Technologies from TOX for the energy revolution

Creating perfect connections

TOX PRESSOTECHNIK offers technologies that produce electrical and mechanical connections easily and durably in one step. They are used for products generating and using green hydrogen – such as solar installations, electrolyzers, traction batteries, fuel cells and external storage systems. The product range of TOX includes suitable tools, drive and press systems, as well as different control units and supports users on their way to climate neutrality.

The automotive industry is changing. From 2035, no new cars fueled by diesel or petrol are to be licensed in Europe any longer. Electric mobility is a crucial component for a sustainable and climate-friendly traffic image. This means the number of electrified vehicles is continuing to rise already. The car manufacturers must develop new drives and thus energy storage systems and design them to be more efficient at the same time.

The storage systems comprise battery cells, which are integrated into battery packs and are a crucial component contributing to the success of electromobility. The fuel cells as energy converter supply clean and climate-neutral power for electric motors. They convert hydrogen from the tank and oxygen from the air into electricity. As greenhouse gases can be reduced with hydrogen, these motors have already been a beacon of hope in the energy revolution for some time.

Solutions for green hydrogen

Green hydrogen and its derived products are particularly environmentally friendly. The electricity is generated from renewable energies – for example, from sunlight. High-performance solar cells are needed for this. Green hydrogen is produced in electrolysis plants, which split water into its components hydrogen and oxygen. “Our technologies support the manufacturing and assembly of the solar cells and electronic components”, says Frank Ortmann, Business Development Manager at TOX PRESSOTECHNIK. “But we also deliver technical solutions for the production of battery cells and packs, fuel cells and systems, electrolytic cells and electrolyzers.” For Ortmann and his colleagues, the focus is on the connection of the used sheet metals in such a way that the electrical and mechanical requirements are met, and malfunctions are avoided throughout the service life.

The demands are growing. The long-term function of the battery packs essentially depends on the mechanical protection, power distribution and battery cells. The demands on current density, operating temperature, pressure inside the cell and size of the stack for the hydrogen-operated fuel cells are growing. The modules for the solar cells can now be produced fully automatically and in large quantities to meet the huge demand. “In addition, an ever more cost-efficient production is required,”, says Ortmann. “This applies to small series with a large number of manual process steps, as well as to automated series production.”

Creating dimensionally stable connections

The clinching technology is part of the joining processes for example. It is used by companies to join sheet metals of different strengths or different materials, also including adhesives or other intermediate layers. In industrial applications, clinching is suitable for single sheet metal thicknesses of 0.1 millimeters up to a total layer thickness of 12 millimeters and a tensile strength of up to 800 Newton per square millimeter. In this procedure, punches and dies form ductile materials resulting in a push-button-like, firm, inseparable, positive locking and frictional connection. As the joint zone is not thermally affected here, neither the properties of the materials change, nor is there any distortion.

With connections for power transmitting applications, such as power rails for fuel cell systems, battery cell connectors and heat-sensitive battery cells, manufacturers use TOX eClinching. Here, durable, electrical connections ensure numerous metallic microcontacts. These forming processes do not need any element. This enables them to achieve a higher dynamic strength throughout the service life, compared to the weld point. The connections are gas- and liquid-tight. This results in high corrosion resistance. In addition, coated materials as well as different material strengths can be joined. More advantages: clinching or eClinching accrues far less costs, and a significant reduction of the CO_2 footprint compared to conventional welding procedures is achieved.

In addition to joining without element, there are also joining technologies with auxiliary tools, such as riveting or the press fitting of functional elements. “Both technologies ensure that the housing components of a battery pack for example, such as tray, cover, cross member and further structural elements are joined together securely and durably”, says Mr. Ortmann. Depending on the design, more than 100 points of connection can be required for this. They can be designed as separable or inseparable gas- and liquid-tight connection, to prevent corrosion or outgassing. If the gas and liquid tightness of the battery carrier must also be ensured if for example the grounding bolt is pulled out due to an accident or excessive

mechanical load, TOX offers clinch-rivet bolting. This can be used to also attach a cooling plate reliably and close to the battery carrier.

Suitable drive technology

TOX provides technology know-how, joining modules and complete presses, hand, machine and robot tongs. Adding to this are controls, sensors and software for process monitoring and quality assurance. “We develop pneumohydraulic as well as electromechanical solutions”, says Ortmann.

The electromechanical TOX ElectricDrive is energy-efficient, precise, low maintenance and equipped with a force and stroke control. The press force ranges from 0.02 to 1,000 kilonewton. But it can be integrated quickly with the preconfigured and calibrated system using plug-and-play. Typically, these servo press modules are used for the assembly, joining and press fitting of for example bearings, seals and functional elements. “Due to a special clean room version, they also prevent conductive or interfering particles from getting into the production process of sensitive components. This is the only way to ensure the high quality of the components”, says Frank Ortmann.

Amongst others, the pneumohydraulic drives – the TOX Powerpackages – are used for the pressing of film onto the battery cell without the formation of bubbles. This series consists of energy-efficient pneumatic cylinders with integrated, closed hydraulic system and automatically starting power intensifier. The product range provides press forces of two to 2,000 kilonewton, power strokes up to 69 and total strokes up to 400 millimeters. The drives are equipped amongst others with a power bypass, complete air-oil separation and a hydraulic damping system in the return stroke. Adding to this is optional monitoring for pressing processes.

