable.

› APPLICATIONS:
  Tensioning of wire, cable, films, paper, etc.
  Positioning of fuel flow controls, film processors
  Braking for motors and dereeling
  Load simulation for motor testing, fuse testing, etc.

› OPTIONS:
  Nonstandard coil voltages
  Special mounting configurations
  Modified shafts

Hysteresis clutches provide an efficient, smooth, electrically controllable link between a motor and a load. While presenting integral ball bearing supported input and output shafts, the clutch features a field (electromagnet) assembly that is prevented from rotating by fixing to a bulkhead. When the coil is energized, the input and output shafts are coupled by magnetic fluxes, thus driving the load. The torque transmitted is proportional to the current supplied to the device.

› TORQUE AS A FUNCTION OF INPUT CURRENT:

When a field setting is approached from zero current, it will produce less torque than if approached from prior current because of residual magnetism. Accurate and repeatable torque outputs are delivered when the setting is approached from the same direction.
APPLICATION EXAMPLE:
To select a brake to tension a 7-inch (178 mm) diameter pay-off reel in a system requiring total (web or strand) tension of 2 lbf (8.9 N) and a process speed of 600 FPM.

**BRAKE TORQUE**  
\[ T = \text{Force (F)} \times \text{Radius (D/2)} \]

- \[ T = 2 \text{ lbf} (8.9 \text{ N}) \times 3.5 \text{ in.} (88.9 \text{ mm}) = 7 \text{ lbf in.} (791 \text{ Nmm}) \]
- \[ T = 32 \text{ ozf} \times 3.5 \text{ in.} (88.9 \text{ mm}) = 112 \text{ ozf in.} \]

**SLIP SPEED**  
\[ \text{rpm} = \frac{\text{Linear velocity (V) (in./min.)}}{\text{Circumference (in.)}} \]
\[ \text{or} \]  
\[ \text{rpm} = \frac{\text{Linear velocity (V) (mm/min.)}}{\text{Circumference (mm)}} \]

- \[ \text{rpm} = \frac{600 \text{ ft./min.} \times 12}{\pi \times 7 \text{ in.}} \]  
- \[ \text{rpm} = 327 \]

**ENERGY**  
\[ W = (T \times \text{rpm}) \times \frac{1}{63025} \times 746 \]
\[ W = (7 \text{ lbf in.} \times 327 \text{ rpm}) \times \frac{1}{63025} \times 746 = 27 \text{ watts} \]

Quick Check: The curves to the left can be used as a quick check to verify the kinetic power calculation. Simply locate the required torque on the vertical axis, move horizontally until you intersect the appropriate speed line, and then read vertically (up or down) to obtain the resulting watts or horsepower.

Selection: From the data on the following pages it can be seen that an S90HYB-120024 Hysteresis Brake which has a rated torque of 120 ozf in. (847 Nmm), a maximum speed capability of 12000 rpm, and an energy dissipation capability of 75 watts continuous, would be the proper selection for this application.

Note: In a clutch application, slip speed is the difference in rotational speed between the input and output members of the clutch assembly. In the above example, tensioning was being accomplished with a clutch inserted between a take-up reel and a motor driving at 500 rpm. The actual slip used to compute the energy dissipation requirements would be 500 rpm (clutch input speed) - 327 rpm (clutch output speed = 173 rpm). This difference in speed would obviously impact the result for energy dissipation.
HYSTERESIS CLUTCHES

MAINTENANCE-FREE
INFINITELY ADJUSTABLE
TORQUE INDEPENDENT OF SLIP SPEED

**COIL DATA:**
Voltage: 24V DC

Maximum recommended speed is 3600 rpm

---

### INCH COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number *</th>
<th>Min. Static Torque @ rated V DC oz in.</th>
<th>Max. Drag Torque De-Energized &amp; Degaussed ozf in.</th>
<th>Max. Wattage @ rated V DC @ 25°C</th>
<th>Input Inertia lbf in. sec</th>
<th>Output Inertia lbf in. sec</th>
<th>Max. Dissipation Capacity Watts</th>
<th>A Dia. ±.015</th>
<th>B Dia. +.0000 -.0005</th>
<th>C Dia. +.0000 -.0005</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90HYC-231A19</td>
<td>30.0</td>
<td>.70</td>
<td>8</td>
<td>8.3 x 10^-3</td>
<td>1.4 x 10^-3</td>
<td>20</td>
<td>2.312</td>
<td>.1875</td>
<td>.3750</td>
</tr>
<tr>
<td>S90HYC-500A50</td>
<td>200.0</td>
<td>2.50</td>
<td>8</td>
<td>271.0 x 10^-3</td>
<td>44.5 x 10^-3</td>
<td>120</td>
<td>5.000</td>
<td>5.000</td>
<td>7.497</td>
</tr>
<tr>
<td>S90HYC-638A50</td>
<td>400.0</td>
<td>7.00</td>
<td>8</td>
<td>860.0 x 10^-3</td>
<td>128.5 x 10^-3</td>
<td>150</td>
<td>6.375</td>
<td>5.000</td>
<td>7.497</td>
</tr>
</tbody>
</table>

* To be discontinued when present stock is depleted.

