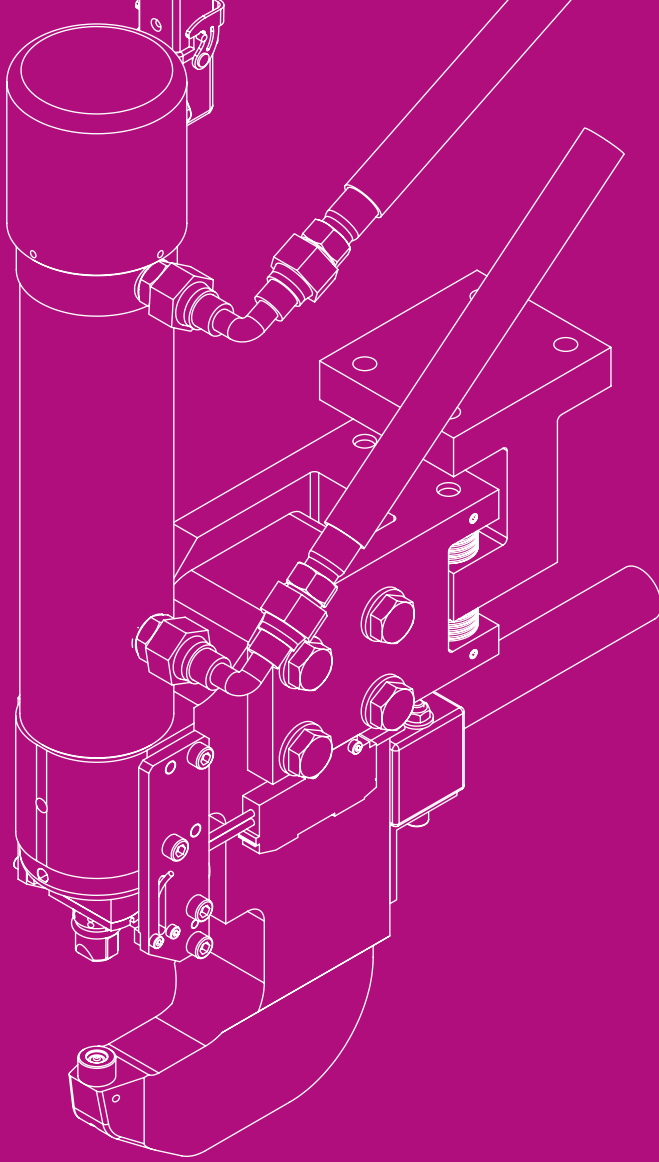




 **Avdel**<sup>®</sup>

**Fastriv<sup>®</sup>**  
**Self-Pierce**  
**Rivet**  
**Fastening**  
**Systems**



## The Fastriv® self-piercing assembly system

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Self-piercing fastener technology has been in use since the 1960's. However, the full potential of this assembly process has only recently been realised. Self-piercing assembly has now rapidly developed into a new branch of joining technology. The Fastriv® system combines high performance fasteners with precision placing tools and monitoring equipment. Using Fastriv® self-piercing rivets for the assembly of sheet metal components, joints can be made reliably with high dynamic and static strength characteristics.

The Fastriv® self-piercing system is a simple, clean and efficient method of joining sheet metal components without the need for pre-punched or pre-drilled holes. Fastriv® self-piercing rivets may be used for joining similar or dissimilar sheet materials. Assembly is achieved by driving a self-piercing, semitubular fastener into the materials to be joined.

A joint made with Fastriv® fasteners is both leak proof and has a very high degree of joint integrity. In addition, the joint has higher dynamic strength in comparison to a spot welded joint. For these reasons it is predicted that at least 30% of

situations where spot welding is employed can be replaced beneficially by self-piercing.

Depending on the application, the installation equipment can be floor standing or involve a portable riveting head for use with either manual or robotic manipulation. Fasteners are supplied by remote blow feed from a vibrating bowl through a flexible plastic tube.

The Fastriv® self-piercing system is designed to customer specifications for batch or flow line assembly. With the addition of process monitoring control equipment the integrity of the joint can be maintained to the user's satisfaction.

Together with our customers we develop fastening systems that simplify your production process and improve the quality and functionality of your products. We are not just a provider of fasteners and equipment but a design and development partner helping you to improve assembly and product performance.

