MAGNETIC PARTICLE SLIP CLUTCHES

Design:
The magnetic particle slip clutch uses a sealed, steel outer housing and permanent magnets arranged alternately (north and south poles) around a central hub. The space between the housing and the magnets is filled with a ferromagnetic compound (hysteresis particles). The particles align themselves along the flux pattern between the steel housing and the magnets, creating a magnetic coupling between them. (See Fig. 1)

The torque rating is determined by the number of particles added. The clutches can be manufactured in the range from 2.82 to 39.55 N • cm. Because the coupling is magnetic, torque value remains stable over time, temperature and speed value.

Applications:
One of the applications is for paper feeding devices on scanners, copy machines and fax machines. Paper is an abrasive material. Pages often stick together and usually the thickness of the paper is different. The paper feeding device uses a powered roller to "urge" the top sheet off an infeed stack toward the interface between a second pair of rollers just beyond the urging mechanism. On the second pair, one of the rollers is powered; the second is unpowered, spring-loaded against the first and rides on a shaft linked to the chassis through the magnetic particle clutch. With no paper in the feeder mechanism, the clutch slips; when a single page is drawn between rollers, friction between the rollers and the paper remains high enough to maintain slippage and paper passes through the mechanism normally.

If two or more pages are drawn in, the coefficient of friction between the pages is not high enough to drive the unpowered roller. The slip clutch now acts as a drag brake holding back the lower roller. The roller stalls, preventing all but the top page from continuing through the feed device.

Fig. 1
Reversible Magnetic Particle Slip Clutch
MAGNETIC PARTICLE SLIP CLUTCHES

ZERO MAINTENANCE
CONSTANT TORQUE LEVELS

▶ MATERIAL:
Shell - Steel
End Caps - Plastic

▶ FEATURES:
Requires no power
Uses permanent magnets and magnetic particles
Long operational life
Sealed from contamination

▶ SPECIFICATIONS:
d Tolerances:
Fig. 1: +0.1/0
Fig. 2: +0.022/0

* D1 Tolerance: 0/-0.033 (h8)

** Optional torques available only by special order.

When the slip clutch is to be subjected to any radial or axial thrust, use of the ball bearing design is required.
Units should be used on horizontal shafts only.

### METRIC COMPONENT

| Catalog Number | d Bore | d1 | D Hub Dia. | D1 Hub Dia. | D2 | l | l1 | End Lgth. | L Total Lgth. | Max. Allowable Speed rpm | +10% Nominal Opt. Range** | Torque Nominal N•m | Weight kg |
|----------------|--------|----|------------|-------------|----|----|----|-----------|-----------------|-----------------|-------------------------|------------------------|----------------|----------|
| S90APLMP08030028 | 8      | –  | 17  | 20  | 20  | 2.5 | 27.5 | 300       | 0.030 – 0.040 N•m | 0.019 – 0.040 N•m | 0.025                  |                        |            |
| S90APLMP08060028 | 8      | –  | 17  | 20  | 20  | 2.5 | 27.5 | 300       | 0.060 – 0.060 N•m | 0.040 – 0.060 N•m | 0.025                  |                        |            |
| S90APLMP08120035 | 8      | –  | 17  | 20  | 27  | 2.5 | 34.5 | 250       | 0.120 – 0.120 N•m | 0.060 – 0.120 N•m | 0.030                  |                        |            |

Fig. 1 Plastic Bearings

| Catalog Number | d Bore | d1 | D Hub Dia. | D1 Hub Dia. | D2 | l | l1 | End Lgth. | L Total Lgth. | Max. Allowable Speed rpm | +10% Nominal Opt. Range** | Torque Nominal N•m | Weight kg |
|----------------|--------|----|------------|-------------|----|----|----|-----------|-----------------|-----------------|------------------------|------------------------|----------------|----------|
| S90APLMS08099037 | 8      | 10 | 20* | 32  | 30  | 2  | 37  | 400       | 0.099 – 0.120 N•m | 0.070 – 0.099 N•m | 0.120                  |                        |            |
| S90APLMS08150037 | 8      | 10 | 20* | 32  | 32  | 2  | 37  | 400       | 0.150 – 0.150 N•m | 0.099 – 0.150 N•m | 0.120                  |                        |            |
| S90APLMS08199044 | 8      | 10 | 20* | 32  | 37  | 2  | 44  | 400       | 0.199 – 0.200 N•m | 0.150 – 0.199 N•m | 0.150                  |                        |            |
| S90APLMS08301044 | 8      | 10 | 20* | 32  | 37  | 2  | 44  | 300       | 0.301 – 0.301 N•m | 0.199 – 0.301 N•m | 0.150                  |                        |            |

Fig. 2 Ball Bearings

** EQ. SP. ON A Ø26 ± 0.2 B.C.

M3 x 0.5 (3x)

2.4 ± 0.1
MAGNETIC PARTICLE SLIP CLUTCHES WITH SHAFT

ZERO MAINTENANCE
CONSTANT TORQUE LEVELS
INTEGRAL SHAFT

**MATERIAL:**
- Shell - Steel
- End Caps - Plastic
- Shafts - Steel

**FEATURES:**
- Requires no power
- Uses permanent magnets and magnetic particles
- Long operational life

*Optional torques available only by special order.

