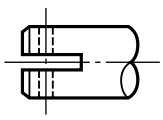
Contents & Features

Features

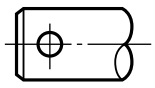
- The desired attraction force can be obtained.
  The attraction force matching to the actual load can be obtained by changing the shapes of the mating sections of the movable and stationary iron cores.
- The exciting current is constant regardless of the stroke.
  The exciting current of an AC solenoid 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 beat noise is generated.
  DC solenoids do not generate the beat 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.

Solenoid Specifications

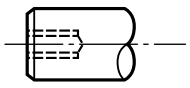
Item		Standard	Optional
Coil	Connection Method	Terminals, Lead Wires or Lead Wires With Connectors	———
	Insulation Class	Class A (105℃)	Class E, Class B, Class F, Class H
	Safety Standards	———	Materials Conforming to the UL and CSA Standards
	Accessories	———	Temperature Fuse, Diode, etc
	Winding	Single Winding	Double-Winding
	Bobbin	With Pipe or Without Pipe	———
Movable Iron Core	Joint Method	Methods Shown below or other Methods	———
	Surface Treatment	Nickel-Plated, Galvanized, MoS_2 Coating or Teflon Coating	———
Pipe	Inner Surface Treatment	———	MoS_2 Coating, Teflon Coating
Life	———	50,000 to 300,000 Operations	Contact Us.
Construction	Attraction Method	Pull Type	Push Type
	Silencing	E-ring Rubber, Silencing Rubber (Except for Self-Sustaining Models)	———



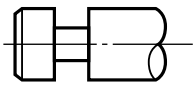
Slit



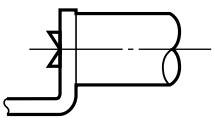
Single hole



Tapped hole



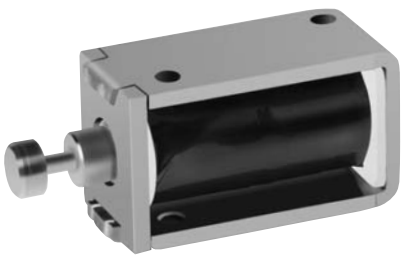
Groove

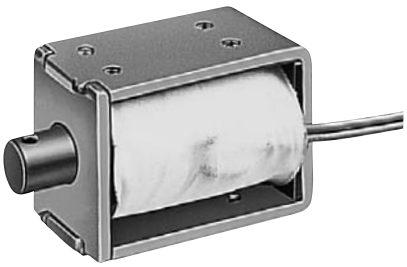


Caulking

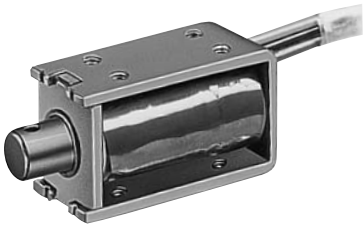
Product List

Item / Type		Model No.	Dimensions (W) × (H) × (L) mm
DC Solenoid	PM Type	JPM1316	12 × 9.5 × 21
		JPM1210	13 × 10 × 25
		JPM0822	15 × 13 × 19.7
		JPM0364	20 × 19 × 30
		JPM0288	29 × 24 × 41
		JPM0298	30 × 26 × 57
		JPM0328	33 × 30 × 60
Self-sustaining Solenoid (SELMAG)	with Built-in Permanent Magnet	JSM0105	13 × 10 × 22
		JSM0015	29 × 24 × 41
	with External Permanent Magnet	JSM5011	16 × 14 × 26.5

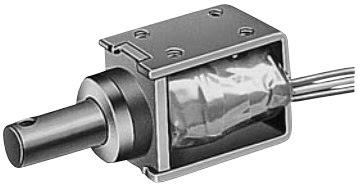




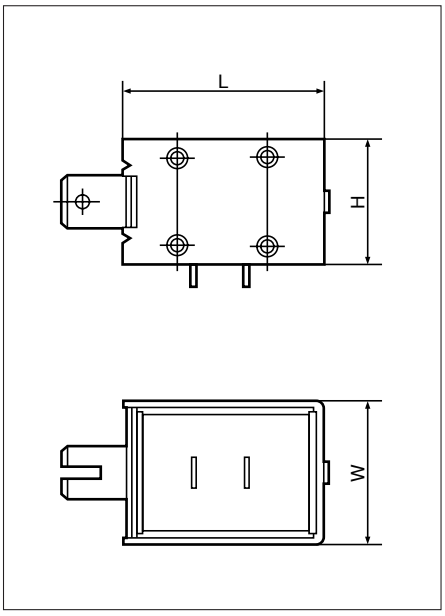
PM Type



Self-Sustaining Solenoid
(with Built-In Permanent Magnet)



Self-Sustaining Solenoid
(with External Permanent)



How to Select Solenoids

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

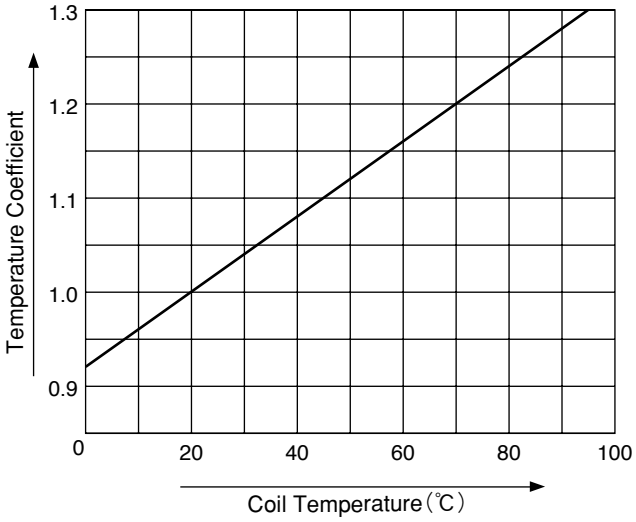
DC solenoid is used continuously or intermittently depending on the application. Power consumption is determined by the duty cycle and operation time (maximum power ON time) for each cycle.

