# PUSH-PULL SOLENOIDS

## 1. Design and Features

The push-pull solenoid design utilizes a coil with the maximum amount of magnet wire in the smallest amount of space. This coil assembly is then packaged in a metal housing using highly permeable steel thus obtaining maximum force and minimum size and weight. The armature design utilizes a secondary magnetic circuit, which provides an increasd output of force of 20-50% (comparison is made of a 491C with a stroke of 3 mm). The push design is meant for applications that require relatively short strokes (0-8mm). In general, the solenoid height is half the outside diameter. The output shaft is attached to the armature and can be attached to either end of the solenoid. Thus, attaching to the shaft on the base side actuates as a push solenoid. Attaching to the shaft on the armature side actuates the solenoid in the pull mode.

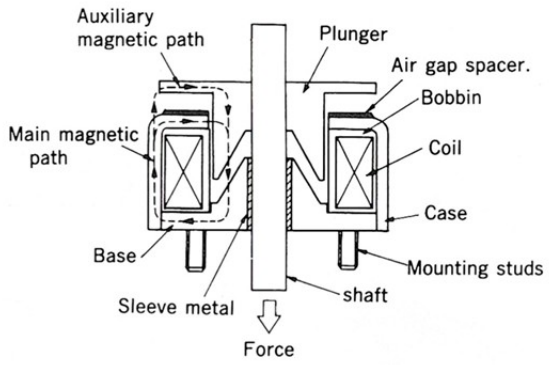


Fig. I Conical pole piece

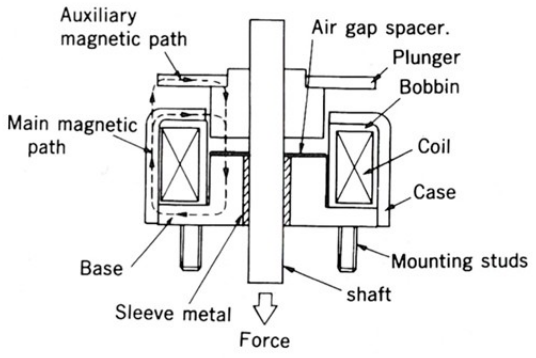


Fig. 2 Flat pole piece

## 2. Stroke and Force

The push-pull solenoid is available with 2 standard pole piece configurations. The conical pole (Fig. 1) is meant for medium strokes (3-8mm). The flat pole piece (Fig. 2) is designed for short strokes (0-3mm), and where high holding force is required. Force-stroke curves for each size and configuration are shown in the catalog. For the best performance and efficiency the stroke should be kept to a minimum.

## 3. Operational Considerations

A) Temperature

The coil data of push-pull solenoids shows the values at ambient temperature 20℃ and with a standard heat sink. If a solenoid is used at a rating shown in the coil data, it is designed so that the coil temperature rises and reaches equilibrium at approximately 85℃. In applications where the ambient temperature is higher than 20℃ or the heat sink is smaller than indicated in the catalog, possible thermal damage can occur. Temperature rise tests should be performed by the customer to assure that the coil does not reach 120℃. Coils can be constructed to operate at temperatures higher than 120℃ without thermal damage. Please consult the factory for details.

B) Air Gap Spacer

The push-pull solenoid uses an air gap spacer between the armature and the case. This spacer is installed to prevent the armature and base from coming into mechanical contact with each other, which would cause residual magnetism.

C) Return Spring

The push-pull solenoid does not include a return spring. Therefore, the application must include a return spring.

D) Shaft Modification

It is not recommended that the customer modify the shaft, as the shafts are fabricated before assembly. Any special configuration can be supplied. Please consult the factory for details.

E) Installation of Solenoid

The size 191C and 191F use tapped holes for mounting in the base. Caution needs to be observed that the mounting screws used to attach these solenoids are the correct length so as not to damage the coil.

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## 4. General Characteristics

| | |
|---|---|
| Insulation class | Class E (120℃)<br>Lead wire class A (105℃) |
| Dielectric strength | AC 1000V 50/60 Hz 1 min.<br>(at normal temperature and normal humidity) |
| Insulation resistance | More than 100 Mohm at DC 500V megger<br>(at normal temperature and normal humidity) |
| Expected life | Standard life : 2 million cycles<br>Extended : 10 million cycles |

(Solenoid cycle life is very dependent upon side load, frequency of use, and environmental conditions. Cycle life tests should be performed by the customer.)

## 5. How to Select a Solenoid

Before selecting a push-pull solenoid, the following information must be determined :

A) Force

The actual force required in the application should be increased using a safety factor multiplier of 1.5 to arrive at the force value that should be used in your specification.

B) Duty Cycle

Use the aforementioned formula to calculate duty cycle. Also note the maximum on time. (See page 2)

C) Stroke

Stroke is determined by application requirements.

D) Operating Voltage

Operating DC voltage is determined by the application and voltage available.

After determining these specifications, one can find the correct size solenoid for the application, using the force-stroke characteristic tables and graphs. The coil data is also shown for different sizes of magnet wire. If the exact operating voltage is not in the coil data table, use the nearest voltage shown in the table.

NOTE : When the operating voltage falls between 2 coil sizes, always use the higher AWG numbered coil so as to prevent potential thermal damage. To determine the force output of the solenoid after temperature rise, please use the amp-turn force graphs (pages 42, 43) after calculating the amp-turns.

## 6. Ordering Information

●When ordering a push-pull solenoid, the correct part number needs to be determined, from the following combination of characteristics (1-5) :

(1) M-Metric Thread
F-SAE Thread

(2) Solenoid Size (example-341)

(3) C-Conical plunger
F-Flat plunger

(4) Coil Wire Size (AWG)

(5) P-Standard Life Bearing
PE-Extended Life Bearing
(191C, 191F, 874C, and 874F have standard life bearings only.)

●Example of a complete part number:

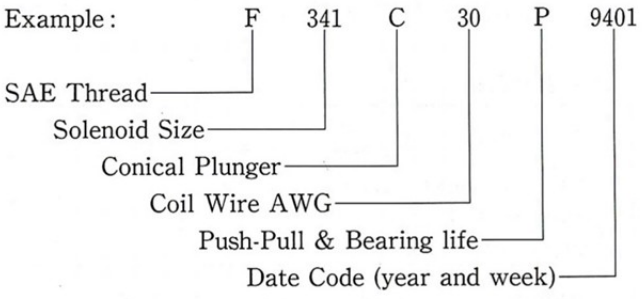
| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| F | 341 | C | 30 | P |

This part number is for a solenoid with ① SAE threads, ② size 341, ③ with a conical plunger, ④ with 30 Awg. coil wire, ⑤ and standard life bearings.

## 7. Labeling

For push-pull solenoids the part number labeling is as follows :

A) Standard Solenoid (no modifications).
The solenoid label will have the part number and the date code.




B) Special Configuration (required for any modification to a standard design)
Any change from the standard catalog design requires that a custom part number be assigned, which will also include the date code of manufacture.