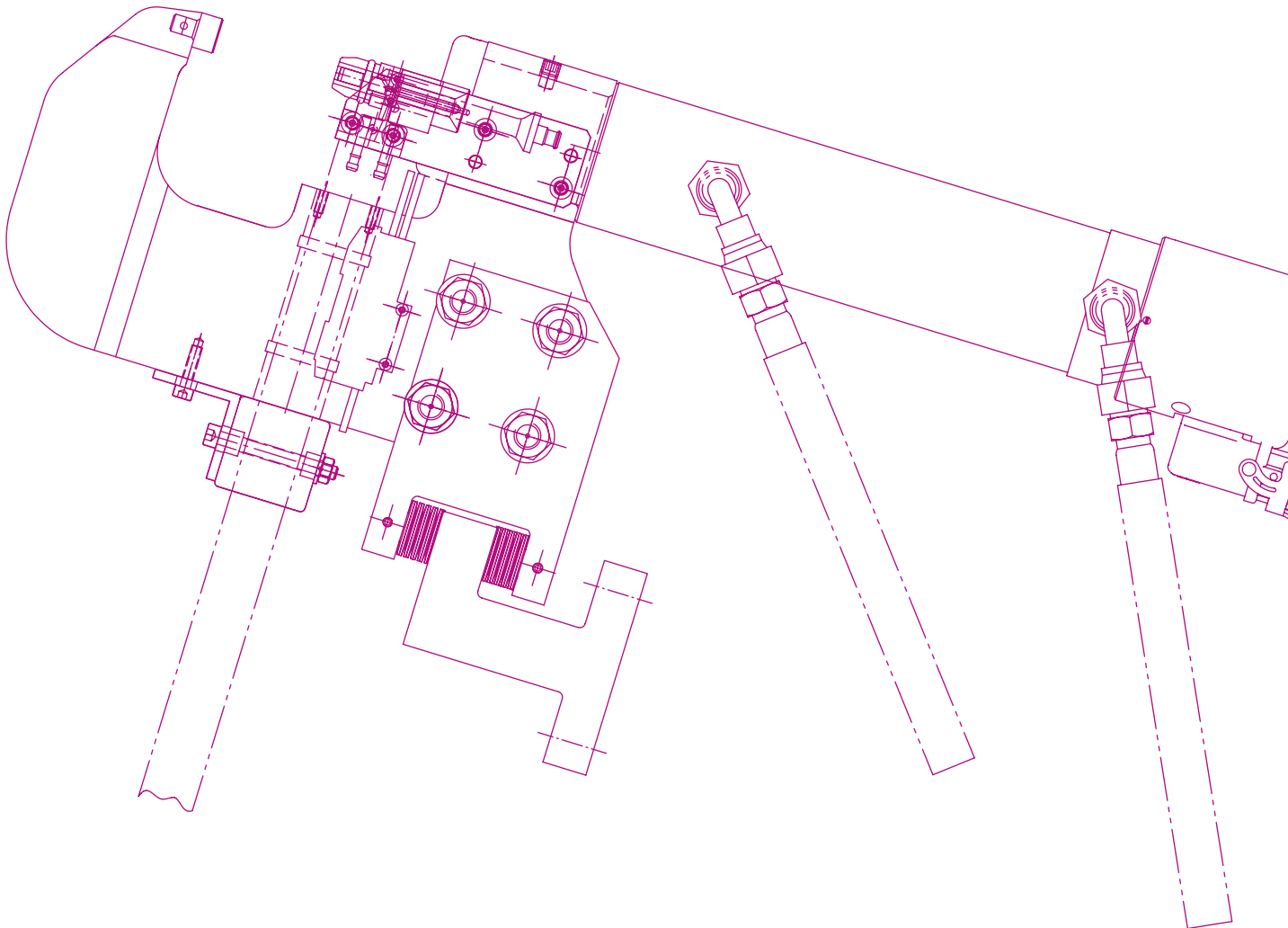
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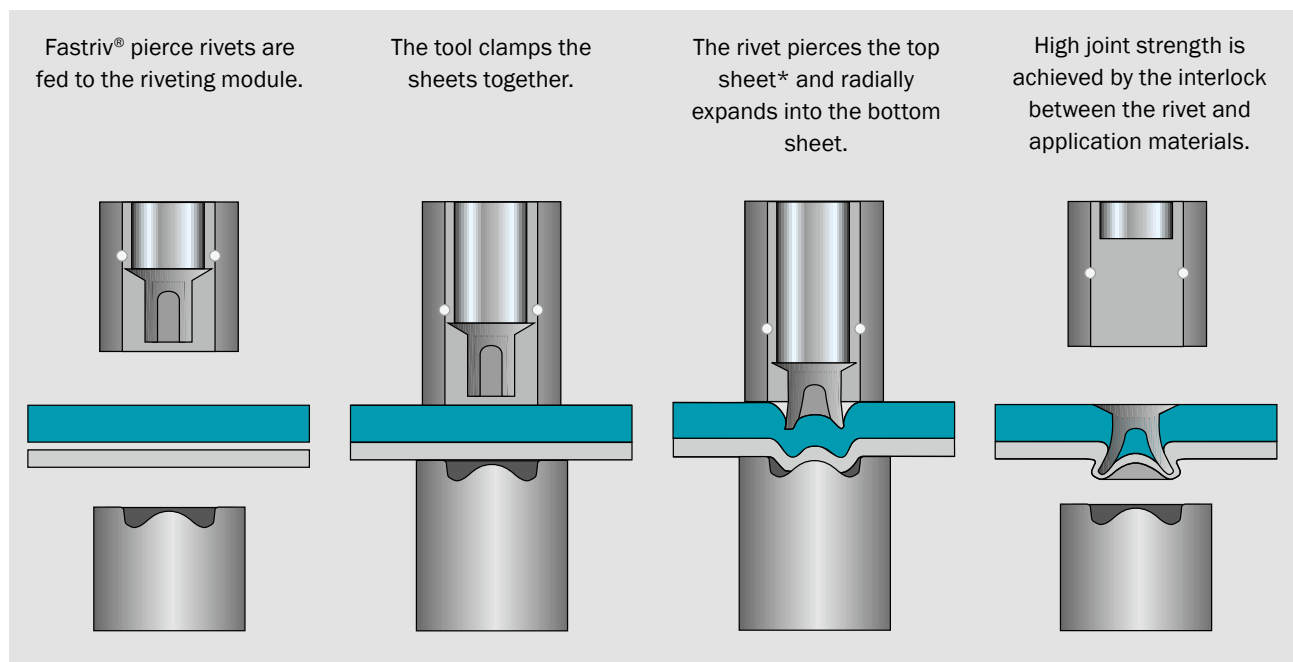


