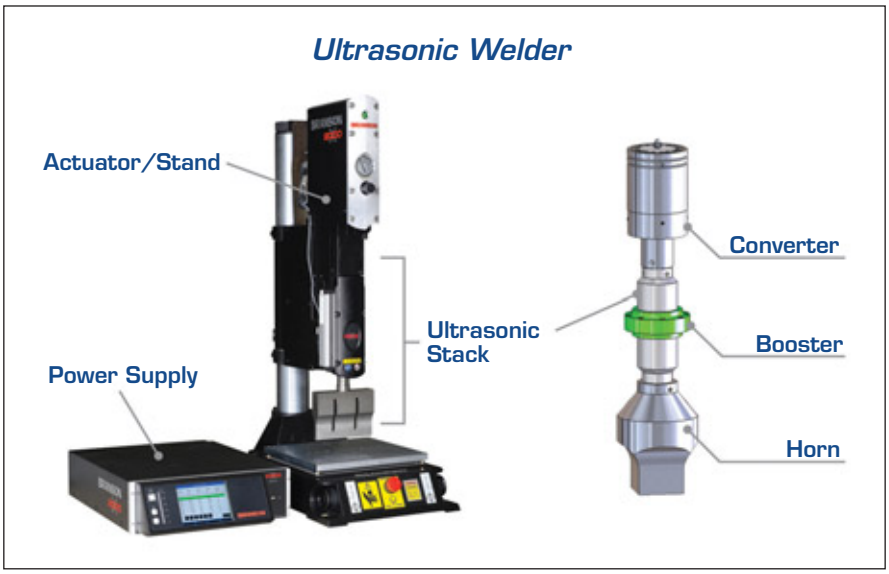
Adapting to Manufacturing Challenges of COVID-19

Emerson's Branson ultrasonic welding technology is used to slit, seam, and bond nonwoven fabrics into a variety of sterile surgical drape kits, surgical caps, surgical and face masks, gowns, scrubs, and other PPE. (Credit: Emerson)

The COVID-19 pandemic has caused great changes and challenges, disrupting not only the global marketplace but also the supply chains that keep people and essential businesses healthy and functioning. For example, amid an already growing market for infection-control gear and hygienic products made of nonwoven thermoplastic fabrics, COVID-19 has greatly strained and helped to reshape the global supply chain for nonwoven personal protective equipment (PPE).

Before the pandemic, a major share of nonwoven materials and PPE were produced in Asian countries, particularly China. However, the global spread of COVID-19 has driven many countries — and many of their businesses — to create or expand regional production of nonwoven PPE to meet local demand, especially for the surgical-grade and N95 face masks needed by medical professionals as well as the general public to stem the spread of the virus. This market response — and the incremental PPE production offered by both existing and new-to-the-market producers — has played an important role in global pandemic response efforts.

Because Emerson's Branson™ ultrasonic welding technology is widely used in nonwoven PPE production, Emerson personnel responded to the pandemic by helping existing nonwoven product manufacturers rapidly expand local PPE production, while collaborating with new-to-the-market players to create and implement innovative PPE production solutions. Behind the scenes, Emerson's Branson ultrasonic welding business, part of Emerson Automation Solutions, ramped up production of plastic welding equipment, including standardized products and assemblies, to ensure continuous supply and the shortest possible delivery times. This incremental production enabled Emerson to supply hundreds of additional Branson welding units — together with the local expertise, application-specific tooling, and technical support — needed to meet new production challenges and customer demands in every corner of the world.



Components of the weld stack (converter, booster, sonotrode) are mounted on a movable actuating arm that gently and continuously compresses the nonwoven layers onto the rotating anvil, where the sonotrode delivers the ultrasonic energy that permanently welds them together. (Credit: Emerson)

Fast-Track Response Boosts Australia's PPE Output

In March 2020, as Australia's Department of Defence (ADF) faced the implications of the spreading pandemic, it sought out domestic suppliers to produce the estimated 58 million Level 3 surgical masks Australia would need by November 2020. The ADF offered the production contract to Melbourne-based MedCon, Australia's only domestic supplier. However, due to the influx of low-cost masks from Asia, MedCon's annual mask production had sunk to just 2 million and just one of its aging mask-making machines remained in production.

