

# How to Properly Pin a Shaft and Hub Assembly

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

One of the primary benefits of using a Coiled Spring Pin to affix a hub or gear to a shaft is the Coiled Pin's ability to prevent hole damage. Another benefit is that the Coiled Pin absorbs wider hole tolerances than any other press-fit pin. This translates to lower total manufacturing costs of the assembly.

There are a few design guidelines that must be adhered to in order to achieve the maximum strength of the pinned system and prevent damage to the assembly:

**The design guidelines can be divided into two groups: 1) the shaft and hub, and 2) the pin.**

## 1. Shaft and Hub Considerations

- The hole in a shaft should not exceed 1/3 of the shaft diameter. For mild steel and nonferrous shafts, standard duty pins are recommended. The extra strength of a heavy duty pin is only beneficial if the hole is less than 1/4 the diameter of the shaft or if the shaft is hardened (*Figure 1*).
- It is recommended that the hub be designed with a minimum wall thickness of 1.5 times the diameter of the pin. Otherwise, the strength of the hub will not match the shear strength of the pin (*Figure 1*). As the wall thickness of the hub increases, so does the area of material around the pin.

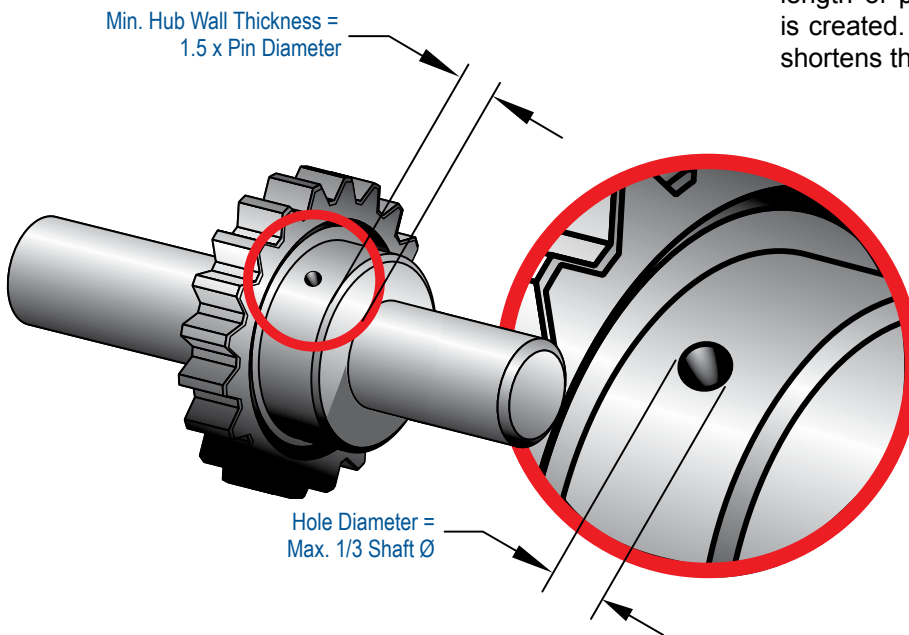
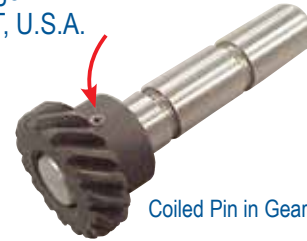


Figure 1

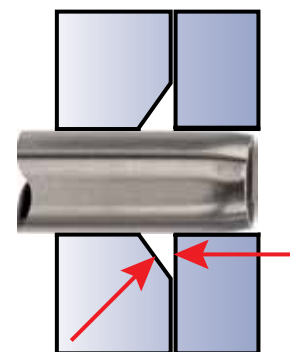


Coiled Spring Pin



Coiled Pin in Gear Shaft

- The diameter of the holes through both the shaft and hub should be precision matched to eliminate any movement of the pin within the holes. It is recommended that the difference between the hole diameters in the hub and shaft not exceed 0.05mm (.002") to prevent movement of the parts relative to each other. Otherwise, the pin will be subject to dynamic loading such that a very small change in velocity could equate to a significant change in force impacting the assembly.
- The hole should be centered in both the shaft and hub to prevent stress concentration and ensure there is enough material around the pin to withstand the applied forces.
- If the holes cannot be precision matched, dividing the tolerance between the shaft and hub is recommended. The larger half of the tolerance should be applied to the component with the longest engagement length, and the smaller half should be applied to the other component.
- Countersinks on the holes are not recommended. In addition, the outer diameter of the shaft (OD) and the inner diameter of the collar (ID) should be designed such that the distance between the shear planes (OD-ID) does not exceed 0.13mm (.005"). In both cases, an unsupported length of pin in an area where torque may be applied is created. This could cause a bending moment, which shortens the lifespan of the pin (*Figure 2*).



