Tech Briefs

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Everett Charles Technologies introduces rugged high-current probe

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Tony DeRosa, Senior Product Manager, Everett Charles Technologies

Everett Charles Technologies (ECT) recently introduced the latest addition to its family of high-current probes—the HC375. Rated at 100A DC, the probe is designed for a broad range of challenging industrial test applications including transportation, automotive, power grid, military, and PCB test. The family of high-current probes offers tip styles that have been developed to reduce arcing, and body geometries and materials that minimize resistance.

Tony DeRosa, Senior Product Manager at ECT, noted that the company's probes cover the critical factors of high-current testing, such as low-resistance plungers, optimized base materials and plating, high-temperature spring design, and high-current tip geometry. *Chip Scale Review* asked DeRosa to describe the kinds of improvements that enabled the new probes to be optimized for reduced arcing. DeRosa zeroed in on increasing the spring force. "High spring force increases contact between the plunger tip and test contact surface," explained DeRosa. "It also increases contact within the probe by applying high force between the plunger and barrel through the internal bias ball." He further noted that the high spring force slightly deforms the contact surfaces on both sides, thereby increasing the contact area on the discrete points of contact, as well as increasing the number of contact points. "This decreases the overall resistance of the contact by increasing the number of conductive paths. Lower resistance reduces heat that causes fouling and reduces the instances of arcing." With respect to material selection, the company switched to a more conductive barrel material. "Our new barrel material (Phos Bronze) is three times as conductive as our old material (Nickel Silver). It is also a much stronger material."

To ensure that resistance was minimized in the new probe design, the company performed a Kelvin, 4-wire resistance test under high current (i.e., up to 100A). "The probe temperature was also monitored using a thermocouple at the highest temperature point on the part, usually at the plunger barrel contact point, which is the highest resistance in the current path," said DeRosa. "The resulting data (**Figure 1**) indicates that the resistance is constant at about 5 Ohms across the entire current range, and the probe temperature rise is well within the operating temperature of the spring material." The basic test setup is shown in **Figure 2**.