To meet the 29-fold increase in mask production, MedCon urgently needed to modernize three old machines and build five new ones. For help, MedCon and the ADF turned to Australia's premier machine builder, Foodmach, ask-


Medical mask production utilizes continuous ultrasonic welds for seams on the width and length of the mask, while the tie straps or elastic ear loops are bonded with plunge or "spot" welds. (Credit: Emerson)

ing it to complete all eight machines in just 18 weeks, start to finish. Pressed for time, their project managers requested Branson ultrasonic welding technology to equip the four welding stations needed in each mask-making machine. Through Consonic Pty., the regional representative, Foodmach request expedited deliveries from Emerson.

Emerson responded quickly, shipping the first group of welders in just 14 days, with two more shipments to follow. In all, Emerson's North American-based manufacturing facility delivered 34 welding units, enough to outfit all eight mask-making machines and allow for two welding units as spares. Each unit included a 20 Hz Branson DCX power supply, a matched converter and booster, plus application-specific weld tooling and training, locally produced and supplied by Consonic.

With the help of Emerson's global supply chain and local customer support, Foodmach completed and delivered all mask-making machines to MedCon on schedule. This effort helped put MedCon on track not only to meet its 29-fold production goal in November but also to continue meeting Australia's PPE requirements amid the worsening global COVID-19 situation.

Ultrasonic welds strongly bond even small items like the ties on a disposable surgical mask at a fraction of the cost of stitchery or glue and can be used immediately. (Credit: Emerson)

Ultrasonics: A Natural for Manufacturing Nonwoven PPE

Ultrasonics are a natural fit for production of nonwoven products. Basically, ultrasonic welders convert electrical energy to high-frequency mechanical vibration, which is transmitted through tooling into thermoplastic nonwoven material. The vibration creates frictional heat that melts the material, an operation that can be focused and utilized to:

- Cut or slit a large roll of nonwoven fabric into narrower strips (cut edges are simultaneously seamed/sealed ultrasonically).
- Bond two pieces of nonwoven fabric into finished seams of surgical garments, or attach loops or ties to caps, surgical masks, or other types of PPE.
- "Quilt" multiple layers of different nonwoven material into masks and respirators or other medical absorbent or infection-control products. For example, in N95 and high-grade surgical masks, the *quilt* typically includes an inner and outer spunbond layer of meltblown polypropylene, which together provide structure and protection for a middle layer of meltblown polypropylene fibers. The middle fiber layer is electrically charged to capture and hold extremely small particles, such as those of the COVID-19 virus.

Ultrasonic welding is remarkably energy efficient because the welder consumes power only when it is cutting, slitting/sealing, or bonding the nonwoven fabric. Because the welder generates heat instantly through vibration, there's no need for constant energy consumption, such as that required for preheating a heat knife, for example, or maintaining it at the proper operating temperature.

Compared with other methods for cutting and bonding nonwovens, ultrasonic technology offers significant advantages. By producing strong, repeatable seams and joints without the need for or glues or adhesives, it eliminates the risk of contamination and the need for setup time and space for drying. It replaces the time and effort of sewing as well, along with the tiny thread holes that can harbor possible microbial contaminants. Ultrasonic seams are ready for use as soon as they are produced and are capable of withstanding repeated sterilization processes. The ultrasonic welding process can even be used in cleanrooms.

Conclusion

In times of crisis, every organization is challenged to balance great urgency — the need to adapt to sudden and unexpected circumstances — with the need for continued focus on key values, vital personal and business relationships, and the long-term planning and effort needed to ensure a bright future.

To adapt to the COVID-19 crisis while continuing its operations, the Automation Solutions business of Emerson, for example, is responding with urgent attention to employee and customer safety in every interaction, with an emphasis on making distance training, learning, and equipment support tools available in key languages, and with increasingly rapid response to the vital, fast-changing supply-chain needs of its global customers.

The company is staying focused on the long term by developing new products, improving the applicability and performance of technologies, and leveraging the vast resources of the company's global organization and supply chain to give customers and partners competitive advantage.

This article was written by Vernon Murray, President of Branson Welding and Assembly at Emerson. He has global responsibility for sales, operations, finance, quality, human resources, engineering, product marketing, and management for the Branson business. For more information, visit ***http://info.hotims.com/79410-340.***