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

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 and the ampere turn (AT) decreases as the temperature rises. When the coil temperature changes, the coil resistance changes in relation to the temperature coefficient obtained as shown below.



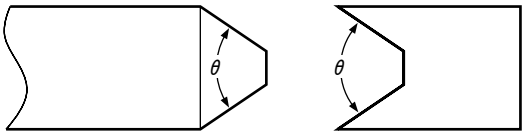
■Change in attraction force depending on the voltage

As the power voltage changes, the ampere turn (AT) and attraction force changes. This must be remembered when you set the attraction force.

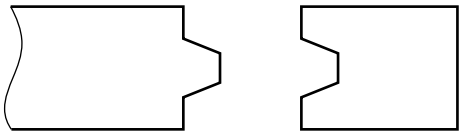
■Change in attraction force in relation to the shape of the iron core

The performance of the DC solenoid depends on the shape of the attraction section of the movable iron core. Generally speaking, the following relationship is obtained between the iron core angle θ shown below and the stroke, although this relationship may differ depending on the size of the solenoid.

$\theta =$ 45° or less·····4mm stroke or more
$\theta =$ 90° or more ·····1 to 2mm stroke
$\theta =$180° ·····0 to 1mm stroke



If both the attraction force and the force at a certain stroke are used, the plunger having the step shown below may achieve better results.



■Effect of residual magnetism

Even when the magnetic field applied to the solenoid is removed, magnetism remains to some extent depending on the chemical components of the material and the strain caused during the forming of the material.
This residual magnetism may prevent the attracted movable iron core from returning, causing problems during operation. Therefore, the magnitude of the residual magnetism should be considered an important factor when selecting solenoids.
Hosiden takes many steps to reduce residual magnetism. Please let us know your application conditions beforehand.

■Optional solenoid

In addition to the standard products described in this catalog, Hosiden can offers many optional products. They include a silencing model which reduces metallic noise generated when the movable iron core bumps the stationary iron core during attraction. There is also a model equipped with a temperature fuse. If the temperature exceeds the safety temperature limit, the power to the coil is turned off. This prevents the coil from burning and causing a fire. Push-pull and long-life models are also available. Contact us for details regarding these optional products.

■Solenoid characteristics

- Standard Operation Conditions
  (1) Ambient Temperature : −5 to 40℃ (No solSenoid freezing)
  (2) Relative Humidity : 45 to 85% (No solenoid freezing)
- Standard Test Conditions
  (1) Ambient Temperature : 20±2℃
  (2) Relative Humidity : 65±5%
  (3) Atmospheric Pressure : 1,013hpa
- Standard test power supply
  Battery or DC power supply with little pulsation.
- Insulation resistance between coil and yoke
  100MΩ or more when measured by a 500 V DC at the normal temperature and humidity.
  (The insulation resistance values of the small solenoids are specified separately.)
- Dielectric strength between coil and yoke
  1,000V AC for one minute or 1,200 V AC for one second at the normal temperature and humidity.
  (The dielectric strength values of the small solenoids are specified separately.)
- Attraction force, sustain force, residual magnetism, temperature rise, life test and nameplate description are specified individually.

■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 so that the allowable coil temperature rise is 65℃ when the ambient temperature is 40℃. Contact us if you desire a different ambient temperature or insulation class.

Insulation Class	Y	A	E	B	F	H	C
Allowable Maximum Temperature	90	105	120	130	155	180	More than 180

■Measurement of rise in temperature

The resistance method and the thermometer method are usually used to measure the rise in temperature of electric devices. Since the temperature gradient between the inside and the outside of the solenoid coil is considerably high, the rise in temperature of the coil may not be accurately obtained by measuring the outside temperature. Generally, the mean temperature of the coil is measured by the resistance method using the resistance coefficient of copper.

● Calculation formulas for the resistance method

$$\frac{234.5+t_2}{234.5+t_1} = \frac{R_2}{R_1} \quad \cdots\cdots\cdots\cdots\cdots\cdots (1)$$

This formula is modified as follows to obtain t.

$$t_2 = \frac{R_2}{R_1}(234.5+t_1) - 234.5$$

After t_2 is obtained, rise in temperature θ can be calculated by the following formula. $\cdots\cdots\cdots\cdots\cdots\cdots (2)$

$$\theta = t_2 - t_1 \pm \Delta t$$

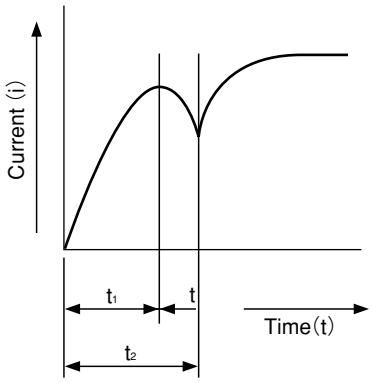
Formulas (1) and (2) are modified and combined to formula (3) for easier calculation.

$$\theta = \left(\frac{R_2}{R_1} - 1\right)(234.5+t_1) \pm \Delta t \quad \cdots\cdots\cdots (3)$$

t_1 : Temperature before the solenoid is energized(℃)
t_2 : Temperature after the solenoid is energized(℃)
R_1 : Resistance before the solenoid is energized(Ω)
R_2 : Resistance after the solenoid is energized(Ω)
Δt : Change in ambient temperature from the time before the solenoid is energized to the time following the temperature rise.
(Add Δt if the ambient temperature rises. Subtract Δt if the ambient temperature drops.)