# Fastriv<sup>®</sup> Fastening System

The Fastriv<sup>®</sup> pierce rivet fastening system is engineered to pierce and fasten in one operation, simplifying assembly and reducing costs while providing a strong, reliable joint. They are an excellent fastening solution where welding is impossible or undesirable, such as joining dissimilar materials, pre-coated sheets or layered materials.



## The Principle of the Fastriv<sup>®</sup> self-piercing System



Because piercing and joining take place at one time, and drilling and hole alignment are eliminated, the Fastriv<sup>®</sup> pierce riveting system results in higher productivity and more cost-effective assembly.

\* multiple sheets can be joined

# Fastriv<sup>®</sup> Fastening System

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Since there are no accepted standards for pierce rivets, all brands are not the same. The geometry of Fastriv<sup>®</sup> pierce rivets is designed to provide optimal performance.

The Fastriv<sup>®</sup> pierce rivet system joins sheet metals, aluminums, plastic and other materials. It is an efficient fastening solution over other fastening methods such as spot welding, bolting, adhesive bonding, clinching or blind riveting. Unlike welding, Fastriv<sup>®</sup> pierce rivets do not create a heat-affected zone in the materials during installation, so changes and damage to the application materials are minimized.

During installation, the pierce rivets are fed automatically and pressed into the components. Installation systems are tailored to your manufacturing processes and requirements – from hand-operated systems to automated assembly lines.

Riveting modules and dies are configured to the respective application and can be combined with other Avdel installation systems.



## Features

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- Pierce and fasten in one operation, eliminating need for insertion holes and alignment
- Self-sealing; rivet radially expands into material, without breaking through substrate
- Provides consistent, high joint strength, comparable to spot welds and other mechanical fastening methods
- Unlike welding, Fastriv<sup>®</sup> fasteners join materials without creating a heat-affected zone, thereby preventing shrinking and minimizing distortion and other material changes
- Can be used on a wide variety of materials including steel, aluminum, nylon webbing, plastic, and rubber
- Can join dissimilar materials and cleanly join pre-coated, pre-painted or pre-plated materials
- Can be used to join materials with intermediate compounds, including adhesives
- Rivets can be plated or painted to your specifications
- Can join materials with oil or other surface contaminants
- Process load monitoring can be incorporated into installation tooling system to track and notify operator of variances in joint

