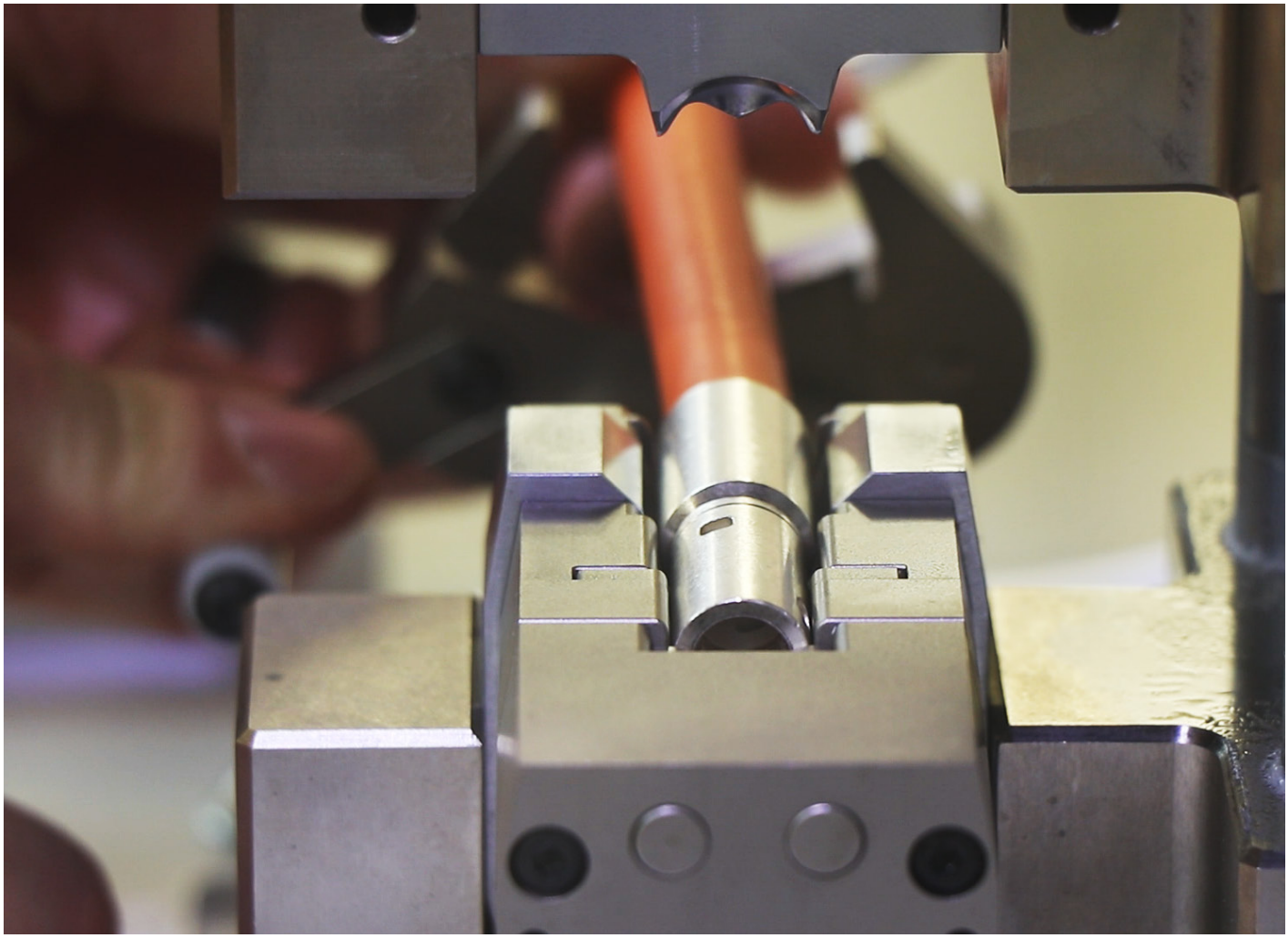
HIGH-VOLTAGE TOOLING AUTOMATION: KEY TO ICT MARKET GROWTH

TE Connectivity's Automated Tooling Provides OEMs with Speed and Quality Advantages



The industrial and commercial transportation (ICT) industry's adoption of electrification has outpaced the passenger vehicle market to date, although that industry is picking up speed. Governmental mandates and financial incentives have helped fuel the purchase and use of route vehicles such as city buses to reduce pollution in urban environments. Electric buses will constitute two-thirds of the global bus fleet by 2040[1]. Meanwhile, other ICT vehicles such as trucks, mining and construction equipment, last-mile delivery vehicles, and military vehicles have electrified to reduce fuel consumption and carbon dioxide emissions. These vehicles leverage various architectures, such as conventional or plug-in hybrid, battery electric vehicle (BEV), or hydrogen fuel cell electric vehicles, depending on application requirements.

So, what does this mean for market growth? The global commercial vehicle market is slated to grow at a brisk 32.7% CAGR from 2020 to 2027[2]. Among the regions, the European commercial vehicle market is slated to have the fastest growth, propelled by appetite for electric vans used for logistics and eCommerce[3]. China, of course, remains the dominant market for ICT vehicles, driven in part by the country's mass adoption of electric buses[4].