■Response speed

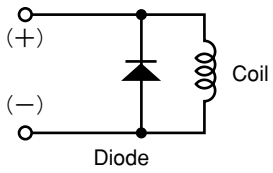
The response speed may drop due to electrical transient phenomena and the relationship among the magnetomotive force, load and stroke. In the return motion, the response speed may drop due to residual magnetism. To measure the response speed, a digital oscilloscope should be used as shown in the figure.

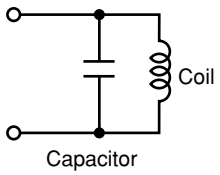


t_1 : Movement start time of the movable iron core
t_2 : Time from switch on to movement completion of the movable iron core
Δt : Movement time of the movable iron core

● Surge voltage absorption method

When the DC solenoid is turned off, a surge voltage is produced. this surge voltage may damage the circuit devices. To absorb this surge voltage, a diode or a capacitor is connected as shown below.

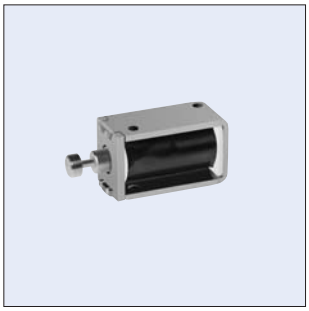


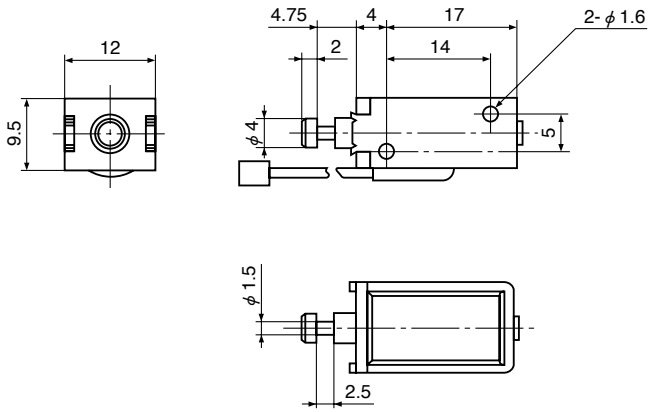


DC Solenoids (PM Type)

Unit:mm

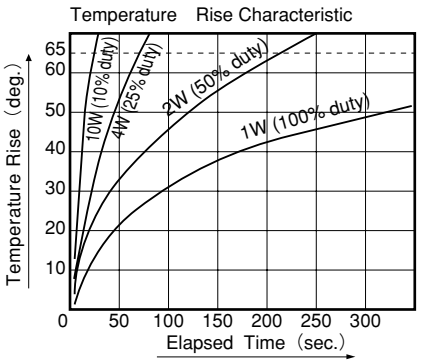
JPM1316

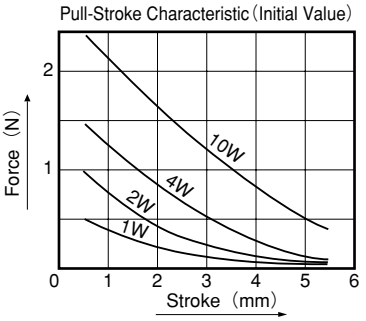




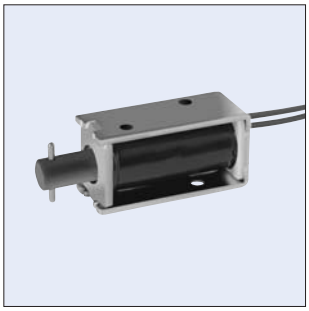
Continuous Duty : 1W

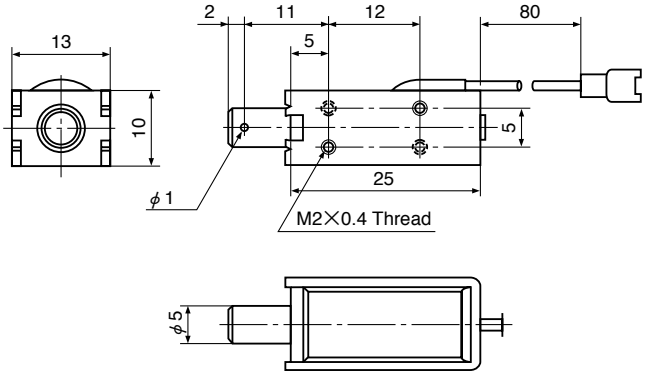
Voltage (V)	Resistance (Ω)	Current (mA)
6	36	167
12	145	83
24	576	42





