Welding Applications

Laser Welding Tightly Wound Coils

THE APPLICATION

Typical coil welding applications require a complete weld around the entire circumference of the coil. In most cases, there is only a single layer of a coil, with the weld preventing the coil from expanding under operation. In other cases, another coil layer is located within the coil. A good example of this type of application is known as a flexible drive shaft. The application consists of joining an inner and outer coil, where both are very tightly wound under high tension. Table 1 lists the specifics for the coil.

	Wire Diameter	Material
Outer Coil	0.008”	Steel (Annealed)
Inner Coil	0.008”	Steel (Annealed)

Table 1

Laser welding is well suited to this particular type of application due to its non-contact nature, minimal heat input into the part and ability to prevent coil “spring out” during the welding process.

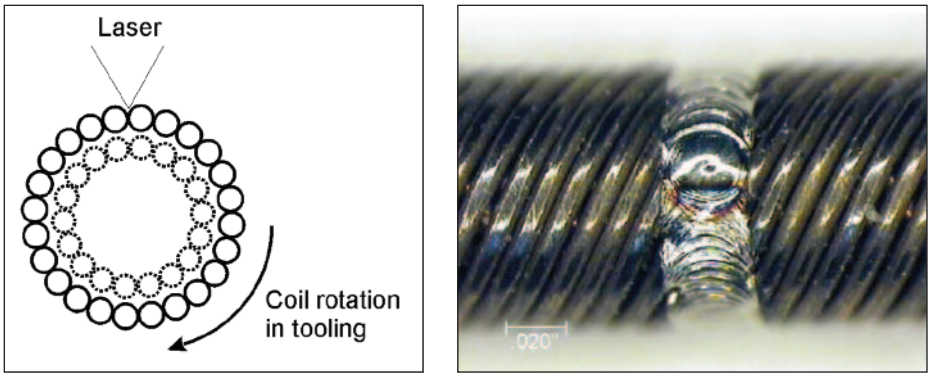

Figure 1 A cross sectional schematic of the weld geometry of the two coils, and a view of the circumferential lap weld.

THE PROBLEM

The most prominent problem during the welding process is damaged coils, this occurs due to the spring out effect as many coils are tightly wound under high tension. During the laser welding process, for the duration of the weld pulse, the material is in a molten state. During this molten state, the coil can break, retract, and spring-out resulting in tears in the coil.

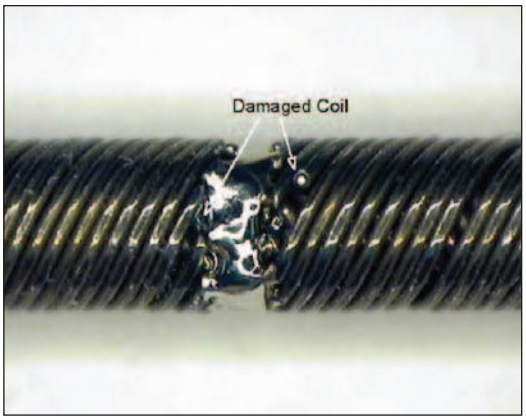

Figure 2 shows damaged coils as a result of the coil breaking and retracting during when it is in the molten state.

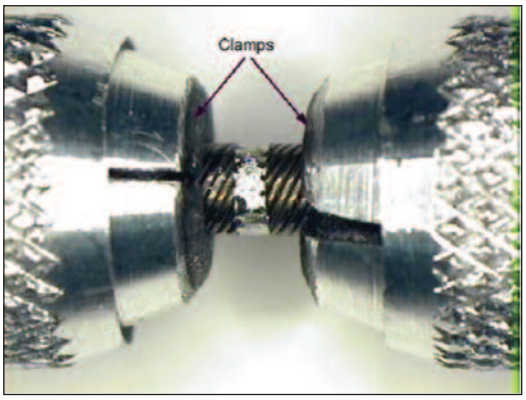

Figure 3 Positioning of the part clamps adjacent to the weld area ensures minimal coil movement during welding.

CREATIVE TOOLING AND LASER PULSE SELECTION CAN SOLVE THE PROBLEM

By reducing the pulse width typically below a 1ms, with a suitable pulse repetition rate the spring out effect is alleviated as the time the coil is in the molten state is minimized. In addition, by tightly clamping the coils close to the weld area the coils are held stationary during the weld around the entire circumference of the coil. These clamps must be placed as close to the weld area as possible without interfering with the beam.

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