[Technical Data]

How to Use Coil Springs and Precautions

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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 notes on undesirable usage that should be avoided for the sake of safety.

(1) Always Use A Spring Guide
When used without a spring guide, the coil spring may buckle or bend midway. This can cause it to break since the internal surface of the bending is subjected to concentrated high stress. Be sure to use a spring guide, such as a shaft and an outer diameter guide, with the coil spring.
* In most cases, the best results are obtained by inserting 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 1.0 mm smaller than the inner diameter of the coil spring.
When the coil spring has a long free length (i.e., free 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 it bends.

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

(4) Avoid A Short Shaft Length and Shallow Counterbore Hole Depth
If the guide is too short, the coil spring may touch the guides tip when it is buckled. The resulting friction can cause the coil spring to break. It is recommended that the guide length be set longer than half of the initial height. Also be sure to chamfer the shaft to around C3 level.

(5) Do Not Use in Excess of The Maximum Deflection (300,000 times limit) or Near Its Solid Length
When the coil spring is used in excess of the 300,000 times limit, its Cross-section starts receiving stress that is higher than the theoretical value. This can cause the coil spring to break. Furthermore, when the coil spring is used at around its solid length, its active coils gradually adhere to each other, increasing the spring constant value and causing the load curve to rise, as shown in Fig.-2. Do not use the coil spring in excess of the 300,000 times limit.

(6) Set up An Initial Deflection
When there is a gap 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 objects that become caught between the coils cause that part of the coil spring to stop functioning as active coils, forcing the other coils to deflect, as shown in Fig.-3. This effectively reduces the number of active coils, increasing the stress on the spring, and eventually causing it to break. Be careful not to allow debris or foreign objects to clog the coils.

(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 the 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, counterbore holes. If this happens, this coil spring will eventually break for the same reasons described in (1) above. Moreover, due to spring load differences, the weaker spring is overcome by, and deflects more than, the stronger spring, as shown in Fig.-6. This will make the weaker spring more prone to damage, or cause it to break.

(10) Do Not Use Two Coil Springs in Parallel
Use of two coil springs in parallel, as shown in Fig.-7, may result in the inner coils being sandwiched between the outer coils, or vice versa, when they contract. 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 these weakened spots.

MISUMI Endurance Test Conditions

(1)Spring Guide Formula
Shaft Penetration
Shapt Dia.: -1.0mm less than d dimension

(2)Initial Deflection
1.0mm

(3)Amplitude
Deflection with 300,000 time limit value

(4)Velocity
180spm

* The maximum number of allowable operating times may vary depending on the service conditions.

