[Technical Data]
Radial Bearing (Class 0) Tolerances and Allowances
Excerpts from JIS B 1514

About IP Codes for Sensor Switches

Radial Bearing(Class 0) Tolerances and Allowances

(1) Inner Wheel

Unit μm

d (mm) Nominal Inner Diameter of Bearing		△dmp		Diameter Series V_{dp} 9	0,1	2, 3, 4	V_{dmp}	K_{ia}	△Bs Single Bearing		△Bs Bearings in Combinations		V_{Bs}
More	or Less	Above	Below	Max.	Max.	Max.	Max.	Max.	Above	Below	Above	Below	Max.
0.6(1)	2.5	0	–8	10	8	6	6	10	0	–40	–	–	12
2.5	10	0	–8	10	8	6	6	10	0	–120	0	–250	15
10	18	0	–8	10	8	6	6	10	0	–120	0	–250	20
18	30	0	–10	13	10	8	8	13	0	–120	0	–250	20
30	50	0	–12	15	12	9	9	15	0	–120	0	–250	20
50	80	0	–15	19	19	11	11	20	0	–150	0	–380	25
80	120	0	–20	25	25	15	15	25	0	–200	0	–380	25
120	180	0	–25	31	31	19	19	30	0	–250	0	–500	30
180	250	0	–30	38	38	23	23	40	0	–300	0	–500	30
250	315	0	–35	44	44	26	26	50	0	–350	0	–500	35
315	400	0	–40	50	50	30	30	60	0	–400	0	–630	40
400	500	0	–45	56	56	34	34	65	0	–450	–	–	50
500	630	0	–50	63	63	38	38	70	0	–500	–	–	60
630	800	0	–75	–	–	–	–	80	0	–750	–	–	70
800	1000	0	–100	–	–	–	–	90	0	–1000	–	–	80
1000	1250	0	–125	–	–	–	–	100	0	–1250	–	–	100
1250	1600	0	–160	–	–	–	–	120	0	–1600	–	–	120
1600	2000	0	–200	–	–	–	–	140	0	–2000	–	–	140

(1)0.6mm is included in this class. (2)Applies to each orbit ring made for bearing combination.

(2) Outer Ring

D(mm) Nominal Outer Diameter of Bearing		△Dmp		Open Bearing, Diameter Series V_{DP} f 9	Open Bearing 0,1	Open Bearing 2,3,4	Sealed Bearing, Shielded Bearing 2,3,4	(4) V_{Dmp}	K_{ea}	△Cs		V_{Cs}
More	or Less	Above	Below	Max.	Max.	Max.	Max.	Max.	Max.	Above	Below	Max.
2.5(3)	6	0	–8	10	8	6	10	6	15			
6	18	0	–8	10	8	6	10	6	15			
18	30	0	–9	12	9	7	12	7	15			
30	50	0	–11	14	11	8	16	8	20			
50	80	0	–13	16	13	10	20	10	25			
80	120	0	–15	19	19	11	26	11	35			
120	150	0	–18	23	23	14	30	14	40			
150	180	0	–25	31	31	19	38	19	45			
180	250	0	–30	38	38	23	–	23	50	Depends on △Bs tolerance against d of the same bearing.		Depends on △Bs tolerance against d of the same bearing.
250	315	0	–35	44	44	26	–	26	60			
315	400	0	–40	50	50	30	–	30	70			
400	500	0	–45	56	56	34	–	34	80			
500	630	0	–50	63	63	38	–	38	100			
630	800	0	–75	94	94	55	–	55	120			
800	1000	0	–100	125	125	75	–	75	140			
1000	1250	0	–125	–	–	–	–	–	160			
1250	1600	0	–160	–	–	–	–	–	190			
1600	2000	0	–200	–	–	–	–	–	220			
2000	2500	0	–250	–	–	–	–	–	250			

(3) 2.5mm is included in this class. (4)Applies when a retaining ring is not installed.

