DC Solenoids
HOSIDEN

Contents & Features

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Features

- The desired attraction force can be provided.
  The attraction force matching to the actual load can be provided by changing the shapes of the mating sections of the movable and stationary iron cores.
- The exciting current is constant regardless of the stroke.
  The exciting current of an AC solenoid varies depending on the stroke. With a DC solenoid, however, the exciting current is determined by DC resistance only and is constant regardless of the stroke.
- Operation noise is reduced.
  If there is a clearance between the movable and stationary iron cores of an AC solenoid, the coil may be burnt. In the case of a DC solenoid, its exciting current is constant regardless of the clearance of the movable and stationary iron cores. Therefore, a shock-absorbing material can be provided between the movable and stationary iron cores to reduce operation noises.
- No buzzing noise is generated.
  DC solenoids do not generate the buzzing noise AC solenoids generate due to the pulsating attraction force.
- Constant operation time.
  The operation time of the DC solenoid is constant regardless of the frequency. This is because it is driven by direct current.
- Long life is ensured.
  The service life of the solenoid depends greatly on the amount of mechanical wear between the movable iron core and the guide (pipe). The sliding section of the guide is specially treated to extend its service life.
<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coil</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection Method</td>
<td>Terminals, Lead Wires or Lead Wires With Connectors</td>
<td>—</td>
</tr>
<tr>
<td>Insulation Class</td>
<td>Class A (105°C)</td>
<td>Class E, Class B, Class F, Class H</td>
</tr>
<tr>
<td>Safety Standards</td>
<td>—</td>
<td>Materials Conforming to the UL and CSA Standards</td>
</tr>
<tr>
<td>Accessories</td>
<td>—</td>
<td>Temperature Fuse, Diode, etc</td>
</tr>
<tr>
<td>Winding</td>
<td>Single Winding</td>
<td>Double-Winding</td>
</tr>
<tr>
<td>Bobbin</td>
<td>With Pipe or Without Pipe</td>
<td>—</td>
</tr>
<tr>
<td><strong>Movable Iron Core</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Method</td>
<td>Methods Shown below or other Methods</td>
<td>—</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Nickel-Plated, Galvanized, MoS₂ Coating or Teflon Coating</td>
<td>—</td>
</tr>
<tr>
<td>Pipe</td>
<td>Inner Surface Treatment</td>
<td>—</td>
</tr>
<tr>
<td>Life</td>
<td>—</td>
<td>50,000 to 300,000 Operations</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attraction Method</td>
<td>Pull Type</td>
<td>Push Type</td>
</tr>
<tr>
<td>Silent</td>
<td>E-ring Rubber, Silencing Rubber (Except for Self-Sustaining Models)</td>
<td>—</td>
</tr>
</tbody>
</table>

![Slit](image1.png) ![Single hole](image2.png) ![Tapped hole](image3.png) ![Groove](image4.png) ![Caulking](image5.png)
## Product Lineup

<table>
<thead>
<tr>
<th>Type</th>
<th>Item</th>
<th>Model No.</th>
<th>Dimensions (W) × (H) × (L) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Solenoid</td>
<td>PM Type</td>
<td>JPM1316</td>
<td>12 × 9.5 × 21</td>
</tr>
<tr>
<td>Self-sustaining Solenoid (SELMAG)</td>
<td>with External Permanent Magnet</td>
<td>JSM5011</td>
<td>16 × 14 × 26.5</td>
</tr>
</tbody>
</table>

**PM Type**

**Self-Sustaining Solenoid (with External Permanent)
Before using this catalog, please pay special attention to the following items so that you may select the most economical and effective model for your application.

### Continuous operation and intermittent operation
DC solenoid is used continuously or intermittently depending on the application. Power consumption is determined by the duty cycle and operation time (maximum power ON time) for each cycle.

\[
\text{Duty cycle} = \frac{\text{ON time}}{\text{ON time} + \text{OFF time}} \times 100\%
\]

If the maximum power ON time in one cycle exceeds three minutes, the operation is regarded as continuous. This judgement differs slightly depending on the shape of the solenoid.