---

*Ref.*

<table>
<thead>
<tr>
<th>D Dia. +.0000 -.0005</th>
<th>E ±.005</th>
<th>F ±.015</th>
<th>G Min. ±.005</th>
<th>H ±.015</th>
<th>J ±.015</th>
<th>K</th>
<th>L Min.</th>
<th>M Dia. ±.025</th>
<th>N ±.010</th>
<th>P ±.010</th>
<th>R ±.010</th>
<th>Weight lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90HYC-231A19</td>
<td>.8750</td>
<td>.020</td>
<td>.375</td>
<td>.75</td>
<td>.125</td>
<td>.125</td>
<td>1.775</td>
<td>.6-32</td>
<td>.250</td>
<td>1.250</td>
<td>1.250</td>
<td>3.920</td>
</tr>
<tr>
<td>S90HYC-500A50</td>
<td>1.6250</td>
<td>.030</td>
<td>1.000</td>
<td>1.25</td>
<td>.220</td>
<td>.220</td>
<td>2.750</td>
<td>#10-32</td>
<td>.562</td>
<td>2.500</td>
<td>4.500</td>
<td>6.815</td>
</tr>
<tr>
<td>S90HYC-638A50</td>
<td>1.6250</td>
<td>.030</td>
<td>1.000</td>
<td>1.25</td>
<td>.220</td>
<td>.220</td>
<td>3.220</td>
<td>#10-32</td>
<td>.562</td>
<td>2.500</td>
<td>4.930</td>
<td>7.245</td>
</tr>
</tbody>
</table>

---
CLUTCH & BRAKE TECHNICAL INFORMATION

> 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:

<table>
<thead>
<tr>
<th>Material</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronze</td>
<td>1.05</td>
</tr>
<tr>
<td>Steel</td>
<td>1.00</td>
</tr>
<tr>
<td>Iron</td>
<td>.92</td>
</tr>
<tr>
<td>Powdered Metal Bronze</td>
<td>.79</td>
</tr>
<tr>
<td>Powdered Metal Iron</td>
<td>.88</td>
</tr>
<tr>
<td>Aluminum</td>
<td>.35</td>
</tr>
<tr>
<td>Nylon</td>
<td>.17</td>
</tr>
</tbody>
</table>

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)

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

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.