All of this is creating increased demand for high-voltage tooling, placing new pressures on manufacturers to improve their processes and equipment. OEMs and ICT vehicle manufacturers use large cables, exceeding 10 mm^2, for high-voltage systems such as electric drivetrains. However, the wide mix of terminal shapes, sizes, and crimping requirements complicate the standardization of large-wire processing[5].

To date, product manufacturers have relied on manual processes to adopt to their customers' needs. However, that is increasingly no longer an option as the market is moving from manual cable processing and crimping to automated processes. As with other industries, automation offers speed, consistency, and scale advantages partners want. Investing in automation enables product manufacturers to support their customers' growing business, with high-quality, reliable prepared wires in the quantities they seek.

Recognizing this growing market trend, TE Connectivity (TE) invested in evolving its product portfolio of hybrid and electric mobility solutions (HEMS) wire processing equipment to enable flexible automation processes several years ago. From wire processing to wire crimping, we now offer a complete solution to support our customers' high-voltage system growth, including die sets, die holders, high-force presses, and our new high voltage cable processor. Our solutions include:

HV-CP High Voltage Cable Processor

Quality high-voltage cable terminations require proper processing of complex high-voltage cables. OEMs that use our new HV-CP machine benefit by receiving high-quality prepared wire they can immediately use for HV applications. They no longer need to fear the manual wire processing issues, such as torn insulation, foil left on cables, nicked or protruding braid strands, or nicked conductor strands, that result in material waste, higher costs, and production delays. Since large-wire preparation is extremely costly, removing waste can strengthen OEM margins.

The HV-CP machine is designed to match terminal specifications by stripping the outer jacket, foil shield, braid shield, and inner insulation of high voltage cables in as little as 30 seconds. Integrated air jets automatically clean the blades during each cutting cycle, and an in-line vacuum system removes slugs and debris, keeping the processing area clean and efficient.

OEMs also gain greater flexibility. At only 687 mm wide, the HV-CP machine was designed to help OEMs automate wire preparation in tight spaces on facility floors. In addition, the HV-CP solution is also relatively low maintenance, with an estimated blade life of 100,000 cycles and the ability to change stripping blades, cutting wheels, and mandrels in a matter of minutes.

High Voltage Modular Die Holder

Unlike static applicators that are heavy, sometimes complex to assemble, and difficult to change over, the new HV modular die holder is a lightweight, flexible design that can fit into select high-force presses and enables just one person to change over tools within three to five minutes. Previously, it was not uncommon for two individuals to change over static applicators: with one holding the die holder, and the other unscrewing it from the press.

These processes slowed production, while introducing potential quality issues into the mix. With TE's current applicator design, those challenges are now in the past.

The HV modular die holders have several other advancements designed to make them easier to use. A spring-loaded wire clamp assembly that can handle a variety of wire sizes can be quickly relocated to front, left, or right-side positioning to accommodate different crimping requirements. The inclusion of a fine-crimp-ad-

just feature helps operators quickly dial in more precise crimp heights. OEMs and automakers gain the flexibility to process a wide array of large wires for their applications without the need to continually reset tooling.

TE's HF/HV-20 Terminators

The HF/HV-20 presses are robust, compact, high-force-bench-top machines capable of reaching 178kN (20T) of crimp force, with fast, repeatable accuracy. The HV-20 model comes with a CQM II digital interface for crimp force monitoring, variable speed, and an integrated vacuum system to keep sensitive connections clean and clear of debris commonly associated with high voltage cable processing.

To best fit the application process, the flexible design of the high-force machines accommodates multiple processing orientations. The adjustable die holder platform can be easily rotated to handle processing from the left, front, or right side of the unit. Side-feed guarding is also available for all models to accommodate both loose piece and reeled terminal applications.

The TE HF/HV-20 machine can handle wires up to 120 mm^2, enabling it to be used for a wider range of use cases than other machines, which typically handle wires up to 50 mm^2 or 100 mm^2. The TE HF/HV-20 crimp speed can be varied from 1.3 to 8.3 seconds, enabling better terminal material flow. This protects larger wires from unnecessary stress that leads to material destruction.

OEMs that want to push their quality to higher limits should consider the HV-20, which also provides crimp force monitoring for 100% quality monitoring and an integrated vacuum system to keep electrical connections clean.

CONCLUSION

In conclusion, HEMS tooling automation offers significant advantages to OEMs and ICT vehicle manufacturers, and equipment manufacturers are continually setting the bar higher with new machinery that offers more control and rich functionality. While there are a range of applicators available on the market, TE offers OEMs the peace-of-mind of working with a supplier who controls the end-to-end process.

As a product and applicator manufacturer and tooling shop operator, TE validates our equipment with our businesses, customers, and products. We look forward to working with you, to source the right HEMS tooling for your business and application requirements.

Learn more about our HEMS tooling,
Visit te.com/hvtooling

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ABOUT TE CONNECTIVITY

TE Connectivity is a $13 billion global industrial technology leader creating a safer, sustainable, productive, and connected future. Our broad range of connectivity and sensor solutions, proven in the harshest environments, enable advancements in transportation, industrial applications, medical technology, energy, data communications, and the home. With nearly 80,000 employees, including more than 8,000 engineers, working alongside customers in approximately 150 countries, TE ensures that EVERY CONNECTION COUNTS. Learn more at www.te.com and on LinkedIn, Facebook, WeChat and Twitter.

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