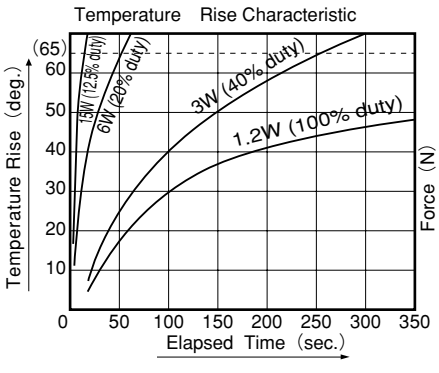
JPM1210

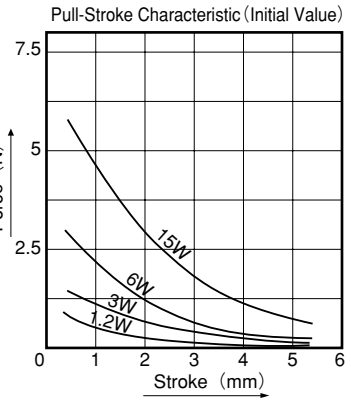




Continuous Duty : 1W

Voltage (V)	Resistance (Ω)	Current (mA)
6	36	167
12	145	83
24	576	42

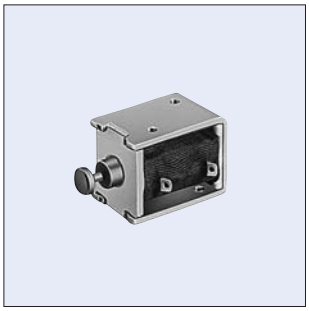


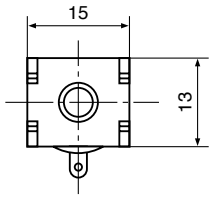


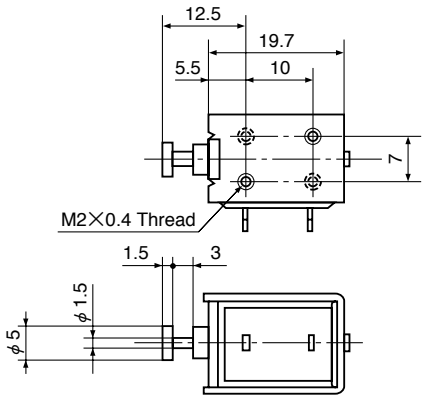
DC Solenoids (PM Type)

Unit:mm

JPM0822

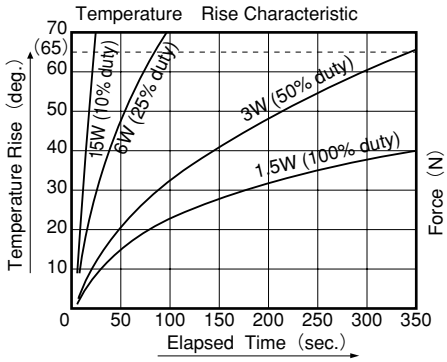


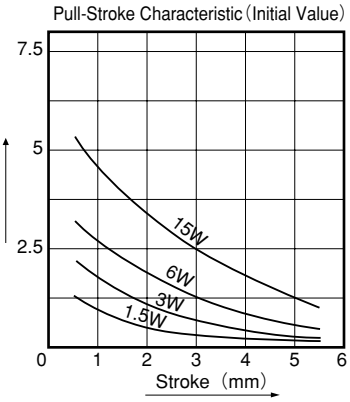




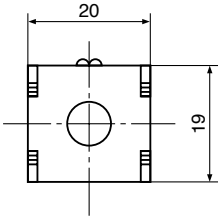
Continuous Duty : 1.5W

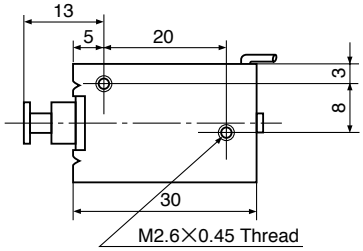
Voltage (V)	Resistance (Ω)	Current (mA)
6	24	250
12	96	125
24	384	63

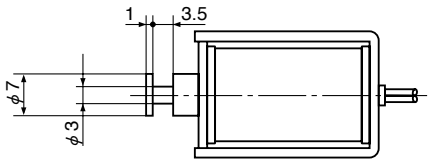




JPM0364

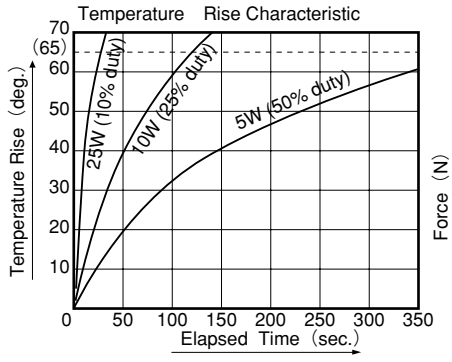


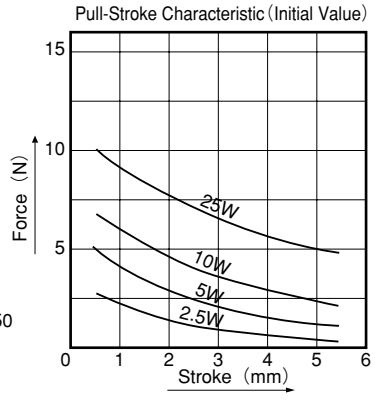




Continuous Duty : 2.5W

Voltage (V)	Resistance (Ω)	Current (mA)
6	14	417
12	58	208
24	231	104
48	923	52
100	4,000	25

