SPIROL®
WHITE PAPER

How to Design the Optimum Hinge

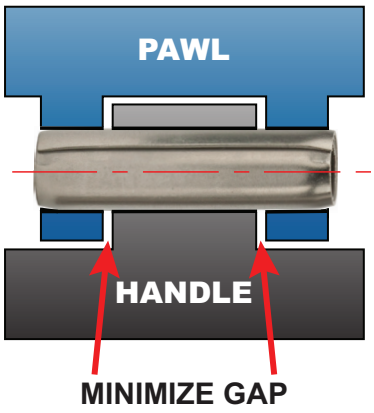
by Christie L. Jones, Market Development Manager
SPIROL International Corporation, Danielson, CT, U.S.A.

There are two primary types of hinges:

1) A ***free fit hinge*** has little to no friction or drag when the latch or handle is rotated. Hinge components are "free" to rotate independent of one another.

2) A ***friction fit hinge*** requires interference to prevent free rotation of components relative to one another. Depending on design intent, resistance can vary from a slight drag to a value sufficient to maintain the fixed position of components anywhere in their full range of rotation.

Figure 1



Although many pin styles are available, Coiled Spring Pins are particularly well suited for use in both friction and free fit hinges. To achieve optimum long-term hinge performance designers should observe some simple design guidelines. Regardless which pin type is used, the gap between hinged components should be minimized to reduce clearance and avoid bending of the pin (***Figure 1***).

Figure 2a

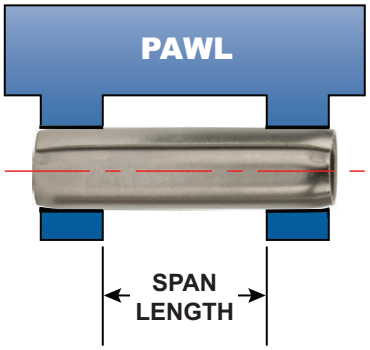
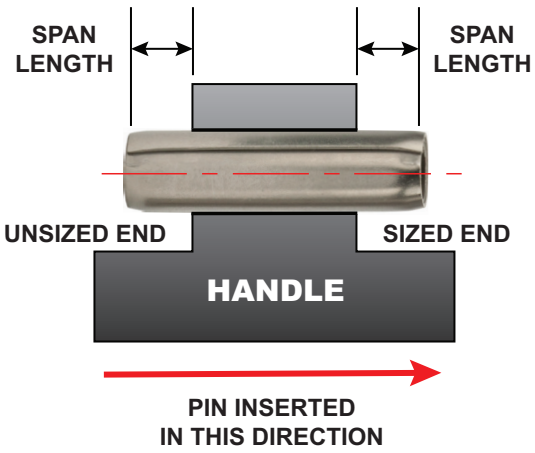


Figure 2b



FREE FIT HINGE

If a ***free fit hinge*** is desired, the Coiled Pin's pre-installed diameter is of negligible importance as pin diameter is determined by the retaining, or smallest hole(s). Coiled Pins are functional springs and recovery & retention in free fit locations must be considered. The amount of recovery/ retention is dependent upon the diameter of the tight (retaining) hole(s) and the 'free span' of the pin. Free span would be defined as the distance a pin passes through a free fit component. As free span increases, the pin diameter will also increase as it "recovers" a portion of its pre-installed diameter (***Figures 2a & 2b***).

It is recommended for better load distribution and closer tolerance hinges that the tight fit of the Coiled Pin be in the outer members of the hinge (***Figure 2a***). The minimum thickness of the outer members should be 1 to 1½ times the diameter of the pin. If the thickness of the outer members are less than the diameter of the pin, then the tight fit should be in the inside hole.

To design a free fit hinge, first establish maximum hole size in the retaining component (tight fit). Insert the Coiled Pin into the retaining component and measure the free diameter of the pin at the center of the span. Add a factor to provide some clearance for the rotating member, usually .001" (0.02 mm) to establish the minimum diameter of the free hole. Then add the required production tolerance to assign the maximum diameter of the free hole.

