

How To Choose Fasteners That Maximize Assembly Life

by Christie Jones
Market Development Manager
SPIROL International Corporation, U.S.A.
February 6, 2009

Fasteners are usually the smallest, least expensive components within an assembly. Even though fasteners usually hold the entire assembly together, they are often overlooked until the end of the design. As important as fasteners are, Design Engineers usually receive no formal training on the mechanics of fastening and joining. (Not something you want to think about next time you are on an airplane.)

An assembly can be held together in many ways: bolts, rivets, screws and pins, to name a few. The methods fall into two broad categories: (1) methods that take two components or two operational steps to stay in place; and (2) methods where the components are self-retaining. The challenge for the Design Engineer is to choose a method that provides the highest quality joint with integrity over time at the lowest manufacturing cost. For many applications, a self-retaining pin is the winning solution. The difficulty is selecting the proper pin with the appropriate strength and flexibility for the application. Technically, when a load is applied, something has to give: the pin, the hole, or an element of the assembly. A pin that is too rigid causes the hole in which it is retained to elongate and leads to eventual assembly failure. A pin that is too flexible will fatigue under dynamic loading.



The Solid Pin's rigidity elongates the hole.

On the contrary, due to the pin's inflexibility, oftentimes Solid Pins damage the holes when used in a dynamic loading application, which leads to premature failure. Additionally, using a softer Solid Pin material reduces host damage, but commensurately reduces the pin's strength. Alternatively, a heat-treated Spring Pin is often stronger than a Solid Pin and its inherent flexibility maximizes assembly life in dynamic, heavy-duty applications.

Solid Pins

Solid Pins come in many different forms. Examples include: Dowel Pins, Knurled Pins, and Grooved Pins. In general, Solid Pins are strong, and relatively inflexible.

They do not absorb shock and dynamic loads, but rather transmit these to the mating components. While there are many applications where a Solid Pin is an effective solution, the dynamic forces in many applications need to be closely examined. For example, there is a common paradigm that Solid Pins are the best option for heavy duty applications. On

Spring Pins

There are two distinct types of **Spring Pins**: **Slotted Spring Pins** and **Coiled Spring Pins**.

Both types share certain characteristics such as flexibility and their ability to accommodate wider hole tolerances than Solid Pins.

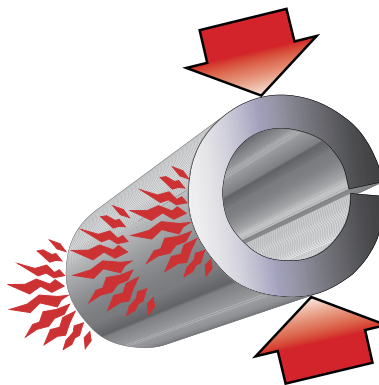


Coiled Pins

Slotted Pins

Slotted Pins

The pins' flexibility reduces manufacturing costs. However there are several **disadvantages to Slotted Pins** that limit their applicability in new designs – particularly in those applications with a soft host material, such as aluminum or plastic, which are subject to dynamic loading.



Under load, stress is concentrated 180° opposite the gap in Slotted Pins.

The Slotted Pin is significantly **less flexible** than the Coiled Pin and it only flexes 180° from the gap. This combination can cause premature assembly failure.

Additionally, Slotted Pins are very **difficult to automatically feed and install**. The most appropriate applications for Slotted Pins are non-critical assemblies, manufactured out of mild to hardened steel, that are manually assembled.



Interlocking does not allow for automatic feeding and installation of Slotted Pins.

Coiled Spring Pins

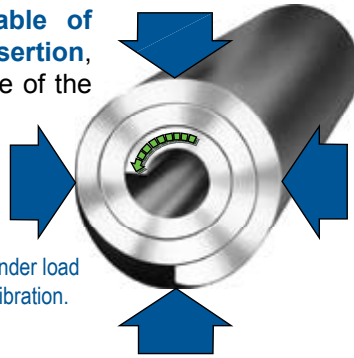
Coiled Pins were invented to address the drawbacks of the Slotted Pins, and to offer the Design Engineer the flexibility to tailor the pin's strength and flexibility to match the application.



