

New High-Performance Electric Motorcycle Uses Innovative Battery Pack Welding System

Batteries integrate electronics with high performance materials

By Jesse Beeker, President, TWIG Power

Michigan-based TWIG Power is partnering with U.S. motorcycle manufacturer Cobra MOTO, LLC in the development of Cobra's CX-E5 Electric Motorcycle, a new high-performance electric motorcycle designed to compete in the future Electric Limited youth classes in AMA competition.

TWIG will be manufacturing the battery packs and other components to enable the race level electric powertrain. TWIG worked with AMADA WELD TECH to develop the battery and interconnect solution process that will ensure integration of electronics and high-performance materials. The resulting setup, a CD-A300A Capacitive Discharge Welder, paired with a TL-088B Pneumatic Weld Head, provides TWIG with ultrafast rise times, consistent welding output and repeatable process results.



Figure 1 – Cobra's CX-E5 Electric Motorcycle high-performance electric motorcycle is designed to compete in the future Electric Limited youth classes in AMA competition.

ELECTRIC MOTORCYCLES GAINING POPULARITY FOR YOUTH MARKET

Electric motorcycles for the youth market are gaining in popularity and are especially prized for the performance control they provide to parents. The new E-moto products enable parents to meter performance modes depending upon the young riders' current skill level. Parents can select modes ranging from walking speeds to high performance settings equivalent to gas powered motorcycles moving at 40 miles per hour.

The youth friendly electric motorcycles are quieter and less intimidating, enabling young riders to set up small tracks in their own backyard environments. The software configurable E-moto products are also easier to ride, featuring a softer or harder hit depending on how the motorcycle is tuned. Easy to use, charge and maintain, E-moto products also reduce environmental noise and emission impacts compared to combustion engine motorcycles.

Cobra's powerful new CX-E5 Electric Motorcycle offers riders a performance similar to that of the company's current 50cc internal combustion engine offerings.



Figure 2 – Battery pack fits on either side of the motorcycle where the gas tank is usually located

BATTERY CRITICAL TO PERFORMANCE

TWIG's battery pack design features two lozenge-shaped batteries that fit on either side of the bike where a gasoline tank is normally located. The battery typically lasts for one race and is then charged and made ready for the next race. There are 84 cells on each side, for a total of 168 welds per pack.

According to Jesse Beeker, TWIG Power President, the battery pack technology was absolutely critical for company's ability to convert from a 2-stroke engine to an electric powertrain. Their emphasis was on the manufacturing of batteries on a realistic capital expenses budget. "We needed a battery manufacturing system that would ensure a high performance high quality, no compromise solution."

To get there, they began by investigating solutions ranging from inexpensive tools to systems capable of manufacturing hundreds of thousands of batteries. TWIG reached out to AMADA WELD TECH's Detroit applications lab for consultation and the engineers jumped at the chance to work on the unique project.

TWIG's design utilizes Engineered Material Solutions' (EMS) highly conductive clad metal tab material. TWIG brought the materials into the lab and worked closely with AMADA WELD TECH application experts, who helped evaluate battery requirements, provided tab design assistance, and advised in designing the interconnect and welding solution. Application experts helped take the TWIG engineers from the first design concepts to understanding pack design challenges and difficulties, to changes that helped to manufacture the battery, and then built the very first pack in their lab.

BATTERY PACK WELDER

After reviewing all of the application requirements in the lab, AMADA WELD TECH recommended the CD-A300A Capacitive Discharge Welder, which is frequently used for battery applications including battery tab welding, tack welding of carrier strips and conductive terminal attachment. The recommended unit features a built-in current monitor and enables users to set pulse limits with second pulse inhibit to prevent weld blow out. Four pulse widths gave TWIG extremely fast rise times, while the dual pulse function helped overcome surface inconsistencies. The unit also offers automatic polarity switching between pulses providing even heating between electrodes and increased electrode life.



Figure 3 – AMADA WELD TECH CD-A300A Capacitive Discharge Welder

TWIG was especially keen on making sure the unit had excess energy capacity so it could deliver more energy if needed. Especially in the early stages, there were several unknowns with changes made between the early prototypes to the eventual production model. As an added bonus, the unit is quite flexible and can also be used to make different types of welds for other batteries and accessories.

Other features TWIG found useful were a process monitor with a color coded bar graph on the RUN screen that provides instant weld history of In Limit/Out of Limit percentages to assess process performance. The upslope function allows gradual ramping of weld energy to alleviate weld splash. In addition, a high resolution 6.5 inch color display shows all weld information on the RUN screen. Finally, the unit's efficient power electronics provides high repetition rates.

Says Beeker, "The welder offered the repeatability and control necessary to achieve that all-important process consistency. It also features a built-in current monitor with limits for the welding process to ensure quality of the final welded assembly."

RACING INTO THE FUTURE

The AMADA WELD TECH welder helped TWIG achieve the integration of electronics and high-performance materials that was key to making the pack a reality. Limited volumes will be produced for the racetrack later this year and volume production is set to begin early in 2022.

