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WHITE PAPER

How to Maximise Retention of Spring Pins

by Evan M. Dowell, Field Sales Manager
SPIROL International Corporation

There are two types of Spring Pins: Coiled Pins (left) and Slotted Pins (right).

Spring Pins are used in many different assemblies for a variety of reasons: to serve as hinge pins and axles, to align components, or simply to fasten multiple components together. Spring Pins are formed by rolling and configuring metal strip into a cylindrical shape that allows for radial compression and recovery. When properly implemented, Spring Pins provide reliable robust joints with excellent retention.

During installation, Spring Pins compress and conform to the smaller host hole. Work used to compress the pin has been captured as potential energy. The compressed pin then exerts outward radial force against the hole wall. Retention is provided by compression and the resultant friction between the pin and hole wall. For this reason, surface area contact between the pin and the hole is critical.

Retention can be optimised by increasing radial stress and/or contact surface area. A larger, heavier pin will exhibit reduced flexibility and as a result, the installed spring load or radial stress will be higher. Coiled Spring Pins are the exception to this rule as they are available in multiple duties (light, standard and heavy) to provide a greater range of strength and flexibility within a given diameter.

There is linear relationship between friction/retention and engagement length of a Spring Pin within a hole. Therefore, increasing the length of the pin and the resulting contact surface area between the pin and host hole will result in higher retention. In addition, considering there is no retention at the very end of the pin due to the chamfer, it is important to take the chamfer length into consideration when calculating engagement length. At no point should the pin's chamfer be located in the shear plane between mating holes as this can lead to translation of tangential force into axial force that can contribute to "walking" or pin movement away from the shear plane until the force is neutralised *(see Figure 1)*. To avoid this scenario, it is recommended that the end of the pin clear the shear plane by a length equal to one pin diameter or more. This condition can also be caused by tapered holes that can similarly translate tangential force into outward movement. As such, it is recommended that holes with no taper be implemented and if taper is necessary it remain under 1° included.

Spring Pins will recover a portion of their pre-installed diameter wherever they are unsupported by the host material. In applications for alignment, it is recommended that the Spring Pin be inserted 60% of the total pin length into the initial hole to permanently fix its position and control the diameter of the protruding end *(see Figure 2)*. In free-fit hinge applications it is preferred to retain the pin in the outer members provided the width of each of these locations is greater than or equal to 1.5X the pin's diameter. If this guideline is not satisfied, retaining the pin in the centre component may be prudent. Friction fit hinges require all hinge components be prepared with matched holes and that each component, regardless of the number of hinge segments, maximises engagement with the pin.

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

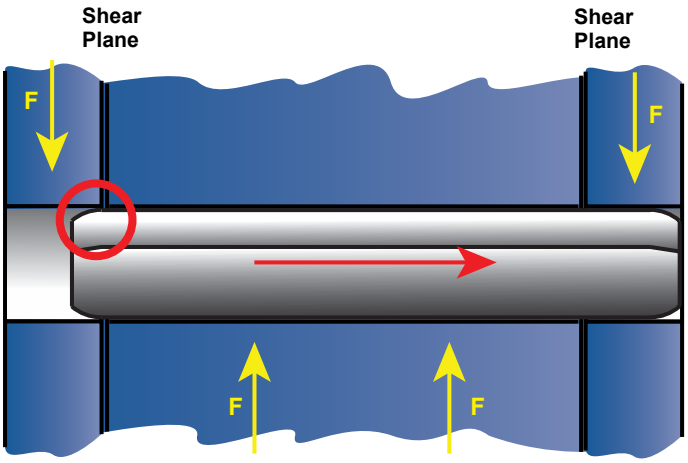

Figure 1

The pin's chamfer must not be in the shear plane. In this case, the pin will move in the direction indicated until the chamfer is no longer in the shear plane.

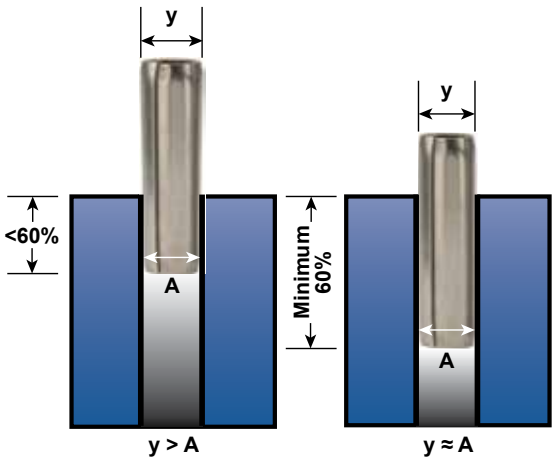

Figure 2

The example on the left shows how the protruding end of the pin maintains a diameter larger than the hole when less than 60% of the length is retained in the host hole. On the right, the protruding end of the pin has a diameter approximately equal to the hole.

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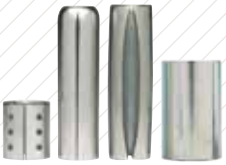

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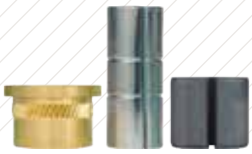

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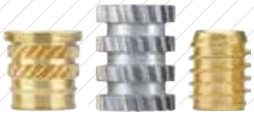

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Technical Centres

Europe

SPIROL United Kingdom
17 Princewood Road
Corby, Northants
NN17 4ET United Kingdom
Tel: +44 (0) 1536 444800
Fax: +44 (0) 1536 203415

SPIROL France
Cité de l'Automobile ZAC Croix Blandin
18 Rue Léna Bernstein
51100 Reims, France
Tel: +33 (0) 3 26 36 31 42
Fax: +33 (0) 3 26 09 19 76

SPIROL Germany
Ottostr. 4
80333 Munich, Germany
Tel: +49 (0) 89 4 111 905 71
Fax: +49 (0) 89 4 111 905 72

SPIROL Spain
Plantes 3 i 4
Gran Via de Carles III, 84
08028, Barcelona, Spain
Tel/Fax: +34 932 71 64 28

SPIROL Czech Republic
Evropská 2588 / 33a
160 00 Prague 6-Dejvice
Czech Republic
Tel: +420 226 218 935

SPIROL Poland
ul. Solec 38 lok. 10
00-394, Warsaw, Poland
Tel. +48 510 039 345

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
Avenida Avante #250
Parque Industrial Avante Apodaca
Apodaca, N.L. 66607 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

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 (0) 21 5046-1451
Fax: +86 (0) 21 5046-1540

SPIROL Korea
16th Floor, 396 Seocho-daero,
Seocho-gu, Seoul, 06619, South Korea
Tel: +82 (0) 10 9429 1451

e-mail: info-uk@spirol.com

SPIROL.co.uk