### Change in attraction force in relation to temperature
The attraction force drops as the temperature rises. This is because the coil resistance increases due to temperature rise and the ampere turn (AT) decreases. The coil resistance changes in relation to the coil temperature according to the coefficient as shown below.

![Temperature Coefficient Graph](image)

### Change in attraction force depending on the voltage
As the power voltage changes, the ampere turn (AT) and attraction force changes. This must be remembered when you set the attraction force.
Special featured solenoid
In addition to the standard products described in this catalog, Hosiden can offer many optional products. They include a silencing model that reduces metallic noise generated when the movable iron core bumps the stationary iron core during attraction. There is also a model equipped with a thermal fuse to prevent the coil from burning and causing a fire due to external factors such as environmental condition. If the temperature exceeds the safety limit, the power to the coil is cut off and the safety of the equipments shall be secured. Push-pull and long-life models are also available. Contact us for details regarding these optional products. Hosiden is ready to respond to custom design based on customer needs.

Insulation class
Allowable maximum temperature values for the corresponding insulation classes are determined as shown in the table below according to JIS C 4003 (Electric equipment insulation class). Solenoids must comply with this standard. Normally, solenoids are categorized as insulation class A. In this class, the continuous rating of the exciting power is determined under the condition of the allowable coil temperature rise 65°C at the ambient temperature 40°C. Contact us if a different ambient temperature or insulation class would be required.

<table>
<thead>
<tr>
<th>Insulation Class</th>
<th>Y</th>
<th>A</th>
<th>E</th>
<th>B</th>
<th>F</th>
<th>H</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowable Maximum Temperature</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>130</td>
<td>155</td>
<td>180</td>
<td>More than 180</td>
</tr>
</tbody>
</table>

Measurement of rise in temperature
The resistance method and the thermometer method are usually used to measure the rise in temperature of electric devices. The rise in temperature of the coil may not be accurately monitored by measuring the outside temperature, since the temperature gradient between the inside and the outside of the solenoid coil is considerably high. Therefore the mean temperature of the coil is usually monitored utilizing the resistance coefficient of copper by the resistance method.

Calculation formulas for the resistance method

\[
\theta = \left( \frac{R_2}{R_1} - 1 \right) \left( 234.5 + t_1 \right) \pm \Delta t
\]

\( t_1 \): Temperature before the solenoid is energized (°C)
\( t_2 \): Temperature after the solenoid is energized (°C)
\( R_1 \): Resistance before the solenoid is energized (Ω)
\( R_2 \): Resistance after the solenoid is energized (Ω)
\( \Delta t \): Change in ambient temperature from the time before the solenoid is energized to the time following the temperature rise.
(Add \( \Delta t \) if the ambient temperature rises.
Subtract \( \Delta t \) if the ambient temperature drops.)
DC Solenoids (PM Type)

JPM1316

Continuous Duty: 1W

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Resistance (Ω)</th>
<th>Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>36</td>
<td>167</td>
</tr>
<tr>
<td>12</td>
<td>145</td>
<td>83</td>
</tr>
<tr>
<td>24</td>
<td>576</td>
<td>42</td>
</tr>
</tbody>
</table>

Temperature Rise Characteristic

Pull-Stroke Characteristic (Initial Value)
Features

- The plunger is attracted by electrical pulses. The attraction continues after the power is turned off. Even if the sustain condition is maintained for many hours, no electric power is consumed and the temperature does not rise.
- The magnetic energy of the magnet allows the solenoid to be powered by a very weak current.
- The plunger is returned to its original position by the minimal force applied by the return coil with pulse current.
- The permanent magnet is hardly affected by the reverse magnetic field generated in the return process. This prevents deterioration of the solenoid performance.

Comparison with DC Solenoid models
(Condition : the drive power is constant.)

