Riveting Technology
Riveting Technology

Riveting – one of the oldest joining technologies – reliably joins even non-weldable materials.
A rational joining technology

Whether it’s for cars, airplanes or trains, many joining tasks are resolved by riveting technologies in the metal processing industry. Riveting is an proven, professional fastening technology, permanently joining two workpieces together. As opposed to screws, rivets hold the advantage of not needing a thread. Compared to thermal joining, they also join non-weldable materials, thus making them ideal joining elements for lightweight constructions and hybrid components. The fast machining and high degree of rationalization make riveting an attractive and reasonably priced joining process.

In serial production, riveting procedures without pre-drilled holes are mainly used. This means the riveting elements punch through the sheet metals themselves and join them in one work step. These joints are characterized by high durability and one-sided even surfaces.
Process competence

Typical industrial riveting procedures

**Self pierce rivet (SPR)**
Universal and without external stamping waste: The semi-hollow punch rivet punches through the first sheet metal and forms the second sheet layer malleably to a closing head. The punched piece fills the hollow rivet shaft and is enclosed within it. This results in a high-strength and tight joint, which is even at the top. This riveting technology is ideal for extremely flexible joints.

**Full pierce rivet (FPR)**
Punching and joining in one step: The rivet punches through all sheet layers. The layer on die side is formed in such a way that the material flows into the annular groove of the rivet and forms an undercut. This rivet joint can be formed level on both sides and is ideally suited to joining high-strength materials with visibility requirements.

**TOX®-ClinchRivet**
The combination of clinching and riveting: A symmetrical ClinchRivet is pressed into the sheet layers and forms the clinch point in the die. The ClinchRivet is formed and remains in the workpiece. This results in a high-strength connection with a one-sided level surface. The ClinchRivet is ideal for thin sheets and tight connections.
Proven Process Quality

Continuous Quality Monitoring
A significant advantage of riveting is the simple quality control even in series production. By continuously measuring the force-travel-curve, each rivet connection can be checked. An additional analysis can be carried out by cross sections (cut through the rivet). The shear and pull strength can be determined in tensile tests.

Preliminary tests in the TOX®-Technical Center
Prior to collaboration, we will already work on the most effective solution for you in our laboratory. Here we will perform preliminary joining tests on your samples, which we test and analyze afterwards. We will also determine all parameters for your application, e.g. the required press force and suitable tools, and we will establish which system can be used for your joining application.

Final Check of the Machine Parameters
Before we deliver a system, we check the real processing results. We will create a cross section and analyze the joining process and the retention forces of the rivet. Everything will be documented in a detailed test report. The delivery condition of the system is based on these determined values and parameters.

Advantages
- Demonstrable joining quality in pre-tests and during series production
- Measurement and documentation of the shear and tensile strengths
- Documentation of the joining quality
- Production of pre-series workpieces

With a cross section (cut through the rivet), the exact formation can be examined under the microscope for analysis. If necessary, optimizations can be made.
TOX® PRESSOTECHNIK with its decades of experience provides you with complete system know-how.

1 Setting tools
Rivet head and die together form the centerpiece. They drive the rivet into the workpiece and are adapted individually to each rivet.

2 Frame
The high forces occurring during riveting are received by a torsion-free frame.

3 TOX®-Drives
The forces required for riveting are generated by electromechanical servo drives or pneumohydraulic cylinders.

4 Rivet supply module
It consists of a bunker (stocks the rivet), a separating system (sorts the rivet and moves it to the correct position) and an feed unit, which moves the rivet to the rivet head.

5 Rivet loading station (docking)
The tong fills its magazine with the rivets to be machined here.

6 Control and process monitoring
- From external impulse to the complete PLC control including safety technology
- Multi-Technology control software for controlling all processes
- Monitoring of process curves and parameters

Sensors
Sensors for automatic control of the process and sequence parameters: Pressure, force-travel measurement and initiators (position sensors).

Safety equipment
Safety door, light curtain, safety control etc.

Accessories
Rivet detection, checking rivets for measure and orientation.
Versions

Rivet systems are available in different versions:

- as tong – stationary or robot-controlled
- as press – either fully automatic, semi-automatic or as manual workstation
- as hand-held tong (perfect for small series production)

Crucial factors are the integration into a production line, optimum feed-in, the desired working speed and the size of the piece parts.
Components

TOX®-Rivet Head

You define the element - we develop the suitable setting system. The different types of rivet place different demands on setting technique and rivet head. Thanks to long-standing experience and the possibility of performing laboratory tests at our premises, we supply the suitable rivet head for each rivet and each application. The structural design of the rivet heads differs depending on:

- Type of rivet
- Type of feeding
- Required press forces
- Drive versions

Advantages

- Magazine and rivet head as integrated solution
- Process-reliable separation of the rivets
- Slim tool design for tight spaces
- Maintenance-friendly design
- High guide accuracy
- Components with low wear

Rivet head designs

TOX®-Rivet Head for self pierce riveting

TOX®-Rivet Head for full pierce riveting

TOX®-Rivet Head for clinch riveting

TOX®-Die

The die is the crucial counterpart of the rivet head and ensures the correct formation of the closing head.
Prerequisite for a smooth process flow is the safe and reliable feeding of the rivet.