Safe pressing in

For the production of battery cells, electrolyzers and fuel cells, TOX provides the electromechanical servo press system TOX ElectricDrive Core. It consists of the electromechanical drive ElectricPowerDrive, a controller with integrated control and intelligent software. It is suitable amongst others for forming, pressing in, punching, stamping as well as the electrically conductive connection of sheet metals via eClinching. “We can adapt the system to the respective task in a modular way and configure it”, says Mr. Ortmann.

The software is intuitive for the user. It has Industry 4.0-capable as well as freely configurable process monitoring and detects an incorrect number of bipolar plates for example in an

electrolysis or fuel cell stack. The program continuously monitors the pressing process and assigns the relevant process parameters to the individual stacks. Mr. Ortmann adds: “Our press system enables the pressing of stacks with forces up to 1,000 Newton, and holding or readjusting forces set during the setting process over long periods.”

Keeping full control

The traceability per joint has long become standard in the production of electrified and autonomous vehicles. Here, manufacturers should be able to continuously monitor all relevant production parameters independent of the technology used. With the TOX-Multi-Technology Platform, every single connection can be checked during series production, and inspection results can be archived online. “The user can easily install and operate the system with the software”, says Ortmann. They can also continue to work immediately after a tong replacement. Process parameters are imported from the network, and the system components are automatically configured.

From the field

For example, TOX has implemented the pressing in and readjusting of fuel cell stacks and electrolyzers with forces up to 1,000 kilonewton per joining module over a defined period for different customers. What mattered here was to permanently monitor the process and compensate, analyze and document setting movements. As the initial stack tension during the running pressing process is in part still fixed manually on the pressurized component, safety must be guaranteed at the highest performance level (e) for personal protection. “We also support manufacturers with regard to checking bipolar plates for their conductivity and tightness”, Ortmann explains. “Adding to this is mechanical joining with the clinching of tightening straps, bipolar plates, electrolytic cells, electrically conductive connections as well as press fitting and assembly of valves for hydrogen pressure vessels.”

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Service for editors

Meta title: E-mobility: TOX supplies tools, drive and press systems

Meta description: TOX supplies suitable tools, drive and press systems as well as different control units for optimum sheet metal joining for the solar industry and E-mobility.

Social media posting: How can components in the battery packs and fuel cells be easily and durably connected electrically and mechanically in one step in E-mobility and the solar industry? TOX PRESSOTECHNIK provides suitable tools, drive and press systems as well as different control units for this purpose. They enable a smooth procedure as well as seamless process monitoring.

Captions:

Image 1: Broad portfolio on the way to climate neutrality: TOX supports users with suitable tools, drive and press systems as well as control units.

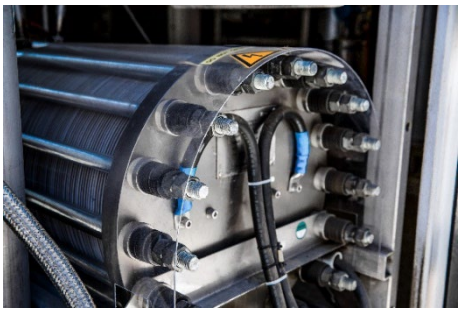

Image 2: Electrolyzers split water into hydrogen and oxygen using electricity.

Image 3: Fuel cell stacks convert hydrogen from the tank and oxygen from the air into electric current.

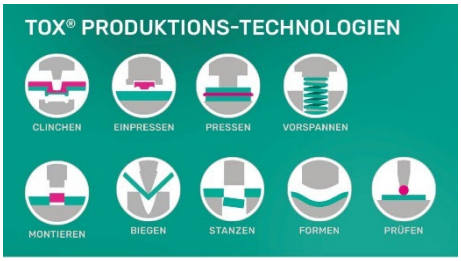

Image 4: Technologies for the energy revolution: With these procedures, TOX can easily and durably produce electrical and mechanical connections in one step.

Technology	Application examples
Clinching	Electrically conductive connection of battery cells, mechanical connection of battery housing, mechanical joining of tightening straps
Press fitting	Functional elements for battery trays
Pressing	Pressing or compressing battery cells
Pretensioning	Pressing in and readjusting of fuel cell stacks and electrolyzers with forces up to 1,000 kilonewton per joining module over a defined period.
Mounting	Valves in hydrogen pressure vessels
Bending	Battery housing components, battery power rails
Punching	Battery housing components, holes of battery power rails
Molding	Battery housing components
Checking	Checking the initial and pressed in final height for fuel cell stacks/electrolyzers to ensure the efficiency of a stack

Table: Application examples for TOX technologies

About the company:

TOX® is a supplier of presses, systems as well as components for sheet metal joining and assembly technology. Since its foundation in 1978, the family business has become a global player with more than 1400 employees worldwide, over 500 of which are based at the headquarters in Weingarten near Ravensburg, Germany. The success story started with one pneumohydraulic drive – the TOX® Powerpackage. The “Components” division now includes pneumohydraulic and electromechanical drives as well as controls, sensors and software for process monitoring and quality assurance. In addition to a large range of presses, the system range comprises manual, machine and robot tongs. Another mainstay are modern sheet metal joining procedures, also incorporating the TOX® Clinching Technology, which makes the company today’s market leader.

Drives, processes and systems from TOX® can be found at automotive manufacturers and their suppliers as well as at industrial businesses for household appliances, electronic components, furniture and much more. Special versions of the TOX® Drives are also approved for the food industry.

TOX® is represented worldwide: 18 subsidiaries, amongst others in the USA and South America, Europe and South Africa, India, China and the entire Pacific Region. 20 representatives in many other markets support and advise local customers.

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