A countersink increases the distance between the shear planes. This can put the pin in bending and thus reduce the strength of the pin.

Figure 2

- Installing a cylindrical pin into a hole on the surface of a cylindrical object leads to two point contact between the pin and the hole. This concentrates the compression force on only two points of the circumference. To increase the contact surface between the periphery of the hole and pin, and to ease installation, a flat should be placed on the exterior surface of the hole (*Figure 3*).

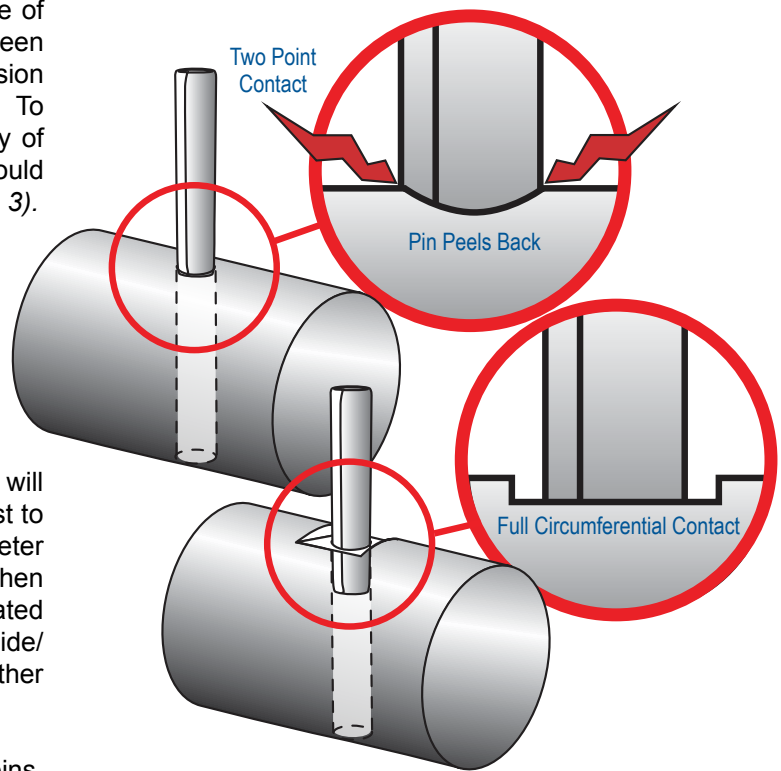


Figure 3

## 2. Coiled Pin Considerations

- It is important to start with the load to which the pin will be subjected. Then evaluate the material of the host to determine the **duty** of the Coiled Pin. The pin diameter needed to transmit the load in the proper duty can then be determined from the shear strength tables located in the **SPIROL® Coiled Spring Pins** design guide/ product catalog taking into consideration these further guidelines:
- Wherever space permits, use **standard duty** pins. Standard duty Coiled Pins have the optimum combination of strength and flexibility for use in nonferrous and mild steel components. They are also recommended for use in hardened components as they have greater shock absorbing capabilities.
- Heavy duty** pins should only be used in hardened materials where space or design limitations rule out a larger diameter standard duty Coiled Pin. An exception to this rule is that austenitic (nickel) stainless steel pins should never be used in hardened components.
- A **light duty** pin is recommended for soft, brittle or thin materials or where holes are close to an edge. In situations not subject to significant loads, light duty pins are often used because of the lower insertion forces required.



SPIROL® Coiled Spring Pins are available in three duties to optimize strength and flexibility.

Original article written by Caroline Mallory.

**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 design is employed for each application.**

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## 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 Tümy 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](mailto:info@spirol.com)

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