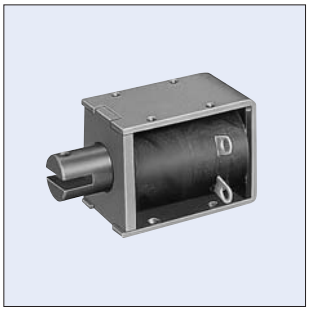


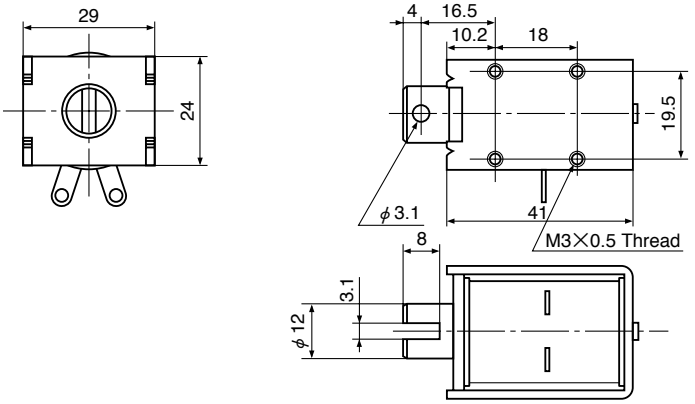


DC Solenoids (PM Type)

Unit:mm

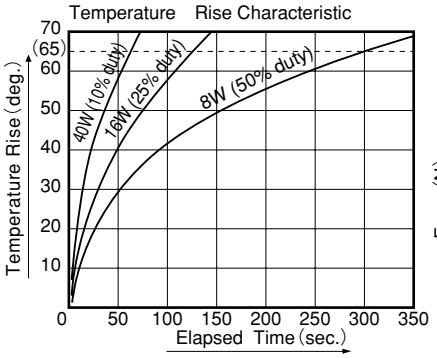
JPM0288

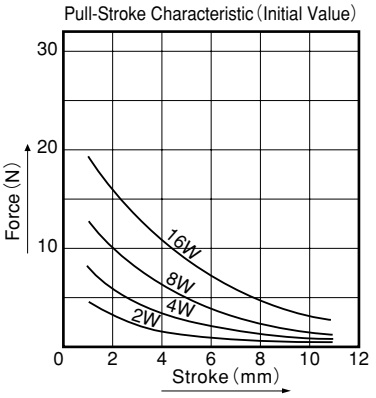




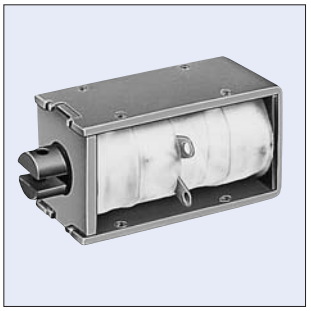
Continuous Duty : 4W

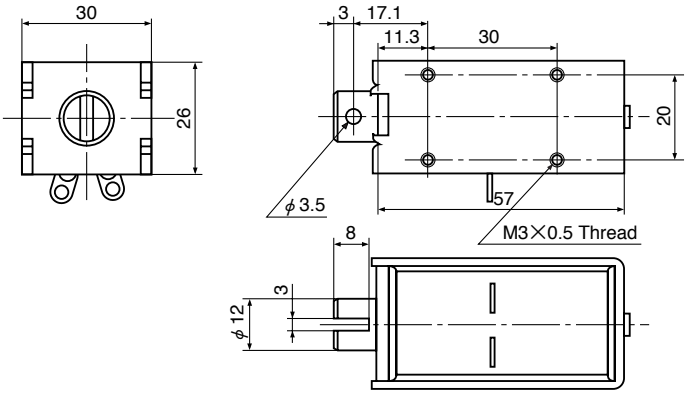
Voltage (V)	Resistance (Ω)	Current (mA)
6	9	667
12	36	333
24	144	167
48	578	83
100	2,500	40





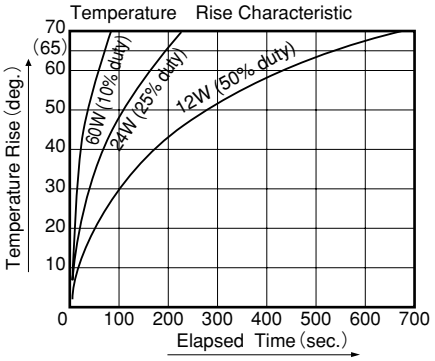
JPM0298

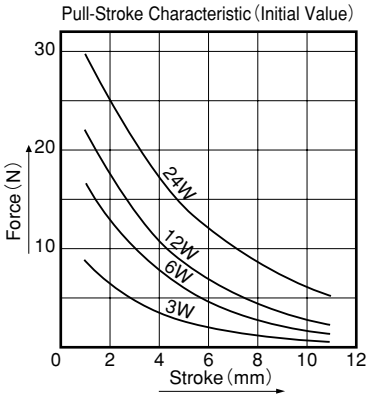




Continuous Duty : 6W

Voltage (V)	Resistance (Ω)	Current (mA)
6	6	1,000
12	24	500
24	96	250
48	384	125
100	1,667	60

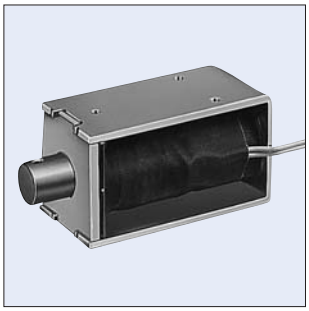


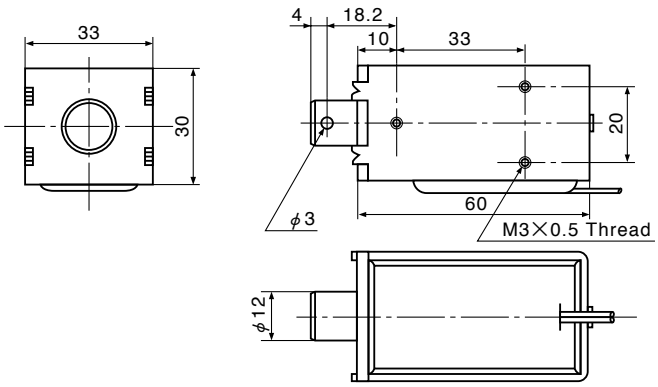


DC Solenoids (PM Type)