<table>
<thead>
<tr>
<th>Dia. in.</th>
<th>WR² lbf in.²</th>
<th>Dia. in.</th>
<th>WR² lbf in.²</th>
<th>Dia. in.</th>
<th>WR² lbf in.²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>.00011</td>
<td>7</td>
<td>66.816</td>
<td>13</td>
<td>803.52</td>
</tr>
<tr>
<td>3/8</td>
<td>.00055</td>
<td>7-1/4</td>
<td>77.04</td>
<td>13-1/4</td>
<td>858.24</td>
</tr>
<tr>
<td>1/2</td>
<td>.00173</td>
<td>7-1/2</td>
<td>87.984</td>
<td>13-1/2</td>
<td>924.48</td>
</tr>
<tr>
<td>3/4</td>
<td>.00864</td>
<td>7-3/4</td>
<td>100.656</td>
<td>13-3/4</td>
<td>995.04</td>
</tr>
<tr>
<td>1</td>
<td>.0288</td>
<td>8</td>
<td>113.904</td>
<td>14</td>
<td>1068.48</td>
</tr>
<tr>
<td>1-1/4</td>
<td>.072</td>
<td>8-1/4</td>
<td>128.88</td>
<td>14-1/4</td>
<td>1147.68</td>
</tr>
<tr>
<td>1-1/2</td>
<td>.144</td>
<td>8-1/2</td>
<td>144.00</td>
<td>14-1/2</td>
<td>1229.75</td>
</tr>
<tr>
<td>1-3/4</td>
<td>.288</td>
<td>8-3/4</td>
<td>162.72</td>
<td>14-3/4</td>
<td>1317.60</td>
</tr>
<tr>
<td>2</td>
<td>.432</td>
<td>9</td>
<td>182.88</td>
<td>15</td>
<td>1404.00</td>
</tr>
<tr>
<td>2-1/4</td>
<td>.72</td>
<td>9-1/4</td>
<td>203.04</td>
<td>16</td>
<td>1815.84</td>
</tr>
<tr>
<td>2-1/2</td>
<td>1.152</td>
<td>9-1/2</td>
<td>223.20</td>
<td>17</td>
<td>2314.08</td>
</tr>
<tr>
<td>2-3/4</td>
<td>1.584</td>
<td>9-3/4</td>
<td>252.00</td>
<td>18</td>
<td>2910.24</td>
</tr>
<tr>
<td>3</td>
<td>2.304</td>
<td>10</td>
<td>277.92</td>
<td>19</td>
<td>3611.52</td>
</tr>
<tr>
<td>3-1/2</td>
<td>4.176</td>
<td>10-1/4</td>
<td>306.72</td>
<td>20</td>
<td>4433.76</td>
</tr>
<tr>
<td>3-3/4</td>
<td>5.472</td>
<td>10-1/2</td>
<td>338.40</td>
<td>21</td>
<td>5389.92</td>
</tr>
<tr>
<td>4</td>
<td>7.056</td>
<td>10-3/4</td>
<td>371.52</td>
<td>22</td>
<td>6492.96</td>
</tr>
<tr>
<td>4-1/4</td>
<td>9.072</td>
<td>11</td>
<td>407.52</td>
<td>23</td>
<td>7757.28</td>
</tr>
<tr>
<td>4-1/2</td>
<td>11.376</td>
<td>11-1/4</td>
<td>444.96</td>
<td>24</td>
<td>9195.84</td>
</tr>
<tr>
<td>5</td>
<td>17.28</td>
<td>11-1/2</td>
<td>486.72</td>
<td>25</td>
<td>10827.36</td>
</tr>
<tr>
<td>5-1/2</td>
<td>25.488</td>
<td>11-3/4</td>
<td>529.92</td>
<td>26</td>
<td>12666.24</td>
</tr>
<tr>
<td>6</td>
<td>36.00</td>
<td>12</td>
<td>576.00</td>
<td>27</td>
<td>14731.20</td>
</tr>
<tr>
<td>6-1/4</td>
<td>42.624</td>
<td>12-1/4</td>
<td>626.40</td>
<td>28</td>
<td>17036.64</td>
</tr>
<tr>
<td>6-1/2</td>
<td>49.68</td>
<td>12-1/2</td>
<td>679.68</td>
<td>29</td>
<td>19604.16</td>
</tr>
<tr>
<td>6-3/4</td>
<td>57.888</td>
<td>12-3/4</td>
<td>735.84</td>
<td>30</td>
<td>22452.48</td>
</tr>
</tbody>
</table>
**Shaft-Mounted Clutches S90CS9 Series**

- **Prime Mover**
- **Rotor**
- **Antirotation Tab**
- **Field**
- **Armature**
- **Gear or Pulley**
- **Hub**
- **Belt or Chain**
- **Load**

**Flange-Mounted Clutches S90CF9 Series**

- **Prime Mover**
- **Rotor**
- **Antirotation Tab**
- **Field**
- **Armature**
- **Gear or Pulley**
- **Hub**
- **Belt or Chain**
- **Load**

**Shaft-Mounted Clutch Couplings S90CSC Series**

- **Prime Mover**
- **Rotor**
- **Belt or Chain**
- **Hub**
- **Antirotation Tab**
- **Field**
- **Armature**
- **Load**

**Flange-Mounted Clutch Couplings S90CFC Series**

- **Prime Mover**
- **Rotor**
- **Belt or Chain**
- **Hub**
- **Antirotation Tab**
- **Field**
- **Armature**
- **Load**
Other voltages and dissimilar bore combinations are available on special order.