Fig-1

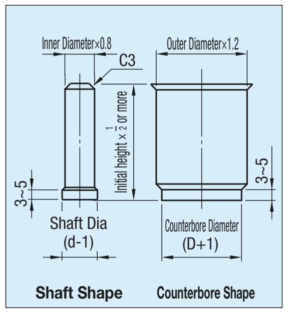


Fig-2

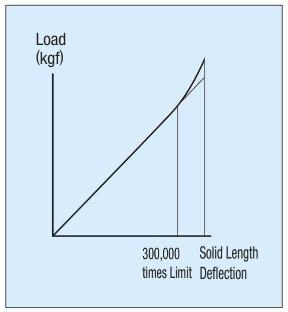


Fig-3

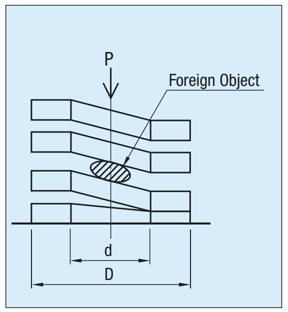


Fig-4

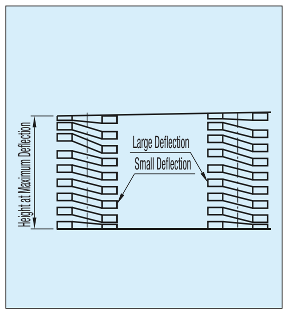


Fig-5

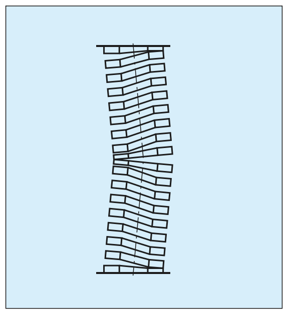


Fig-6

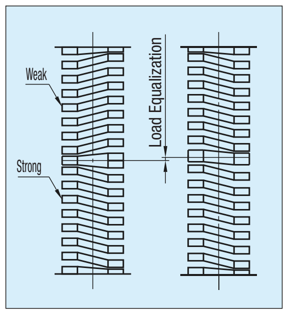
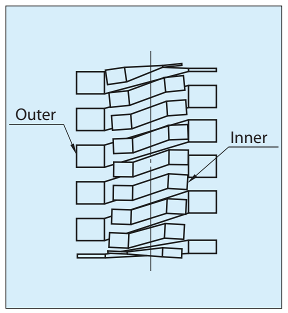


Fig-7



[Technical Data]

Regular Machining Dimension Tolerance

Excerpts from JIS B 0405, 0419(1991)

1. Regular Cut Dimension Tolerance B 0405—1991

Tolerances in Respect of Length Excluding Chamfered Portion

Unit: mm

Tolerance Class		Classification of Reference Dimension							
Symbol	Description	0.5 (1) or More 3 or Less	More than 3 6 or Less	More than 6 30 or Less	More than 30 120 or Less	More than 120 400 or Less	More than 400 1000 or Less	More than 1000 2000 or Less	More than 2000 4000 or Less
		Tolerance							
f	Precision Grade	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5	–
m	Medium	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2
c	Coarse	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	±4
v	Extremely Coarse	–	±0.5	±1	±1.5	±2.5	±4	±6	±8

Note (1) : A reference dimension less than 0.5 mm is followed by a tolerance.

2. Tolerances in Respect of the Length of the Chamfered Portion (Radius of rounding for edges and edge chamfering dimension)

Unit: mm

Tolerance Class		Classification of Reference Dimension		
Symbol	Description	0.5 (2) or More 3 or Less	More than 3 6 or Less	More than 6
		Tolerance		
f	Precision Grade	±0.2	±0.5	±1
m	Medium			
c	Coarse	±0.4	±1	±2
v	Extremely Coarse			

Note (2) : A reference dimension less than 0.5 mm is followed by a tolerance.

3. Angle Tolerance

Tolerance Class		Length of Shorter Side (Unit: mm)				
Symbol	Description	10 or Less	More than 10 50 or Less	More than 50 120 or Less	More than 120 400 or Less	More than 400
		Tolerance				
f	Precision Grade	±1°	±30'	±20'	±10'	± 5'
m	Medium					
c	Coarse	±1°30'	± 1°	±30'	±15'	±10'
v	Extremely Coarse	±3°	± 2°	± 1°	±30'	±20'

4. Regular Perpendicularity Tolerance B 0419—1991

Unit: mm

Tolerance Class	Nominal Length of Shorter Side			
	100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000 3000 or Less
	Perpendicularity Tolerance			
H	0.2	0.3	0.4	0.5
K	0.4	0.6	0.8	1
L	0.6	1	1.5	2

5. Regular Straightness and Flatness Tolerance

Unit: mm

Tolerance Class	Nominal Length					
	10 or Less	More than 10 30 or Less	More than 30 100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000 3000 or Less
	Regular Straightness and Flatness Tolerance					
H	0.02	0.05	0.1	0.2	0.3	0.4
K	0.05	0.1	0.2	0.4	0.6	0.8
L	0.1	0.2	0.4	0.8	1.2	1.6

6. Regular Symmetry Tolerance

Unit: mm

Tolerance Class	Nominal Length			
	100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000
	Symmetry Tolerance			
H	0.5			
K	0.6		0.8	1
L	0.6	1	1.5	2