---

**METRIC COMPONENT**

<table>
<thead>
<tr>
<th>Catalog Number **</th>
<th>D Shaft Dia. 0 - 0.03</th>
<th>D1 Hub Dia.</th>
<th>D2</th>
<th>S</th>
<th>/</th>
<th>Max. Allowable Speed rpm</th>
<th>± 10% Torque Nominal</th>
<th>Opt. Range* N • m</th>
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</thead>
<tbody>
<tr>
<td><strong>Fig. 1 Plastic Bearings</strong></td>
<td></td>
<td></td>
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<tr>
<td>S90BPLMP08030025</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>2.4</td>
<td>20</td>
<td>300</td>
<td>0.030</td>
<td>0.019 - 0.040</td>
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<tr>
<td>S90BPLMP08060025</td>
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<td>15</td>
<td>20</td>
<td>2.4</td>
<td>20</td>
<td>300</td>
<td>0.060</td>
<td>0.040 - 0.060</td>
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<tr>
<td>S90BPLMP08120032</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>2.4</td>
<td>27</td>
<td>250</td>
<td>0.120</td>
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<td>S90BPLMP08181039</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>2.4</td>
<td>34</td>
<td>200</td>
<td>0.181</td>
<td>0.120 - 0.181</td>
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<tr>
<td><strong>Fig. 2 Ball Bearings</strong></td>
<td></td>
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<tr>
<td>S90BPLMS08099028</td>
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<td>15</td>
<td>32</td>
<td>–</td>
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<td>S90BPLMS08150028</td>
<td>8</td>
<td>15</td>
<td>32</td>
<td>–</td>
<td>26</td>
<td>400</td>
<td>0.150</td>
<td>0.099 - 0.150</td>
</tr>
<tr>
<td>S90BPLMS08199035</td>
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<td>15</td>
<td>32</td>
<td>–</td>
<td>33</td>
<td>300</td>
<td>0.199</td>
<td>0.150 - 0.199</td>
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<tr>
<td>S90BPLMS08301035</td>
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<td>15</td>
<td>32</td>
<td>–</td>
<td>33</td>
<td>300</td>
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<td>S90BPLMS08398042</td>
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<td>15</td>
<td>32</td>
<td>–</td>
<td>40</td>
<td>200</td>
<td>0.398</td>
<td>0.301 - 0.396</td>
</tr>
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</table>

*NOTE:* When the slip clutch is to be subjected to any radial or axial thrust, use of the ball bearing design is required.

Units should be used on horizontal shafts only.
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: 0.007 to 4.24 N • m)
- 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 a N • cm to many N • m's
- 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 “D₃” and three tapped holes “T₁,” 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 “T₁”.
Concentricity of pilot diameter “D₃” to bore “d” is 0.025 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.
SPRING-WRAPPED SLIP CLUTCHES

Covered by U.S. Patents and Patents Pending

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

<table>
<thead>
<tr>
<th>METRIC COMPONENT</th>
</tr>
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<tbody>
<tr>
<td>Catalog Number</td>
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<tr>
<td>S9940YMSWC16X03</td>
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<td>S9940YMSWC25X04</td>
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<td>S9940YMSWC76X19</td>
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<td>S9940YMSWC76X20</td>
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</table>

* or ** See Preceding Page
HYSTERESIS BRAKES AND CLUTCHES

TECHNICAL INFORMATION

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 lbs. (8.9 N) and a process speed of 600 FPM.

BRAKE TORQUE \( T \) = Force (F) X Radius (D/2)
\[ T = \frac{2 \text{ lbs. (8.9 N)} \times 3.5 \text{ in. (88.9 mm)}}{1} = 7 \text{ lb. in. (791 Nmm)} \]
or \[ T = \frac{32 \text{ oz.} \times 3.5 \text{ in. (88.9 mm)}}{1} = 112 \text{ oz. in.} \]

SLIP SPEED \( \text{rpm} \) = linear velocity \( (V) \) (in/min) / circumference (in.) or linear velocity \( (V) \) (mm/min) / circumference(mm)
\[ \text{rpm} = \frac{600 \text{ ft/min} \times 12}{\pi \times 7 \text{ in.}} \] or \[ \text{rpm} = \frac{183 \text{ m/min} \times 1000}{\pi \times 178 \text{ mm}} \]
\[ \text{rpm} = 327 \]

