

CASE STUDY 0200

Beyond Crimping: Ultrasonic Welding for Superior Electrical Conductivity

HIGHLIGHTS

The Challenge

A premier supplier of electrical connectors for Automotive, IT Datacom, Aerospace, and other critical industries, sought a method to reduce electrical resistance and prevent the degradation associated with crimp relaxation.

The Solution

A Lunch and Learn with industry experts at Herrmann Ultrasonics revealed the advantages of ultrasonic welding over traditional crimping methods, especially in long-term performance, resulting in lower electrical resistance, greater mechanical strength, and superior reliability.

The Result

By scheduling a Lunch and Learn with Herrmann Ultrasonics Engineers, the client discovered how ultrasonic welding could revolutionize their manufacturing process, to deliver a premium product to their customers who demand high power connectors with zero downtime.

Solve complex challenges and elevate your team's skills and knowledge by scheduling a Lunch and Learn session with industry experts at Herrmann Ultrasonics.

During a scheduled Lunch and Learn session, Herrmann Ultrasonics engineers consulted with a leading manufacturer of electrical connectors about their current crimping process and its associated electrical resistance.

The client was experiencing a loss of electricity or "electrical resistance" in the transmission of power from the cable or wire to the terminal. They were seeking a more effective connection method which would result in lower electrical resistance values.

The Herrmann Ultrasonics expert was able to share with the client's team of engineers that one of the limitations with traditional crimping is a phenomenon which can occur called "crimp relaxation". Even quality crimped electrical connections become "loose" over time resulting in increased electrical resistance, intermittent connections, and even electrical failure.

An alternative to traditional crimping, Ultrasonic welding, uses high-frequency vibrations to fuse materials together, and offers significant advantages in terms of electrical resistance, mechanical strength, and overall reliability.



ULTRASAFE W for fast and precise metal welding

Benefits of Ultrasonic Welding

Electrical connector manufacturers can deliver a superior product to clients with ultrasonic welding with the following benefits:

- **Reduced electrical resistance:** Ultrasonically welded terminals maintain a lower electrical resistance value over time as compared to mechanically crimped lugs.
- **Improved Mechanical Strength:** Ultrasonic welding produces a stronger bond between the conductor and the terminal, making it less susceptible to thermal degradation.
- **Improved Reliability:** The superior properties of ultrasonic welded lugs minimize the risk of failures and maximize uptime.

Thermal Degradation

Traditionally crimped lugs begin to deteriorate over time, resulting in increased electrical resistance; ultrasonically welded lugs retain their resistance over time.

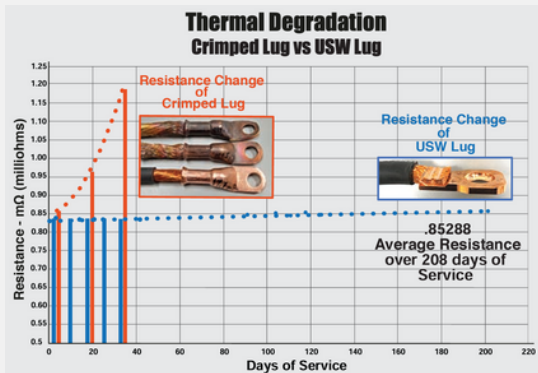


Fig. 1 Thermal Degradation



Fig. 2 Ultrasonic Welded Terminals

About Herrmann Ultrasonics

As a specialist in ultrasonic welding of plastics, packaging materials, nonwovens and non-ferrous metals, Herrmann has been developing safe and efficient welding systems for over 60 years. This results in over 2,000 successfully implemented welding solutions each year. With the services of Herrmann Engineering, more than 600 employees excite customers all over the world.

The Challenge: Improve Reliability and Reduce Electrical Resistance

By scheduling an on-site Lunch and Learn with the client, Herrmann Ultrasonics Sales Director METALS, Frank Myers, was able to share knowledge with their team about the superior advantage of ultrasonic welding over traditional crimping.

Myers highlighted a study created by Dr. Alex Khakhalev and Mark Morgan of EICo Enterprises Inc., titled "The Affects of Electrical Resistance on the GMAW Secondary Loop". This study shows distinct advantages of ultrasonic welding. The data in this study shows that an ultrasonic welding lug has an average resistance change of .85288 mΩ (milliohms) over a 208 day period as compared to 1.17 mΩ in less than 40 days for a crimped lug (see Figure 1).

- Over time, mechanically crimped connections weaken and increase electrical resistance, making them less efficient and reliable.
- Crimped applications have inconsistent cable strand compression irregularities which constrict current flow and cause excessive heat in the lug.
- Applications such as data centers, electric vehicles, and control systems require low resistance to maximize power and reliability.

The Solution: Ultrasonic Welding Improves Electrical Resistance over Traditionally Crimped Connections

By creating a metallurgical bond between the conductor and the lug, ultrasonic welding eliminates the potential for "crimp relaxation" often associated with crimped connections. This results in a more unified and consistent electrical current path, significantly reducing electrical resistance, improving durability, and enabling a smaller footprint compared to crimped lug joints (see Figure 2).

In conclusion, ultrasonic welding offers a superior solution for enhancing the performance and reliability of electrical connections. By eliminating the drawbacks of traditional crimping, ultrasonic welding provides a more secure and efficient connection, empowering manufacturers to achieve significant product and process improvements, while also delivering a strong return on investment and eliminating the need for frequent lug replacement.

In many cases, the full potential of ultrasonic welding may not be immediately apparent. By scheduling an on-site seminar with a Herrmann Ultrasonics Professional, we can work together to identify opportunities for enhancing your current operations and unlock hidden potential for performance, reliability, and efficiency.