TUBULAR SOLENOIDS

1. Design and Features

The tubular solenoids are designed and manufactured to obtain the maximum force output with the minimum of weight and size. Features include a large force output in a small size, minimum flux leakage by design, and a low level of operational noise. The structure consists of a slender cylinder as shown in Fig. 1 and 2. The outside case is a high permeable steel to improve efficiency. Both pull and push type configurations are available as standard.

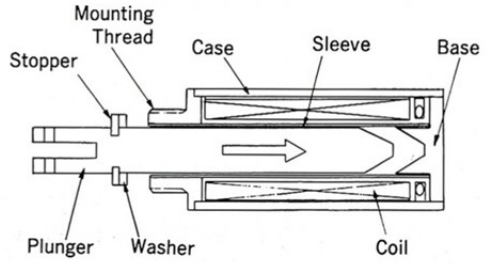


Fig. 1 Pull Type

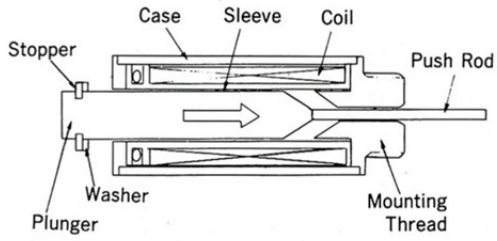


Fig. 2 Push Type

2. Stroke and Force

The tubular solenoid is designed for longer strokes than the conical push-pull type solenoid. As such, the pole piece designs are conical to maximize performance over longer strokes. To improve efficiency, the solenoid stroke should be minimized in the application.

3. Operational Considerations

A) Temperature

The coil data for the tubular solenoids shows the values at ambient temperature 20℃ and with a standard heat sink. If a solenoid is used at the ratings 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 tubular solenoid has an air gap spacer installed between the plunger stopper and the case. This spacer is installed to prevent the plunger and base from coming into mechanical contact with each other, which would cause residual magnetism.

C) Return Spring

The tubular solenoid does not include a return spring. Therefore, the application must include a return spring or modification at the factory.

D) Plunger and Shaft Modifications

It is not recommended that the customer modify the plunger or shaft, as the shafts are manufactured and plated at the factory. Any special configurations can be supplied. Please consult the factory for details.

4. General Characteristics

Insulation class	Class E (120℃) Lead wire class A (105℃)
Dielectric strength	AC 1000V 50/60 Hz 1 min. (at normal temperature and normal humidity)
Insulation resistance	More than 100 Mohm at DC 500V megger (at normal temperature and normal humidity)
Expected life	Standard life : 2 million cycles Extended life : 5 million cycles Long life : 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 tubular 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 (page 73) after calculating the amp-turns.

6. Ordering Information

●When ordering a tubular solenoid, the correct part number needs to be determined from the following combination of characteristics (1-4) :

(1) M-Metric Thread
F-SAE Thread

(2) Solenoid Size (example-130)

(3) Coil Wire Number (AWG)

(4) L-Pull, Standard Life
H-Push, Standard Life
LE-Pull, Extended Life
HE-Push, Extended Life
LL-Pull, Long Life
HL-Push, Long Life

●Example of a complete part number :

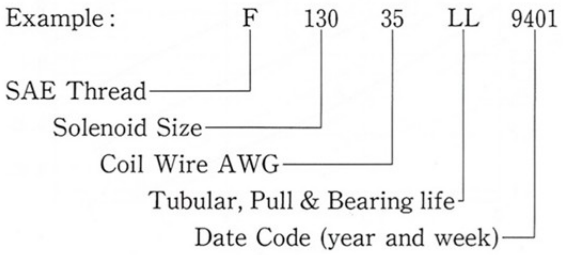
(1)	(2)	(3)	(4)
F	130	35	LL

This part number is for a solenoid with ① SAE threads, ② size 130, ③ with 35 AWG coil wire, ④ and long life (coatings on plunger) bearings.

7. Labeling

For tubular 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 (which identifies the year and week of manufacture).



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.