Dimensional Tolerance

- △ dmp: Tolerance of Mean Inner Diameter within the Plane
- △ Dmp: Tolerance of Mean Outer Diameter within the Plane
- △ Bs : Measured Inner Ring Tolerance or Height Tolerance of Center Orbiting Plate
- △ Cs : Measured Outer Ring Tolerance

Dimensional inequality

- V_{dp} : Inner Diameter Inequality within the Plane
- V_{dmp} : Mean Inner Diameter Inequality within the Plane
- V_{Dp} : Outer Diameter Inequality within the Plane
- V_{Dmp} : Mean Outer Diameter Inequality within the Plane
- V_{Bs} : Inequality of Inner Ring Widths
- V_{Cs} : Inequality of Outer Ring Widths

Rotation Precision

- K_{ia} : Radial Deviation of Inner Rings
- K_{ea} : Radial Deviation of Outer Rings

About IP Codes for Sensor Switches

·IP codes in this catalog are based on"Protection Statement for Equipments"of 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.

IP 6 7

(International Protecion)
First Characteristic Numeral (0~6): Ingress of Solid Foreign Objects
Second Characteristic Numeral(0~8): Ingress of Water with Harmful Effects

Characteristic Numeral	Ingress of Solid Foreign Objects	Ingress of Water with Harmful Effects
0	Non-Protected	Non-Protected
1	Protected against solid foreign objects 50mm in diameter or greater.	Protected against vertically falling water drops.
2	Protected against solid foreign objects 12.5mm in diameter or greater.	Protected against vertically falling water drops angled within 15 degree.
3	Protected against solid foreign objects 2.5mm in diameter or greater.	Protected against spraying water.
4	Protected against solid foreign objects 1.0mm in diameter or greater.	Protected against splashing water.
5	Dust-protected: Prevents the penetration of dust in amounts interfering with equipment operation.	Protected against water jetting from any direction.
6	Dust-tight:No ingress of dust.	Protected against powerful water jetting from any direction.
7	–	Protected against ingress of water in quantities causing harmful effects when the enclosure is temporarily immersed.
8	–	Protected against ingress of water in quantities causing harmful effects when the enclosure is continuously immersed in water under conditions more severe than No. 7, as determined by the parties concerned.

[Technical Data]
How to Use Coil Springs and Precautions

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 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 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 object that becomes 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 sharply 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 object to clog the coils.

⑧ Keep Mounting Faces Parallel
Improper parallelism at the mounting surface 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 as 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 as 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

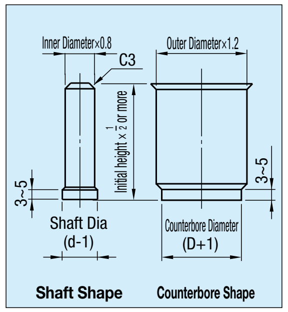

Fig-2

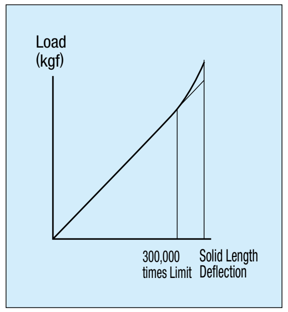

Fig-3

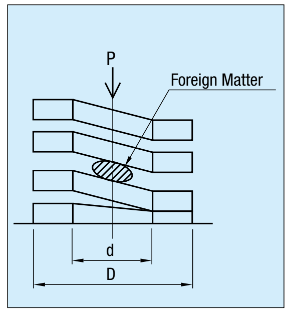

Fig-4

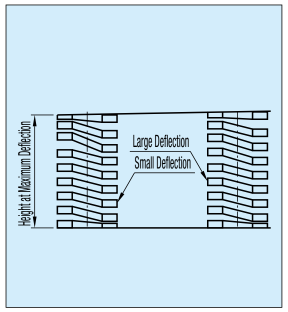

Fig-5

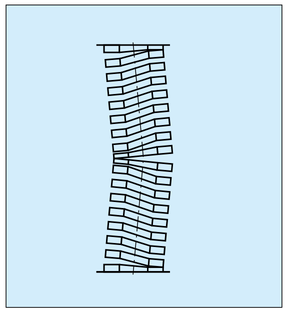

Fig-6

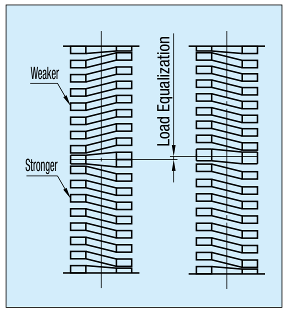

Fig-7