### INCH COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Static Torque lbf in.</th>
<th>Nom. Resist. ohms</th>
<th>Max. Armature Inertia lbf in. sec²</th>
<th>Rotor Inertia lbf in. sec²</th>
<th>Energy Dissipation lbf ft./min.</th>
<th>Armature Engagements maec</th>
<th>Disengagement maec</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90CS9-11A0404</td>
<td>5</td>
<td>128</td>
<td>5</td>
<td>3.5 x 10⁻⁴</td>
<td>2.6 x 10⁻⁴</td>
<td>175</td>
<td>5</td>
</tr>
<tr>
<td>S90CS9-11A0505</td>
<td>5</td>
<td>128</td>
<td>5</td>
<td>3.5 x 10⁻⁴</td>
<td>2.6 x 10⁻⁴</td>
<td>175</td>
<td>5</td>
</tr>
<tr>
<td>S90CS9-15A0404</td>
<td>10</td>
<td>130</td>
<td>5</td>
<td>5.9 x 10⁻⁴</td>
<td>5.2 x 10⁻⁴</td>
<td>295</td>
<td>8</td>
</tr>
<tr>
<td>S90CS9-15A0505</td>
<td>10</td>
<td>130</td>
<td>5</td>
<td>5.9 x 10⁻⁴</td>
<td>5.2 x 10⁻⁴</td>
<td>295</td>
<td>8</td>
</tr>
<tr>
<td>S90CS9-17A0404</td>
<td>15</td>
<td>108</td>
<td>6</td>
<td>7.3 x 10⁻⁴</td>
<td>11.4 x 10⁻⁴</td>
<td>420</td>
<td>10</td>
</tr>
<tr>
<td>S90CS9-17A0505</td>
<td>15</td>
<td>108</td>
<td>6</td>
<td>7.3 x 10⁻⁴</td>
<td>11.4 x 10⁻⁴</td>
<td>420</td>
<td>10</td>
</tr>
<tr>
<td>S90CS9-22A0606</td>
<td>40</td>
<td>75</td>
<td>8.5</td>
<td>33.4 x 10⁻⁴</td>
<td>32.3 x 10⁻⁴</td>
<td>1400</td>
<td>12</td>
</tr>
<tr>
<td>S90CS9-26A0808</td>
<td>80</td>
<td>65</td>
<td>9.5</td>
<td>80.0 x 10⁻⁴</td>
<td>62.0 x 10⁻⁴</td>
<td>2600</td>
<td>15</td>
</tr>
<tr>
<td>S90CS9-30A1010</td>
<td>125</td>
<td>44</td>
<td>15</td>
<td>180.0 x 10⁻⁴</td>
<td>203.0 x 10⁻⁴</td>
<td>2900</td>
<td>18</td>
</tr>
</tbody>
</table>

* Typical torque after burnishing; units shipped burnished.

** For Catalog Number:
- 11A0404, 11A0505, initial working air gap at installation shall be .004/.009.
- 15A0404, 15A0505, initial working air gap at installation shall be .004/.009.
- 17A0404, 17A0505, initial working air gap at installation shall be .004/.009.
- 22A0606, 26A0808, initial working air gap at installation shall be .006/.013.
- 30A1010, initial working air gap at installation shall be .006/.013.

Δ Keyway not available in rotor.

§ No knurl available; S90CS9-26A supplied with (3) #8-32 holes on a 0.1375 B.C.
S90CS9-30A supplied with (3) #8-32 holes on a 0.1750 B.C.
COIL DATA:
Voltage: 24V DC

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

Keyway Dimensions

<table>
<thead>
<tr>
<th>Bore</th>
<th>.250</th>
<th>.375</th>
<th>.500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>.062</td>
<td>.094</td>
<td>.125</td>
</tr>
<tr>
<td>Height</td>
<td>.286</td>
<td>.425</td>
<td>.564</td>
</tr>
</tbody>
</table>

INCH COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Static Torque lbf in.</th>
<th>Max. wattage</th>
<th>Armature Inertia lbf in. sec²</th>
<th>Rotor Inertia lbf in. sec²</th>
<th>Energy Dissipation lbf in./min.</th>
<th>Armature Engagement msec</th>
<th>Disengagement msec</th>
<th>R Bore</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90CF9-11A0404</td>
<td>5</td>
<td>5.0</td>
<td>3.5 x 10⁻⁵</td>
<td>2.5 x 10⁻⁵</td>
<td>175</td>
<td>5</td>
<td>18</td>
<td>.250</td>
</tr>
<tr>
<td>S90CF9-15A0404</td>
<td>10</td>
<td>8.5</td>
<td>5.9 x 10⁻⁵</td>
<td>5.0 x 10⁻⁵</td>
<td>285</td>
<td>8</td>
<td>22</td>
<td>.375</td>
</tr>
<tr>
<td>S90CF9-22A0606</td>
<td>40</td>
<td>10.0</td>
<td>33.4 x 10⁻⁵</td>
<td>31.7 x 10⁻⁵</td>
<td>1400</td>
<td>12</td>
<td>32</td>
<td>.500</td>
</tr>
<tr>
<td>S90CF9-26A0606</td>
<td>80</td>
<td>9.5</td>
<td>80.0 x 10⁻⁵</td>
<td>64.0 x 10⁻⁵</td>
<td>2600</td>
<td>15</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

* Typical torque after burnishing; units shipped burnished.
** For Catalog Number:
-11A0404, initial working air gap at installation shall be .004/.009.
-15A0404, -17A0404, -22A0606, -26A0606, -26A0808, initial working air gap at installation shall be .006/.013.
Keyway not available in rotor.
No knurl available; S90CF9-26A supplied with (3) #8-32 holes on a Ø1.375 B.C.
MAGNETIC PARTICLE CLUTCHES & BRAKES

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.