Unit:mm

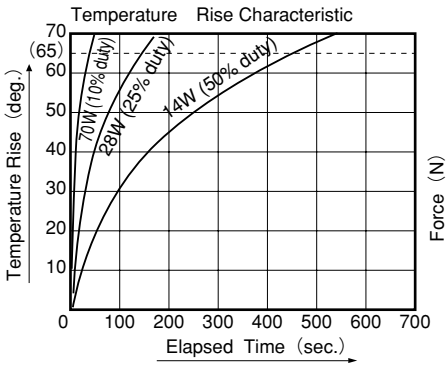
JPM0328

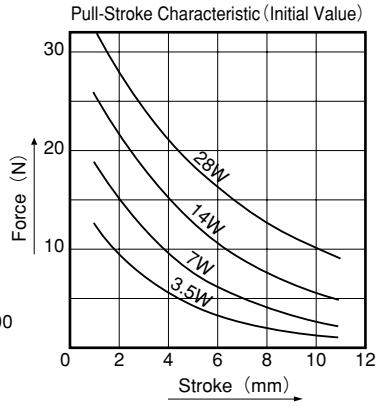




Continuous Duty : 7W

Voltage (V)	Resistance (Ω)	Current (mA)
6	5	1,167
12	21	583
24	82	292
48	329	146
100	1,430	70





Features

- No electric power is necessary during sustain. Once the plunger is attracted, the strong attraction force is maintained without electric power.
- Rises in the solenoid temperature are minimal since the solenoid is controlled by electrical pulses.
- The magnetic characteristics of the magnet remain unchanged even when used for extended periods of time.
- The self-sustaining solenoid is interchangeable with ordinary DC solenoids since they are identical in shape.

Hosiden offers two SELMAG models, each featuring our original magnet circuits.

(1) SELMAG with a built-in permanent magnet
(on page 14)

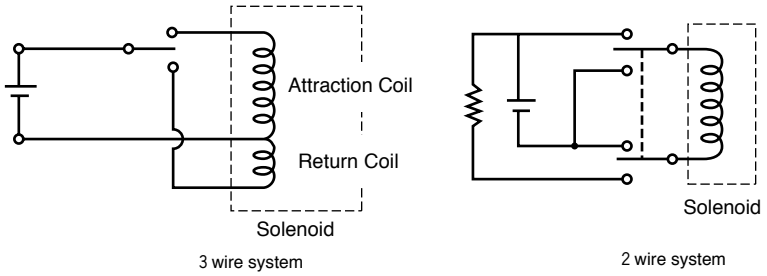
(2) SELMAG with an external permanent magnet
(on page 16)

Contact us for details regarding the features of these models.

(Examples) Drive circuit, 2-wire/3-wire system,
attraction coil, return coil

Example

Drive Circuit



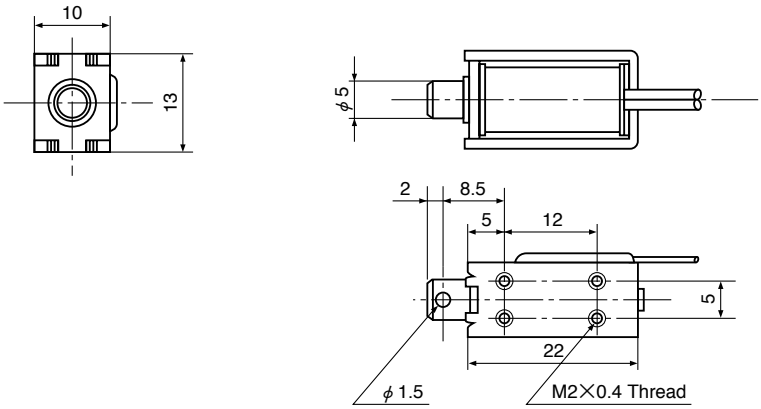
3 wire system

2 wire system

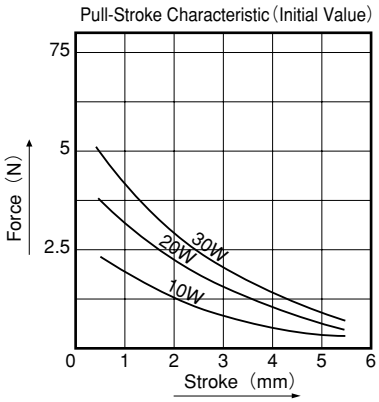
Self-Sustaining Solenoids (with Built-In Permanent Magnet)

