

# The benefits of light duty coiled spring pins in soft and brittle materials

By Adolf Valasek, applications engineer, SPIROL International

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## General benefits of spring pins

Spring pins are mechanical fasteners used for a variety of functions including hinging, aligning and joining two or more parts together. Their method of retention is by radial tension that results from their interference with the host component. The key difference to other fastening methods that rely on interference is that spring pins are designed to be the compliant, flexible element of the joint.

Spring pins exert a constant radial tension against the hole wall and can protect the host component from incurring deformation or other permanent damage to the hole. Thanks to its flexible diameter, spring pins also allow for a much wider hole tolerance, lowering the manufactured cost of the host component.

“Spring pin” is a general term, however. There are other types of fasteners that satisfy the above definition, of which two are the most prevalent – slotted spring pins and coiled spring pins. Slotted spring pins are best known by their C-shape cross section, while coiled spring pins have a 2¼ coil cross section and present the more flexible option as they are made of multiple wraps of thinner material and do not have a slot that would limit its flexibility when it closes.

## The three duties and differences between them

The coiled pin is available in three duties – light, standard and heavy – so designers have the option to choose the optimum balance of strength, flexibility and diameter of the pin for their specific application. All three duties have the same 2¼ coil formation with the core physical difference between them being the thickness of the raw material – and subsequently their flexibility and strength.

Typically, the optimum “duty” is driven by the host material of the application and its strength or hardness as well as the actual functional requirements of the pin within the assembly. Light duty is recommended for plastics, soft metal castings (such as zinc and aluminium die castings) and brittle materials such as ceramics. Standard duty is recommended for mild steels (such as heat treated steels and cast iron) and non-ferrous metals (such as bronze and aluminium), while heavy duty is reserved for hardened steels or severe shock and vibration environments.

Host material type, however, only limits the use of the heavier duties, with the goal being to design in a pin that is strong enough to withstand the applied load, yet flexible enough to isolate and protect the soft or fragile hole material from the forces. A pin too stiff for the applied load and host material would not flex and thus could damage the

hole and potentially result in a failed assembly. On the other hand, light duty coiled pins can be used in all types of host materials. This makes light duty extremely versatile – especially when used in alignment applications where there is limited force applied on the pin.

The light duty presents the most flexible option of the three duties, yet it still has sufficient strength for most applications. In fact, the name “light duty” doesn’t do it justice in terms of its actual strength. Table 1 provides a comparison between high carbon steel light duty coiled pins and low carbon steel solid grooved pins per ASME B18.8.9M.

The strength difference of the grooved pin varies from 1.2kN to 8.2kN higher than that of the light duty coiled spring pin. Considering that the majority of the assemblies that use light duty coiled spring pins are soft or fragile materials, the reality is that the strength of the light duty coiled pin is often more than sufficient – and in fact – often exceeds the strength of the host material. (Believe it or not, the strength of a single 6mm light duty coiled spring is enough to hold up a passenger car.) Additionally, the vast majority of applications only see loads at a fraction of the pin’s strength. So in this sense, the slightly higher strength of the solid pin often adds no benefit to the assembly because it isn’t necessary. Generally, if the pin is not a part of a power transmission mechanism or doesn’t bear large weights, then its ultimate shear strength is not of concern.

## Benefits of the light duty coiled spring pin

Selecting a light duty coiled pin for an application can bring multiple benefits to the assembly, both functionally and commercially.