ENERGY \( W \) = Energy Dissipation requirement is calculated using basic horsepower formula \( \times 746 \text{ watts/HP} \)
\[ W = \left( \frac{T \text{ (lb. in.) X rpm}}{63025} \right) \times 746 \text{ or } \left( \frac{T \text{ (Nmm) X rpm}}{7145221} \right) \times 746 \]
\[ W = \left( \frac{7 \text{ lb. in. X 327 rpm}}{63025} \right) \times 746 = 27 \text{ watts or } \left( \frac{791 \text{ Nmm X 327 rpm}}{7145221} \right) \times 746 = 27 \text{ watts} \]

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 oz. 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

Δ Shaft & Hub Tolerance (h8):
8 mm -0.022
12 & 16 mm -0.027
19 mm -0.033
34.93 & 41.28 mm -0.039

Maximum recommended speed is 3600 rpm.

The projections shown are per ISO convention.

## METRIC COMPONENT

<table>
<thead>
<tr>
<th>Catalog Number *</th>
<th>Min. Static Torque @ rated VDC N • m</th>
<th>Max. Drag Torque De-Energized &amp; De-Gaussed N • m</th>
<th>Max. Wattage @ rated VDC @ 25°C Watts</th>
<th>Input Inertia kg • m²</th>
<th>Output Inertia kg • m²</th>
<th>Max. Dissipation Capacity Watts</th>
<th>A ± 0.4</th>
<th>B Δ h8</th>
<th>C Δ h8</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90HYCM108A08</td>
<td>0.847</td>
<td>0.011</td>
<td>8</td>
<td>17.29 x 10⁻³</td>
<td>1.86 x 10⁻²</td>
<td>80</td>
<td>108</td>
<td>8</td>
<td>16</td>
<td>3.402</td>
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<tr>
<td>S90HYCM162A12</td>
<td>2.825</td>
<td>0.050</td>
<td>8</td>
<td>97.18 x 10⁻³</td>
<td>14.52 x 10⁻³</td>
<td>150</td>
<td>161.9</td>
<td>12</td>
<td>19</td>
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</table>

<table>
<thead>
<tr>
<th>Catalog Number * (Ref.)</th>
<th>D Δ h8</th>
<th>E ± 0.15</th>
<th>F ± 0.4</th>
<th>G Min.</th>
<th>H ± 0.15</th>
<th>J ± 0.4</th>
<th>K</th>
<th>L Min.</th>
<th>M</th>
<th>N ± 0.7</th>
<th>P ± 0.3</th>
<th>R ± 0.3</th>
<th>Weight kg</th>
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<tbody>
<tr>
<td>S90HYCM108A08</td>
<td>34.93</td>
<td>0.7</td>
<td>19.1</td>
<td>25</td>
<td>4.3</td>
<td>54.7</td>
<td>M4</td>
<td>9.5</td>
<td>M4</td>
<td>50.8</td>
<td>45.6</td>
<td>139.8</td>
<td>3.402</td>
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<tr>
<td>S90HYCM162A12</td>
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<td>25.4</td>
<td>32</td>
<td>5.6</td>
<td>81.8</td>
<td>M5</td>
<td>14.3</td>
<td>M5</td>
<td>63.5</td>
<td>56.4</td>
<td>184</td>
<td>13.154</td>
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</tbody>
</table>

* To be discontinued when present stock is depleted.
**ELECTROMAGNETIC SPRING WRAP CLUTCHES**

**VERY FAST RESPONSE**
**FRICTION-FREE OPERATION**
**UNIDIRECTIONAL INPUT**

> **COIL DATA:**
  - Voltage: 24V DC
  - Resistance: 185 ± 10% ohms

> **SPECIFICATIONS:**
  - Static Torque: 30 lbf in. (3.4 N • m)
  - Cycle Life: $1 \times 10^6$ @ 30 lbf in.
  - Max. Operating Speed: 1200 rpm
  - Power: 3.5 watts nominal
  - Operating Temperature: 32°F to 140°F (0°C to 60°C)

Dimensions in ( ) are mm.