If the tight fit is on the inside member of the assembly, as the pin is installed there becomes a sized and an unsized end of the pin (***Figure 2b***). The end of the pin that has not been inserted through the hole is larger than the end that has been sized by the hole. Therefore, measure the diameter of the unsized end to determine the minimum diameter of the free hole in the outside members.

FRICTION FIT HINGE

In a ***friction fit hinge***, all of the holes should be sized identically within the assigned tolerances. If the manufacturer is unable to maintain the same hole size within each component, the tolerance should be split between the components. It is most common to assign the smaller half of the tolerance to the outside holes and larger half to the inside hole.

The Coiled Pin simplifies design as there is no need to incorporate misalignment between holes to achieve friction, as is the case with rigid Solid Pins. Coiled Pins perform best when installed in straight, properly aligned holes. The Coiled Pin's spring characteristics can be used to achieve exceptional performance and maintain desired fit and function throughout the life of the product.

Although this article offers general design guidelines, it is recommended that Application Engineers who specialize in fastening and joining be consulted to ensure the optimum hinge design is employed for each application.

SPIROL® Coiled Spring Pins

Coiled Pins are offered in Light, Standard and Heavy Duty.

For additional information visit the Coiled Pins ***Rapid Search*** page at www.**SPIROL**.com.

SPIROL *offers application engineering support.*

SPIROL Application Engineers will review your application needs and work with your design team to recommend the best solution. For technical support, feel free to contact **SPIROL** directly or start the process by selecting **Pinning Applications** in our **Optimal Application Engineering** portal at www.**SPIROL**.com.

Technical Centers

Americas

SPIROL International Corporation
30 Rock Avenue
Danielson, Connecticut 06239 U.S.A.
Tel. +1 860 774 8571
Fax. +1 860 774 2048

SPIROL Shim Division
321 Remington Road
Stow, Ohio 44224 U.S.A.
Tel. +1 330 920 3655
Fax. +1 330 920 3659

SPIROL Canada
3103 St. Etienne Boulevard
Windsor, Ontario N8W 5B1 Canada
Tel. +1 519 974 3334
Fax. +1 519 974 6550

SPIROL Mexico
Carretera a Laredo KM 16.5 Interior E
Col. Moisés Saenz
Apodaca, N.L. 66613 Mexico
Tel. +52 81 8385 4390
Fax. +52 81 8385 4391

SPIROL Brazil
Rua Mafalda Barnabé Soliane, 134
Comercial Vitória Martini, Distrito Industrial
CEP 13347-610, Indaiatuba, SP, Brazil
Tel. +55 19 3936 2701
Fax. +55 19 3936 7121

Europe

SPIROL France
Cité de l'Automobile ZAC Croix Blandin
18 Rue Léna Bernstein
51100 Reims, France
Tel. +33 3 26 36 31 42
Fax. +33 3 26 09 19 76

SPIROL United Kingdom
17 Princewood Road
Corby, Northants
NN17 4ET United Kingdom
Tel. +44 1536 444800
Fax. +44 1536 203415

SPIROL Germany
Ottostr. 4
80333 Munich, Germany
Tel. +49 89 4 111 905 71
Fax. +49 89 4 111 905 72

SPIROL Spain
08940 Cornellà de Llobregat
Barcelona, Spain
Tel. +34 93 193 05 32
Fax. +34 93 193 25 43

SPIROL Czech Republic
Sokola Tůmy 743/16
Ostrava-Mariánské Hory 70900
Czech Republic
Tel/Fax. +420 417 537 979

SPIROL Poland
ul. M. Skłodowskiej-Curie 7E / 2
56-400, Oleśnica, Poland
Tel. +48 71 399 44 55

Asia Pacific

SPIROL Asia Headquarters
1st Floor, Building 22, Plot D9, District D
No. 122 HeDan Road
Wai Gao Qiao Free Trade Zone
Shanghai, China 200131
Tel. +86 21 5046 1451
Fax. +86 21 5046 1540

SPIROL Korea
160-5 Seokchon-Dong
Songpa-gu, Seoul, 138-844, Korea
Tel. +86 (0) 21 5046-1451
Fax. +86 (0) 21 5046-1540

e-mail: **info@spirol.com**

SPIROL.com