How to Use Coil Springs and Precautions

MISUMI is engaged in a constant effort to design coil springs (excluding Round Wire Springs) with optimum cross-sectional shape and maximum durability. When using the springs, pay due attention to the following precautions and undesirable usage that should be avoided for the sake of safety.

1. Always Use a Spring Guide

When using a spring guide, the coil spring may buckle or bend midway. This can be made to cease by ensuring that the surface of the spring is parallel to the guides. It is recommended that the coil spring should be guided such as a shaft and an outer diameter guide, with the coil spring. In most cases, the worst case scenario is prevented by setting a shaft all the way through the coil spring, from top to bottom, as an inner diameter guide.

2. Clearance between the Spring Inner Diameter and Shaft

When clearance between the spring and the shaft is insufficient, the coil spring's internal surface may come into contact with the shaft and be subject to abrasion at that point. This can lead to the spring eventually breaking at the point of wear. Excessive clearance with shaft; on the other hand, can lead to buckling of the coil spring. It is recommended that the shaft diameter be set approximately 0.1 mm smaller than the inner diameter of the coil spring. When the coil spring has a long free length, i.e., length/OD is 4 or larger, set up a step on the shaft as shown in Fig.-1 to prevent the coil spring's internal surface from touching the shaft when in bending.

3. Clearance between The Spring OD and Counterbore Hole

The coil spring expands in the counterbore in which a shaft is inserted, and this can cause the spring to deflect. The result is a change in the effective length of the coil spring. It is recommended that the clearance between the spring OD and counterbore hole be 0.001 to 0.002 mm. As a rough guide, the clearance is to be set approximately 0.1 mm larger than the outer diameter of the coil spring. The counterbore configuration shown in Fig.-2 is ideal for a coil spring with a small OD.

4. Avoid A Short Shaft Length and Shallow Counterbore Depth Hole

If the guide is too short, the coil spring may buckle in the guide tube, giving rise to the spring's deflection. It is recommended that the guide length be set longer than half of the spring effective length. It is further recommended that the guide length be one-third longer than the theoretical value, i.e., the coil spring's internal surface is not touched when it bends. This will make the weaker spring more prone to damage, or cause it to break.

5. Do Not Use Coil Springs in Series

If two or more coil springs are used in series, they tend to bend, as shown in Fig.-5. This can cause the springs to break, as shown in Fig.-6. The result is that the spring will not function, causing the system to cease operation.

6. Do Not Use the Coil Spring Horizontally

When the coil spring is used horizontally, the internal surface of the spring will come into contact with the shaft, causing abrasion of the spring. The spring will eventually break at these weakened spots.

---

### Technical Data

#### Radial Bearing (Class 0) Tolerances and Allowances

Excerpts from JIS B 1514

**Tables and Diagrams**

- **Radial Bearing (Class 0) Tolerances and Allowances**
  - **Table**: Nominal Inner Diameter Tolerances and Allowances
  - **Diagram**: How to Use Coil Springs and Precautions

- **About IP Codes for Sensor Switches**
  - **Table**: How to Use Coil Springs and Precautions
  - **Diagram**: How to Use Coil Springs and Precautions

---

**About IP Codes for Sensor Switches**

**IP codes in this catalog are based on Protection for Electric Equipment (IEC 529-1989). Sealing ability may be affected by the conditions or environment in which it is used, such as cutting oil, chemicals, or existence of dust.**

- **Ingress of Solid Foreign Objects**
  - **Table**: Ingress of Solid Foreign Objects
  - **Diagram**: How to Use Coil Springs and Precautions

- **Ingress of Water with Harmful Effects**
  - **Table**: Ingress of Water with Harmful Effects
  - **Diagram**: How to Use Coil Springs and Precautions

---

**Technical Data**

**How to Use Coil Springs and Precautions**

**Fig-1**

**Fig-2**

**Fig-3**

**Fig-4**

**Fig-5**

**Fig-6**

**Fig-7**

---

**Fig-1**: Spring Guide Formula

- **Shaft Penetration**: 1.0mm less than the dimension
- **Initial Deflection**: 0.0001
- **Amplitude**: Deflection with 0.0001 limit value
- **Velocity**: 100rpm

**Fig-2**: Load Limit

**Fig-3**: MISUMI Endurance Test Conditions

**Fig-4**: Internal Surface

**Fig-5**: Counterbore Shape

**Fig-6**: Load Limit

**Fig-7**: Foreign Matter