**INCH COMPONENT**

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>B Bore in. (mm)</th>
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<tr>
<td>*S90SWB-13AA04</td>
<td>.2505-.2530 (6.362-6.427)</td>
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<tr>
<td>**S90SWB-13AB04</td>
<td>.2505-.2530 (6.362-6.427)</td>
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<tr>
<td>*S90SWB-13AA05</td>
<td>.3130-.3185 (7.950-8.090)</td>
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<tr>
<td>**S90SWB-13AB05</td>
<td>.3130-.3185 (7.950-8.090)</td>
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**METRIC COMPONENT**

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<tr>
<th>Catalog Number</th>
<th>B Bore mm (in.)</th>
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<tbody>
<tr>
<td>*S90SWBM13AA06</td>
<td>6.01-6.09 (.237-.239)</td>
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<tr>
<td>**S90SWBM13AB06</td>
<td>6.01-6.09 (.237-.239)</td>
</tr>
<tr>
<td>*S90SWBM13AA08</td>
<td>8.01-8.09 (.315-.318)</td>
</tr>
<tr>
<td>**S90SWBM13AB08</td>
<td>8.01-8.09 (.315-.318)</td>
</tr>
</tbody>
</table>

* Hub Input (HI)CW / Shaft Input (SI)CCW
** Hub Input (HI)CCW / Shaft Input (SI)CW

**FLYING LEADS 24 AWG 12 in. (30 cm) LONG**
ELECTROMAGNETIC SPRING WRAP CLUTCHES

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

VERY FAST RESPONSE
FRICITION-FREE OPERATION
HIGH-TORQUE TO SIZE RATIO
UNIDIRECTIONAL INPUT

> COIL DATA:
Voltage: 24V DC
Resistance: 93±10% ohms
Current: .257 amp.
Leads Ends Stripped: 12.0 in. (300 mm) long standard
.19/.31 in. (4.9/7.8 mm)

> SPECIFICATIONS:
Static Torque: 150 lb. in. (16 N • m)
Max. Radial Bearing Load: 30 lb. (13.6 kg)
Max. Operating Speed: 1000 rpm
Response Time, Voltage on at Full Speed: 150 msec Max. 40 msec Nom.
Input Configuration: Hub input or shaft input
Bearing: Reinforced polyetherimide with internal lubricant
Weight: 1.0 lb (0.45 kg)

**SPECIFICATIONS:**
Static Torque: 150 lb. in. (16 N • m)
Max. Radial Bearing Load: 30 lb. (13.6 kg)
Max. Operating Speed: 1000 rpm
Response Time, Voltage on at Full Speed: 150 msec Max. 40 msec Nom.
Input Configuration: Hub input or shaft input
Bearing: Reinforced polyetherimide with internal lubricant
Weight: 1.0 lb (0.45 kg)

**METRIC COMPONENT**

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>B Bore mm (in.)</th>
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<td>*S90SWAM18AA10</td>
<td>10.010-10.079 (.3941-.3968)</td>
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<td>**S90SWAM18AB10</td>
<td>10.010-10.079 (.3941-.3968)</td>
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<tr>
<td>*S90SWAM18AA12</td>
<td>12.011-12.078 (.4729-.4755)</td>
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<td>12.011-12.078 (.4729-.4755)</td>
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**INCH COMPONENT**

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<th>B Bore in. (mm)</th>
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<td>*S90SWA–18AA06</td>
<td>.3755-.3780 (9.54-9.60)</td>
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<tr>
<td>**S90SWA–18AB06</td>
<td>.3755-.3780 (9.54-9.60)</td>
</tr>
<tr>
<td>*S90SWA–18AA08</td>
<td>.5010-.5035 (12.73-12.79)</td>
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<td>**S90SWA–18AB08</td>
<td>.5010-.5035 (12.73-12.79)</td>
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* Hub Input (HI)CW / Shaft Input (SI)CCW
** Hub Input (HI)CCW / Shaft Input (SI)CW
FLANGE-MOUNTED CLUTCHES

ZERO-BACKLASH ARMATURE
FOR PARALLEL LOADS

> COIL DATA:
Voltage: 24V DC

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

The projections shown are per ISO convention.

<table>
<thead>
<tr>
<th>METRIC COMPONENT</th>
<th>Catalog Number</th>
<th>Static* Torque N • m</th>
<th>Max. Wattage</th>
<th>Armature Inertia kgf • m • sec²</th>
<th>Rotor Inertia kgf • m • sec²</th>
<th>Energy Dissipation N • m/min</th>
<th>Armature Engagement msec</th>
<th>Disengagement msec</th>
<th>Bore R</th>
<th>Height L</th>
<th>Width K</th>
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<td>S90CF9M11A0606</td>
<td>0.56</td>
<td>5</td>
<td>0.40 x 10⁴</td>
<td>0.28 x 10⁶</td>
<td>237.3</td>
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<td>7</td>
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<th>(Ref.)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Length**</th>
<th>L</th>
<th>M</th>
<th>T Set Screws</th>
<th>Weight kg</th>
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<td>1.3</td>
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<td>M3</td>
<td>0.1</td>
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<td>50.77</td>
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<td>0.2</td>
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</tbody>
</table>

* Typical torque after burnishing; units shipped burnished.
** Length equals K including initial working air gap at installation.
◊ Keyway not available in rotor.
◊◊ To be discontinued when present stock is depleted.