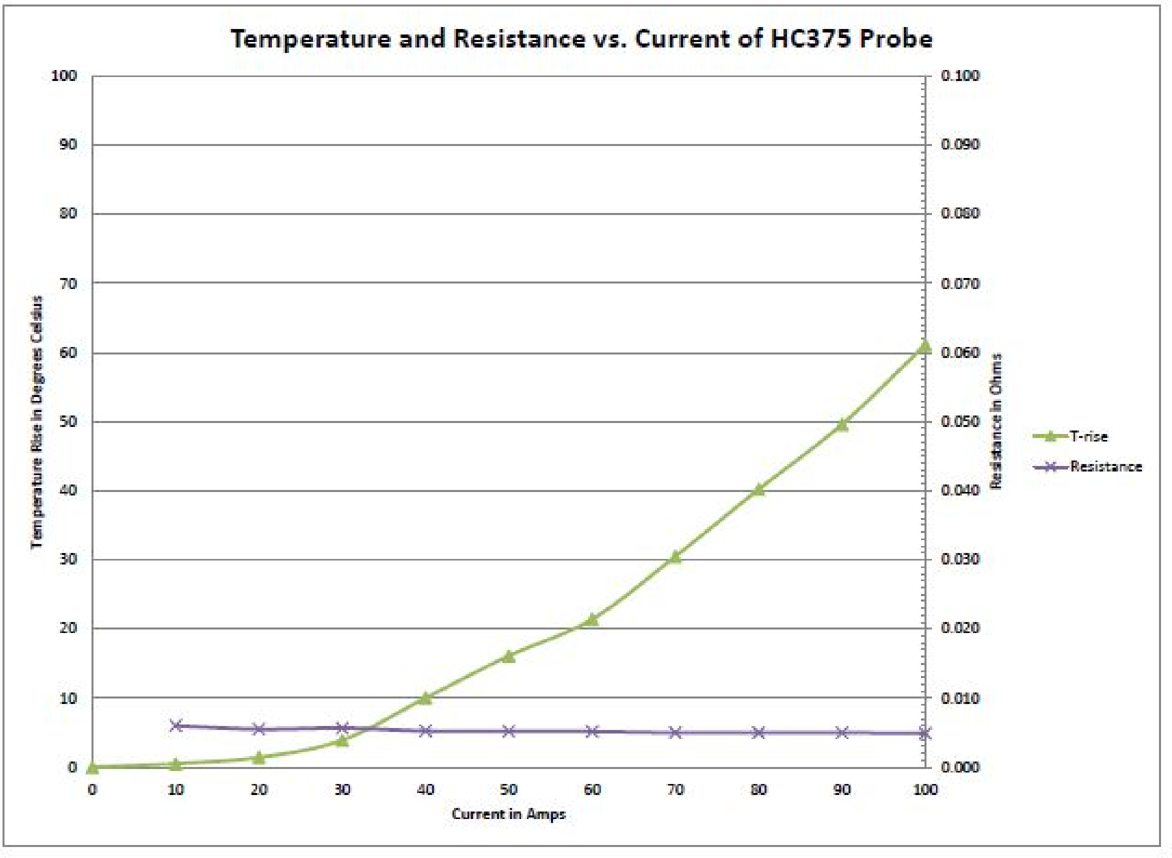
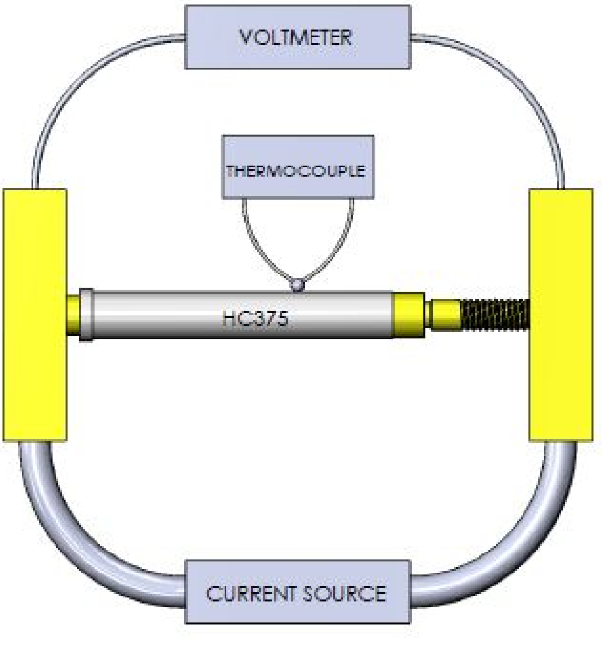


Figure 1: Temperature and resistance vs. current of an HC375 probe. SOURCE: Everett Charles Technologies

Figure 2: Basic test setup.



DeRosa provided additional insight into some of the technical challenges that have to be addressed when developing an effective high-current spring probe. "One must start with the proper base metals and conductive volume to adequately carry the specified maximum current," he told *CSR*. For example, base materials are selected that are high in conductivity and tough enough to resist wear; and a spring material must be selected that can withstand high temperature without losing its mechanical properties (e.g., stainless steel). "The next challenge is to make strong contact between the spring probe and the unit under test (UUT)." There are two important factors that drive strong contact. The first is a high and stable contact force, which means the spring must be extremely heavy duty and robust. "For example, the ECT 100A probe has a spring force of about 8 lbs." The second important factor is maximizing contact surface area between the probe and UUT. "This is driven by a large, flat tip geometry and smooth surface finish. The larger the contact area, the lower the resistance."

The company's experience with machining also played a role in the development of the new probe. "In a spring probe, the current must transfer between two pieces – the barrel and plunger," noted DeRosa. It's therefore vital to hold tight tolerances on critical dimensions that affect the plunger to barrel interaction. "Tip flatness must be held tightly to maximize surface contact area, and diamond-coated tools were used to achieve a smoother surface finish on machined parts." DeRosa also said that the company used master Swiss screw machinists to optimize layouts for higher quality and better throughput. Additionally, custom-engineered proprietary machine add-ons were used.

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