MAGNETIC PARTICLE CLUTCHES

ULTRAFAST RESPONSES
SOFT OR FAST START

› COIL DATA:
Voltage: 24V DC

Voltages 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

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>B Shaft O.D. ± .0002</th>
<th>D Dia. ± .015</th>
<th>E Nom.</th>
<th>F ± .03</th>
<th>G ± .02</th>
<th>H ± .02</th>
<th>C Dia. +.000 - .001</th>
<th>J ± .01</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>* S90MPA-C14D19A</td>
<td>.1872</td>
<td>1.437 1.434</td>
<td>2.88</td>
<td>1.66</td>
<td>.59</td>
<td>.63</td>
<td>*.750</td>
<td>*.60</td>
<td>3 #3-48 1.140 B.C.</td>
</tr>
<tr>
<td>S90MPA-C23D31</td>
<td>.3122</td>
<td>2.650 2.640</td>
<td>4.40</td>
<td>2.50</td>
<td>1.07</td>
<td>.83</td>
<td>1.125</td>
<td>.08</td>
<td>2x3 #6-32 2.031 B.C.</td>
</tr>
<tr>
<td>S90MPA-C28D37</td>
<td>.3745</td>
<td>2.850 2.840</td>
<td>5.07</td>
<td>2.80</td>
<td>1.27</td>
<td>1.00</td>
<td>1.125</td>
<td>.09</td>
<td>2x3 #6-32 2.000 B.C.</td>
</tr>
<tr>
<td>S90MPA-C34D50</td>
<td>.4995</td>
<td>3.380 3.360</td>
<td>5.53</td>
<td>3.38</td>
<td>1.08</td>
<td>1.08</td>
<td>1.375</td>
<td>.08</td>
<td>2x4 #10-32 3.000 B.C.</td>
</tr>
<tr>
<td>S90MPA-C45D75</td>
<td>**.7495</td>
<td>5.000 4.980</td>
<td>6.50</td>
<td>3.67</td>
<td>1.46</td>
<td>1.37</td>
<td>1.625</td>
<td>.13</td>
<td>2x4 #10-32 4.228 B.C.</td>
</tr>
<tr>
<td>S90MPA-C52D75</td>
<td>**.7495</td>
<td>5.200 5.180</td>
<td>6.61</td>
<td>3.67</td>
<td>1.46</td>
<td>1.48</td>
<td>Δ2.000</td>
<td>.13</td>
<td>2x4 1/4-20 4.812 B.C.</td>
</tr>
</tbody>
</table>

* 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.
** Shaft has 3/16 Keyway at 90° from flat (both ends)
Δ C Tolerance +.000 / -.002

---

Catalog Number

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S90MPA-C14D19A</td>
<td>.06 – 2</td>
<td>3</td>
<td>26 x 10⁻³</td>
<td>2000</td>
<td>6</td>
<td>4</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>S90MPA-C23D31</td>
<td>.12 – 5</td>
<td>5</td>
<td>13 x 10⁻³</td>
<td>2000</td>
<td>10</td>
<td>20</td>
<td>18</td>
<td>3.0</td>
</tr>
<tr>
<td>S90MPA-C28D37</td>
<td>.4 – 15</td>
<td>6</td>
<td>33 x 10⁻³</td>
<td>1400</td>
<td>20</td>
<td>35</td>
<td>25</td>
<td>5.0</td>
</tr>
<tr>
<td>S90MPA-C34D50</td>
<td>.6 – 35</td>
<td>10</td>
<td>15 x 10⁻³</td>
<td>1000</td>
<td>30</td>
<td>50</td>
<td>70</td>
<td>9.0</td>
</tr>
<tr>
<td>S90MPA-C45D75</td>
<td>1 – 70</td>
<td>14</td>
<td>66 x 10⁻³</td>
<td>1000</td>
<td>50</td>
<td>80</td>
<td>90</td>
<td>17.0</td>
</tr>
<tr>
<td>S90MPA-C52D75</td>
<td>4 – 130</td>
<td>15</td>
<td>15 x 10⁻³</td>
<td>1000</td>
<td>80</td>
<td>80</td>
<td>130</td>
<td>22.0</td>
</tr>
</tbody>
</table>