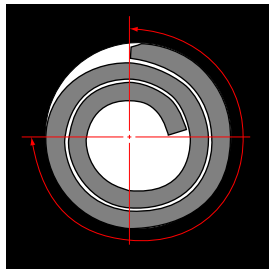
Light, Standard
and Heavy Duty
Coiled Pins

This ability to "customize" the function of the pin ensures that each application has the optimum combination of strength and flexibility. Light duty pins are generally recommended for soft or brittle materials. Medium (or standard) duty pins are recommended for use in mild steel and non-ferrous assemblies. Heavy duty pins should be used in hardened components.

The Coiled Pin is the most capable of absorbing shock and vibration after insertion, therefore providing prolonged useful life of the assembly, and it is conducive for automatic feeding and installation in high volume situations.



The Coiled Pin flexes under load to absorb shock and vibration.



Coiled Pin has 270° contact with the hole.

Coiled Pins can be used as hinge pins, alignment pins, stop pins and to fasten multiple components together (e.g.: to pin a gear and shaft). Coiled Pins are not usually recommended as cam followers, or where there is limited length of engagement for the pin. These applications are usually best served by a Solid Pin with retention features.

Considering the many different ways to fasten assemblies, it is recommended that Engineers take advantage of the Application Engineering services provided by the manufacturers of engineered fasteners. By partnering with industry experts in fastening and assembly, Engineers can be assured that their assembly will be equipped with the most cost effective solution that provides exceptional performance and preserves the integrity of the application throughout the life of the product.

SPIROL offers free samples and engineering support.

SPIROL Application Engineers will review your application needs and work with your design team to recommend the best solution. One way to start the process is to select **Pinning Applications** in our **Optimal Application Engineering** portal at www.SPIROL.com.

© 2009 Spirol International Corporation 02/09. No part of this publication may be reproduced or transmitted in any form or by any means, electronically or mechanically, except as permitted by law, without written permission from Spirol International Corporation.

U.S.A. Spirol International Corporation
30 Rock Avenue
Danielson, Connecticut 06239
Tel. 860.774.8571 Fax 860.774.2048

Spirol West Inc.
1950 Compton Avenue, Unit 111
Corona, California 92881-6471
Tel. 951.273.5900 Fax 951.273.5907

Spirol International Corporation Shim Division
321 Remington Road
Stow, Ohio 44224
Tel. 330.920.3655 Fax 330.920.3659

Spirol Distribution
30 Rock Avenue
Danielson, Connecticut 06239
Tel. 800.321.4679 Fax 860.774.0487
(For Distributor Customers)

Canada Spirol Industries, Ltd.
3103 St. Etienne Boulevard
Windsor, Ontario
Canada N8W 5B1
Tel. 519.974.3334 Fax 519.974.6550

Mexico Spirol México, S.A. de C.V.
Carretera a Laredo KM 16.5 Interior E
Col. Moisés Saenz
Apodaca, N.L. 66613 México
ó Apdo. Postal 151 de Apodaca, N.L.
Tel. (81) 8385 4390 Fax (81) 8385 4391

Europe Spirol Industries, Ltd.
Princewood Road
Corby, Northants
England NN17 4ET
Tel. 44 (0) 1536 444800
Fax 44 (0) 1536 203415
(For Distributor Customers)
Tel. 44 (0) 8003 890034

Spirol SAS
Rue Henri Rol Tanguy
Z.A. Les Naux
51450 Bétheny
France
Tel. 33 (0)3 26 36 31 42
Fax 33 (0)3 26 09 19 76

Spirol GmbH
Brienner Strasse 9
80333 Munich
Germany
Tel. 49 (0) 931 454 670 74
Fax. 49 (0) 931 454 670 75

Asia Pacific Spirol International Engineered Fastener Trading Co. Ltd.
No. 11 Xi Ya Rd. North
Section A, 1F, Building 14
Wai Gao Qiao Free Trade Zone
Shanghai, China 200131
Tel. (8621) 5046 1451/1452
Fax (8621) 5046 1540

e-mail: info@spirol.com

SPIROL.com

ISO/TS 16949:2002 Certified