Unit:mm

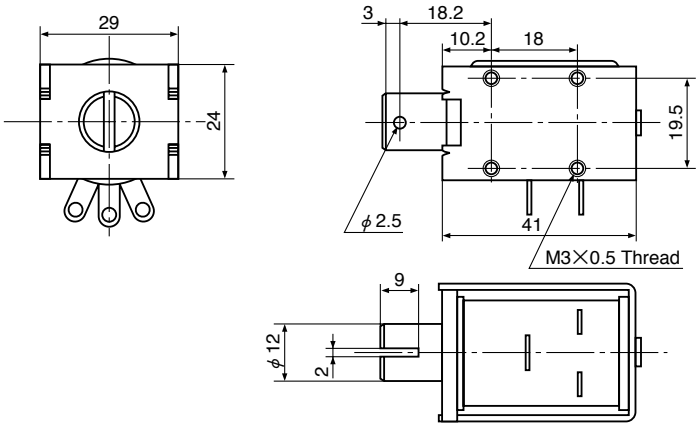
JSM0105



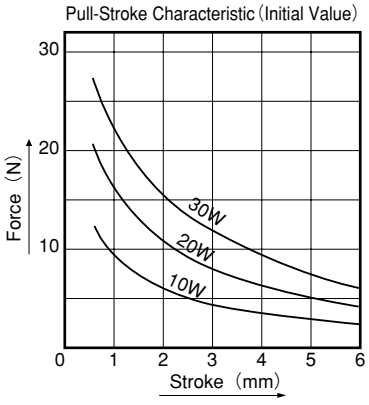
Self Holding Force : 2.94 N min.
Force for Release : 0.49 N min.
Minimum on Time of Power Supply : 100 ms min.



JSM0015



Self Holding Force : 14.7 N min.
Force for Release : 1.96 N min.
Minimum on Time of Power Supply : 100 ms min.



Self-Sustaining Solenoids (with External Permanent Magnet)

Features

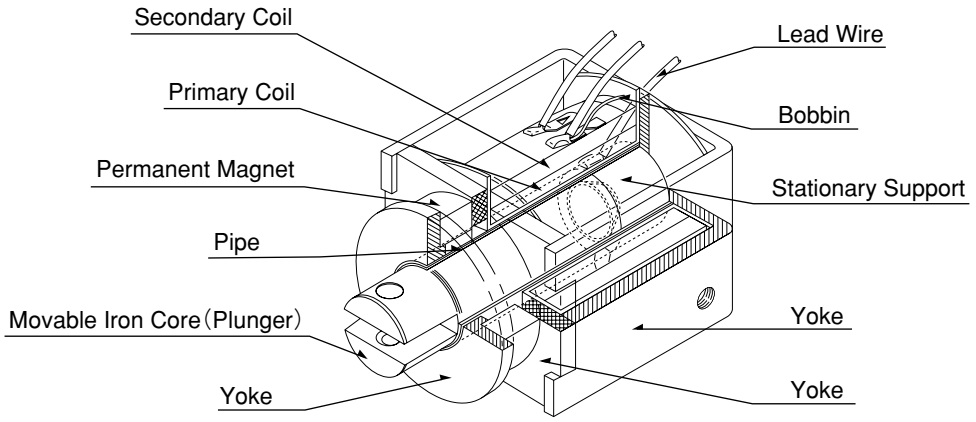
- The plunger is attracted by electrical pulses. The attraction continues after the power is turned off. Even if the sustain condition is maintained for many hours, no electric power is consumed and the temperature does not rise.
- The magnetic energy of the magnet allows the solenoid to be powered by a very weak current.
- The plunger is returned to its original position by the force obtained by when an electrical pulse is applied to the return coil.
- 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 conventional 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 :

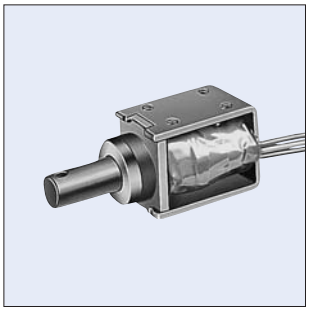
	Return Circuit	Sustaining Circuit
Self sustaining model	Required	Not required
Conventional model	Not required	Required

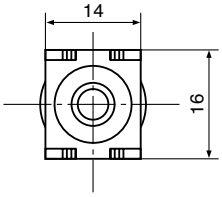


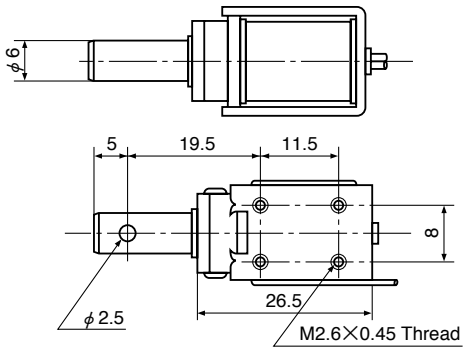
Self-Sustaining Solenoids (with External Permanent Magnet)

Unit:mm

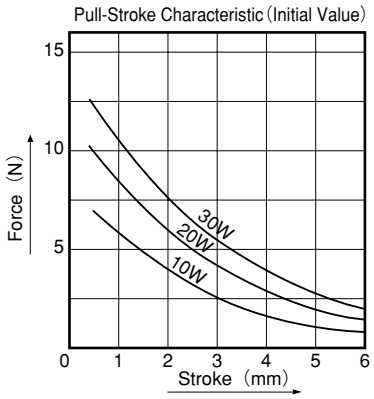
JSM5011



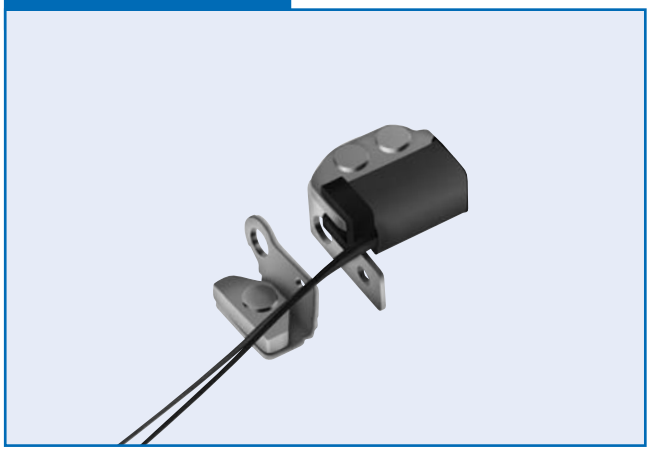




Self Holding Force : 7.84 N min.
Force for Release : 1.96 N min.
Minimum on Time of Power Supply : 100 ms min.