A bunker stocks larger quantities of rivet elements. It is usually outside the joining cell and can simply be refilled at any time. The supply module provides a filling quantity within the feed hose. The modular system enables the fast and simple exchange of individual components.

Singulation and feeding system

Singulation is required for processing. In most cases, the rivet heads are fed by means of blow air and molded hoses. Sensor modules that check the rivets for dimensions or quality can also be integrated here. The conveyor pot and sorting device are adjusted to the rivet and the desired machining process. We also take great care to coordinate the design of the cranks and locks for singulation.
Components

Flexible control-software for integrated production

Flexible Multi-Technology Control
One system - many possibilities! Our multi-technology control operates and monitors all functions. It is drive-independent and can be used for any technology. When a robot changes its tong, the system recognizes the parameters and can continue working immediately. This means the highest degree of flexibility. Additionally, the intuitive TOX®-HMI software allows easy installation and operation of the system. It is clearly structured and internationally understandable.

Integrated Production
Due to numerous interfaces, it is easy to connect the TOX®-Equipment to a company network. The system components communicate with each other via fieldbus. Processes can be continuously monitored and improved with the data collected here. Feedback from the production process can be used to optimize the technology parameters (e.g. residual bottom thickness). Unnecessary maintenance work and downtimes can be avoided thanks to predictive maintenance.

Advantages
- One control for different application technologies
- Import of process parameters from customer network
- Autoconfiguration of system components
- Condition Monitoring: Storage of operating hours, maintenance counter, tool information etc.
- Preventive Maintenance avoids downtime
- Dynamic process monitoring
- Numerous interfaces for connecting periphery units (e.g. measurement sensors, feeding systems etc.)
- Network communication via e.g. OP-C UA / MQTT

Process Monitoring Devices
The quality parameters of the riveting can be examined and documented by a separate device.

Sensors
Optional sensor systems can be used to check and display fill levels, process progress but also quality characteristics of the elements.
Frames and Columns

The forces that occur during riveting are absorbed by a frame or the columns of a column press. The designs take into account interfering contours, total weight, piece part accessibility, working conditions and occupational safety.

Frames
Torsion-resistant frames are used for tongs and presses. We respond to the specific requirements with standard frames or individual designs.

Column Presses
Column presses are particularly useful for multi-point clinching tools. They can be manufactured in various sizes, but all have the same precision and good handling.

TOX®-Drives

Large forces are needed to set a rivet joint. These required joining forces are generated by electromechanical servo drives or pneumohydraulic cylinders.

TOX®-ElectricDrive
The modular electromechanical servo drive systems generate press forces up to 1000 kN. A maximum of 80 kN is required for riveting therefore most drives used have 30 - 60 kN.

TOX®-Powerpackage
The strong pneumohydraulic drive, which is already used worldwide in thousands of machines. Available with press forces of 2 – 2000 kN.

Additional Components

Information about additional components like controls, piece part holders, safety devices and accessories can be found on our website tox-pressotechnik.com.
TOX® PRESSOTECHNIK designs process chains more economically – with special systems, intelligent assembly systems and fully automatic feeds with integrated additional functions. We possess long-standing experience and comprehensive know-how in the development and design of these systems.

We are keeping an eye on the high efficiency of the later process chain at all times and place our customer’s requirements at the center of our work. We are committed to finding the best solution for optimising the manufacturing processes according to our customer’s requirements.

For this reason, our machines are the product of close cooperation between customers and our project managers. Our service team will also be on hand quickly and reliably at all times following completion.

Identify demand
An extensive consultation forms the basis of each concept for us – for special machines as well as production systems. We use much experience and a high level of expertise to identify the framework conditions, determine the required components, and sketch out a first system layout. In our lab we can perform sampling runs with original materials, components and elements in parallel.

Development process
The specific system concept is forwarded to our construction department, which creates the machine layout and generates detailed drawings for production. The components are manufactured or procured according to plan and the system is mounted. Then, the electrics are installed and the control components are configured.

Commissioning
On completion, the machine is test driven. Once everything corresponds to the requirements and planning, acceptance occurs in-house – if desired, together with the customer. Following delivery, set-up and connection of the system, commissioning is supported by our qualified personnel.

After-sales service
The operating personnel receives extensive training. Either at our premises or on site at the original machine. Often, we also support initial production and provide advice and assistance. When everything is running smoothly, all that is required are regular maintenance tasks.
Application examples

Riveting robot tongs are often used in the automotive industry.

TOX®-Press for the testing of different rivets in the lab.
**TOX®-Press** with partially automated workpiece handling for the setting of 16 full pierce rivets into a coupling housing.