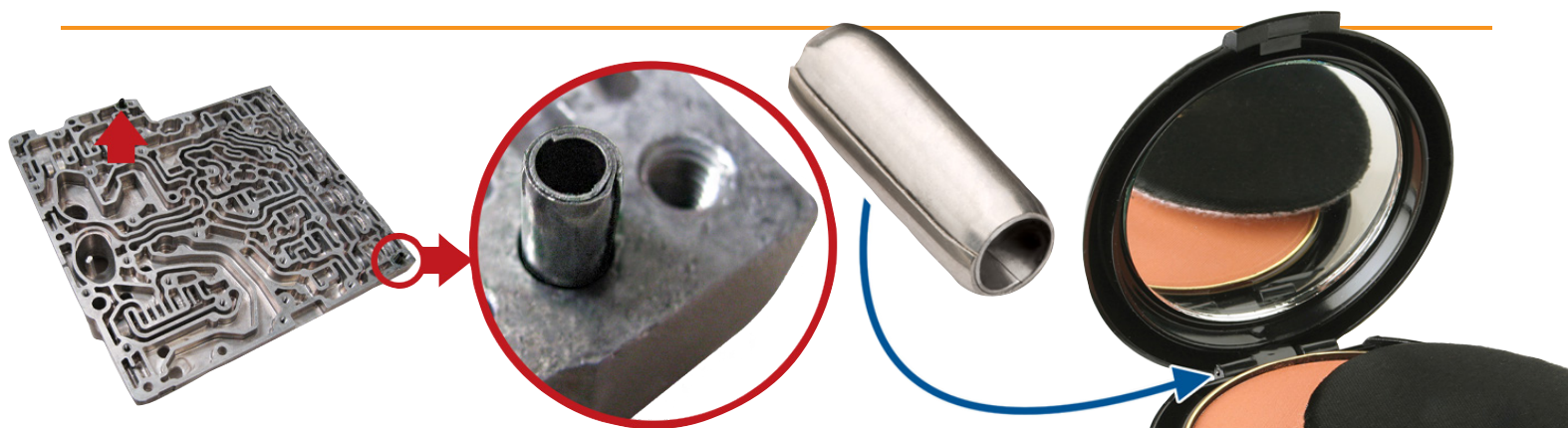


Diameter (mm)		2.5	3	4	5	6	8
Double Shear Strength (kN)	Light Duty Coiled Pin	2.3	3.3	5.7	9	13	23
	Solid Grooved Pin	3.5	5	8.8	13.8	19.9	31.2
Strength Difference (kN)		1.2	1.7	3.1	4.8	6.9	8.2

Table 1







The most notable benefit of a light duty pin is its lower insertion force due to greater flexibility. The insertion force of a light duty coiled pin is 50% less than a standard duty coiled pin and 75% less than that of both a heavy-duty coiled pin and a slotted pin. Additionally, light duty also has the best ratio between shear strength and insertion force, meaning that in cases where there are no limitations on pin diameter, it will always be easier to install a larger diameter light duty coiled pin versus a smaller diameter standard or heavy duty coiled pin of equivalent shear strength. Manually installing light duty pins will be less strenuous for assembly workers, improving the ergonomics and safety of the assembly line.

Light duty coiled pins are comprised of less raw material, resulting in a lower piece price compared to other duties. What is more enticing, however, are the potential overall assembly cost savings. Given the lower insertion force of light duty coiled spring pins, the fastener installation equipment does not need to be as powerful, thus a lower cost for the capital goods expenditure can be realised. In fact, when comparing a light duty coiled spring pin to a rigid solid pin and considering the lower material costs, lower cost for installation equipment, and the lower manufacturing cost of creating the required hole diameter in the host material, the light duty coiled spring pin has the lowest overall cost of assembly.

Given the superior flexibility of the light duty coiled spring pin, the amount of radial pressure and strain exerted onto the host material is the lowest of all coiled pin duty options, thus mitigating the likelihood of damage to the host even in shear conditions. This property makes light duty perfect for soft and brittle materials, and applications where the joint must remain serviceable.

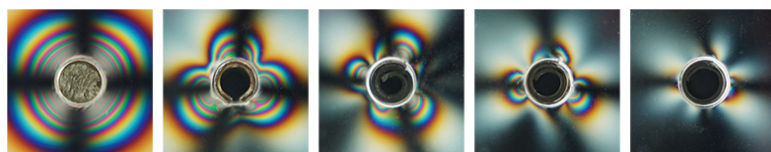


Figure One shows a comparison of radial stress created by different pins. The wider and more colourful of the bands around the pin diameter, the more stress is exerted by the pin onto the hole material.

### Typical applications where light duty reigns supreme

In a typical alignment application, the pin only serves to align two components during assembly. After getting secured by other fastening methods, the pin serves no further purpose. During these steps, there is close to zero shear force being applied to the pin. Traditional components used for alignment applications are precision ground solid dowels, cold formed dowels, spring dowels and coiled spring pins. Spring dowels and coiled pins do not require as tight of a tolerance for the host hole, and they also facilitate

ease of assembly. Both spring dowels and coiled spring pins are a much lower cost component as compared to the precision machined ground dowels. Between the various duties of coiled pins, the light duty accentuates all of these benefits and is a great solution for most alignment applications.

Hand operated or simple swivel point hinges are another example that do not impose great shear strength requirements. Therefore, they are a great application for light duty coiled pins in terms of ease of assembly and overall cost while providing a highly functioning solution. With light duty, it is also very simple to achieve a "high-quality feeling" friction hinge. A special subset of this segment are cosmetic cases, where specially developed extra light duty coiled pins with 1½ coils are the industry standard solution for high-quality case hinges.

For situations where two components are joined together and the joint isn't highly stressed or load bearing, a light duty coiled pin is an excellent choice as it will leverage all of its benefits.

### Conclusion

In closing, light duty coiled spring pins offer a host of advantages in many applications, including lower component and overall assembly costs, host material protection, and ease of installation. Thus, light duty coiled pins should always be considered in applications absent of high load bearing.