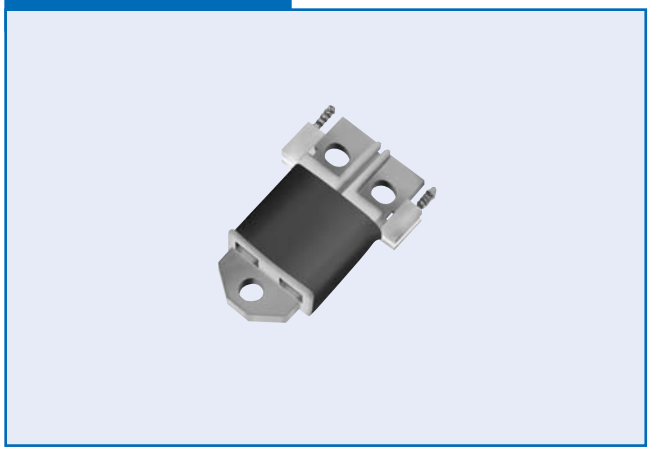


JTM1053



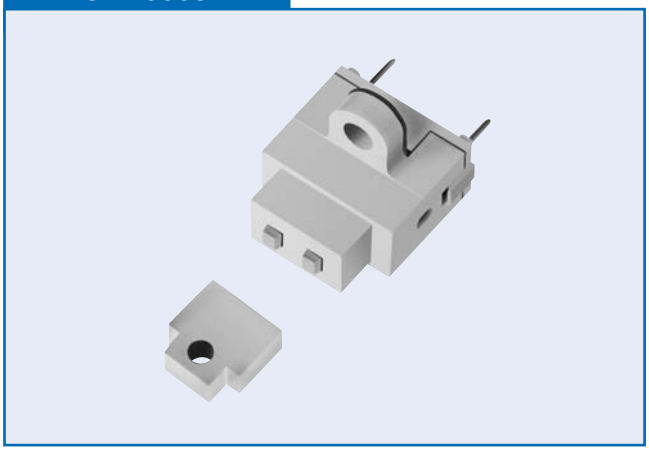
Latch Magnet

JTM5009



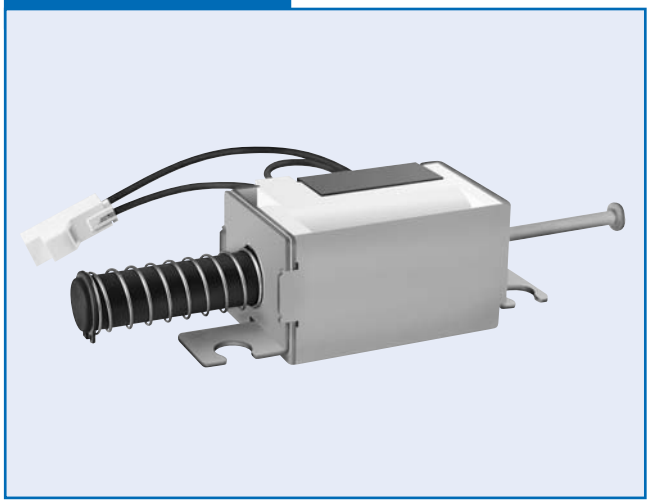
Latch Magnet

JTM5008



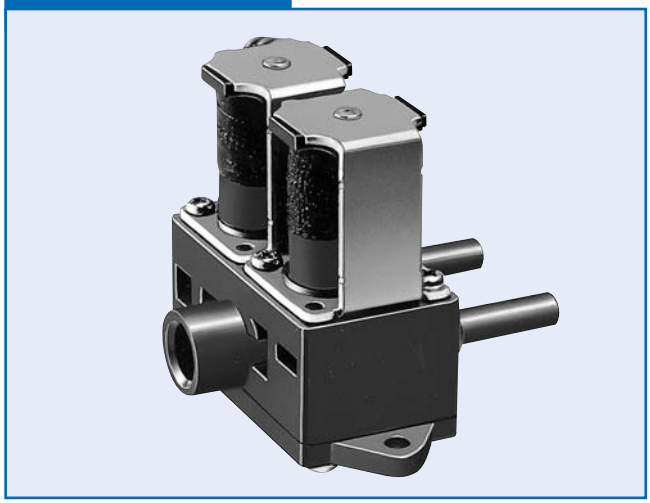
Latch Magnet

JPM1535



DC Solenoid

JPM1455



Solenoid Valve

When Inquiring or Ordering

Please specify the following items when making an inquiry or order.

(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 _____℃

●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℃

(8) **DC resistance**

_____Ω ±_____% at 20℃

(9) **Rise in Temperature**

Coil _____℃ or less (resistance method)

Frame _____℃ or less (thermometer method)

at ambient temperature _____℃

(10) **Residual Magnetism** _____ N or less

(11) **Insulation Class** Class _____

Class Y	Class A	Class E	Class B
90℃	105℃	120℃	130℃

(12) **Life** _____operations or more

Each cycle is comprised of an ON time of _____seconds and an OFF time of _____seconds (minutes).