- Size : about 23% smaller
- Weight : about 25% less
- Power Consumption : Reduced since no power is required during sustain.
- Rise In Temperature : No heat generation

Drive Circuit :

<table>
<thead>
<tr>
<th>Model</th>
<th>Return Circuit</th>
<th>Sustaining Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self sustaining model</td>
<td>Required</td>
<td>Not required</td>
</tr>
<tr>
<td>DC Solenoid model</td>
<td>Not required</td>
<td>Required</td>
</tr>
</tbody>
</table>
**JSM5011**

- **Self Holding Force**: 7.84N min.
- **Force for Release**: 1.96N min.
- **Minimum on Time of Power Supply**: 100ms min.

**Pull-Stroke Characteristic (Initial Value)**

<table>
<thead>
<tr>
<th>Stroke (mm)</th>
<th>Force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>1.96</td>
</tr>
<tr>
<td>5</td>
<td>1.56</td>
</tr>
<tr>
<td>6</td>
<td>1.16</td>
</tr>
</tbody>
</table>

**JPM1535**

- **DC Solenoid**
- **Application**: For opening the refrigerator door
- **Feature**: High torque with push type

**JPM1562**

- **DC Solenoid**
- **Application**: For releasing the shift lever lock
- **Feature**: Silent type

Exhibited with thanks to customers.
Actuators (Custom Designed Products)

**JPM1455**
Solenoid Valve

<table>
<thead>
<tr>
<th>Application</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>For switching the warm water flow of washing toilet</td>
<td>Water-resistant type</td>
</tr>
</tbody>
</table>

**JPM1643**
Door Lock Solenoid

<table>
<thead>
<tr>
<th>Application</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>For locking the door of washing machine</td>
<td>Power saving type</td>
</tr>
</tbody>
</table>

**JTM5009**
Latch Magnet

<table>
<thead>
<tr>
<th>Application</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>For driving the camera shutter</td>
<td>Self-sustaining type</td>
</tr>
</tbody>
</table>

Exhibited with thanks to customers.
When Inquiring or Ordering

Please specify the following items when making an inquiry or order. Please feel free to contact us about custom design.

1. **Working Voltage**: _____ V DC (Min. _____ V DC, Max. _____ V DC)
   (Also tell us the kind of the power supply used.)

2. **Rating**: Continuous Duty
   Intermittent Duty
   In the case of intermittent Duty
   Duty cycle _____%  
   ON time _____ minutes (seconds)

3. **Attraction Force**
   Initial value at _____ V DC applied
   After temperature rise at _____ V DC applied
   Stroke _____ mm _____ N _____ mm _____ N
   _____ mm _____ N _____ mm _____ N

4. **Conditions of Attraction Force Measurement**
   ● Ambient temperature _____ °C
   ● A cycle comprised of an ON time of _____ minutes (seconds) and an OFF time of _____ minutes (seconds) is repeated _____ times.
   The force is then measured at _____ V DC.
   ● Voltage _____ V DC is applied during measurement.

5. **Self Holding Force**: _____ N (Only Self-sustaining Solenoid)

6. **Load**: Horizontal, vertical and circular motions

7. **Rated Current**: _____ A (_____ V DC) at 20°C

8. **DC resistance**: _____ Ω ± _____% at 20°C

9. **Rise in Temperature**
   Coil: _____ °C or less (resistance method)
   Frame: _____ °C or less (thermometer method)
   at ambient temperature _____ °C

10. **Residual Magnetism**: _____ N or less

11. **Insulation Class**: Class _____
    Class Y  Class A  Class E  Class B
    90°C  105°C  120°C  130°C

12. **Life**: _____ operations or more
    Each cycle is comprised of an ON time of _____ seconds and an OFF time of _____ seconds (minutes).
### Model No. Table

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPM 1316</td>
<td>6</td>
</tr>
<tr>
<td>JPM 1455</td>
<td>9</td>
</tr>
<tr>
<td>JPM 1535</td>
<td>8</td>
</tr>
<tr>
<td>JPM 1652</td>
<td>8</td>
</tr>
<tr>
<td>JPM 1643</td>
<td>9</td>
</tr>
</tbody>
</table>

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### CAUTION FOR SAFETY

Please use our products properly based on our Drawing and Specification.

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- The contents described in this catalog may be changed without prior notice due to products improvements or discontinuance of production.
- Every product in this catalog is compliant to RoHS directive.