Instructions and notes for coil springs

MISUMI coil springs (excluding wire springs) are constantly undergoing design of optimal crosssectional form in an effort to improve durability. Take great care of the notes below in order to use it as ease.

1. Always use with a spring guide
   When used without a spring guide, the coil spring may buckle or bend midway. This can cause the spring to break since the internal surface of the bend is subjected to concentrated high stress. Be sure to use a spring guide, such as a shaft and OD (outside diameter) guide, with the coil spring.

2. Clearance between spring ID and shaft
   It is recommended that the shaft diameter be set approximately 1.5 mm smaller than the ID of the coil spring. When clearance between the spring and the shaft is insufficient, the coil spring internal surface may come into contact with the shaft and be subject to abrasion at that point. This will lead to the spring eventually breaking at the point of wear. Excessive clearance, on the other hand, can lead to bucking of the coil spring.

3. Clearance between spring OD and spotfaced hole
   It is recommended that the spotfaced hole diameter be set approximately 1.5 mm larger than the coil spring OD. The coil spring expands in the outward direction when it deflects. Insufficient clearance between the spring and the spotfaced hole results in expansion, and the resulting concentration of stress can cause the coil spring to break. The spotfaced hole configuration shown in Fig. 1 is ideal for a coil spring with a long free length.

4. Avoid a short shaft length and shallow spotfaced hole depth
   If the guide is too short, the coil spring may reach the guides tip when it is compressed. The resulting friction could cause the coil spring to break. It is recommended that the guide length be set longer than half of the initial height. Also make sure to chamfer the shaft to assure C3 level.

5. Do not use in excess of maximum deflection 300,000-times limit / use near solid height
   When the coil spring is used in excess of the 300,000-times limit, the cross section begins to receive a stress higher than the theoretical value. This will cause the coil spring to break. And when the coil spring is used at around its solid height to achieve gradual attains each other, increasing the spring constant value and causing the load curve to rise, as shown in Fig. 2. The resulting high stress that develops will cause the coil spring to break. Avoid using in conditions over 300,000 cycles.

6. Set up an initial deflection
   When there is room for the coil spring to move vertically, it receives an impact force that causes it to bend midway or to buckle. Setting up an initial deflection stabilizes the top and bottom ends of the spring.

7. Avoid entrapment of debris or foreign matter
   Debris or foreign matter that gets caught between the coils causes that part of the coil spring to stop functioning as active coils, making the other coils deflect as shown in Fig. 3. This effectively reduces the number of active coils, increasing the stress on the spring, and causing it eventually to break. Be careful not to let debris or foreign matter foul the coil.

8. Keep mounting faces parallel
   The coil spring should be mounted properly, with its mounting faces (top and bottom faces) parallel to each other. Misalignment can cause the spring to bend midway, subjecting the bend to high stress. This can cause the spring to break at that point. The same applies to the dies in which the coil spring is used, if the parallel alignment between the dies is poor, as shown in Fig. 4, the coil spring can bend midway or exceed the 300,000-times limit prematurely. Keep the coil spring mounting faces as perfectly parallel as possible to prevent this from occurring.

9. Do not use coil springs in series
   If you use two coil springs in series, they will tend to bend as shown in Fig. 5. This can cause them to move out of the shaft or spotfaced holes. If this happens, the coil spring will eventually break for the same reasons described in 1). Also due to spring load differences, the weaker spring is overcome by the stronger spring, as shown in Fig. 6. This will make the weaker spring prone to damage, or cause it to break. Moreover, each spring constant when placing 2 springs in series is 1/2 that of a single spring.

10. Do not use two coil springs in parallel
    Use of two coil springs in parallel may result in the inner coils being sandwiched between the outer coils, or vice versa, when they contract as shown in Fig. 7. This can cause the coil springs to break for the same reason noted in 4).

11. 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 at those spots. The spring will eventually break at those weakened spots.

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[TECHNICAL DATA] INSTRUCTIONS AND NOTES FOR COIL SPRINGS