## Benefits

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- Reduces component costs
- Eases automation requirements
- Maximizes manufacturing flexibility
- Can eliminate drilling and punching operations
- Can eliminate spot welding operations and its environmental hazards, such as fumes and sparks
- Lowers noise level during installation
- May reduce number of fastening points
- Increases product reliability
- Maintains integrity of application material
- Can eliminate rework of products including repainting of coated materials
- Eliminates air/water path through fastening point, resulting in a leak-proof joint
- Can eliminate surface preparation, including cleaning
- Increases consistency and quality on the assembly line

# Comparison to Competing Systems

## The Ideal Alternative

The Fastriv® pierce riveting system is the ideal alternative to common assembly methods such as spot welding, clinching, bolts, adhesives and rivets. A comparison of the features and benefits of Fastriv® fasteners and other common joining methods is shown below and on the following page.

There are two conditions required for the successful use of self-piercing rivet systems:

1. There must be access for tooling on both sides of the sheets
2. The sheet thickness, sheet hardness and ductility need to fall within the practical range for self-piercing technology.

Actual ranges are dependent on application requirements and material types. Generally, the range for sheet metal applications is a combined material thickness of 1.6mm – 8.0mm (.06" – .315").

Material layers that can be joined\* by the Fastriv® pierce riveting system include:

- steel
- cast or extruded components
- materials with an adhesive, sealant or other intermediate layer
- aluminum
- plastic
- rubber
- nylon webbing

Feature	Spot Welding	Blind Rivets	Adhesives	Bolts	Fastriv® Fasteners	Clinching
Hole alignment needed	no	yes	no	yes	no	no
Joining dissimilar materials	no	yes	yes	yes	yes	yes
Joining coated materials	no	yes	yes	yes	yes	yes
Joining 3 or more sheets	poor	good	possible	good	good	poor
Joining sheets with different thickness	poor	good	good	good	good	good
Maximum joint thickness	low	high	no limit	high	medium	medium
Leak-proof joint	partial	possible	yes	possible	yes	yes
Corrosion resistance	poor	good	high	good	good	good
Fatigue strength	low	high	medium	high	high	medium
Aesthetic quality	high	medium	high	low	high	high
Access required for joining	two sides	one side	one/two sides	one/two sides	two sides	two sides
Reliability	medium	high	medium	high	high	high
Ease of inspection	poor	good	poor	fair	good	good
Joint removability	poor	fair	poor	good	fair	fair
Automated assembly	possible	possible	possible	possible	possible	possible
Compatible with other joining methods	yes	yes	yes	yes	yes	yes
Energy requirement	high	low	low	low	low	low
Environmental impact	high	low	high	low	low	low
Cost	high	low	high	low	low	low

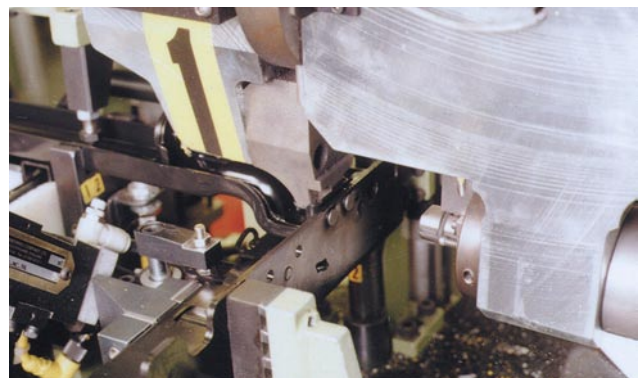
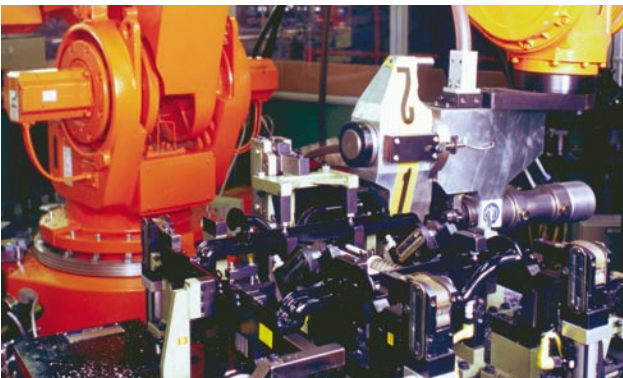
\* Based on laboratory testing and various in-service applications. Testing is required on your application to determine its optimal fastening method. Please contact an Avdel applications engineer for assistance.

# Comparison to Competing Systems

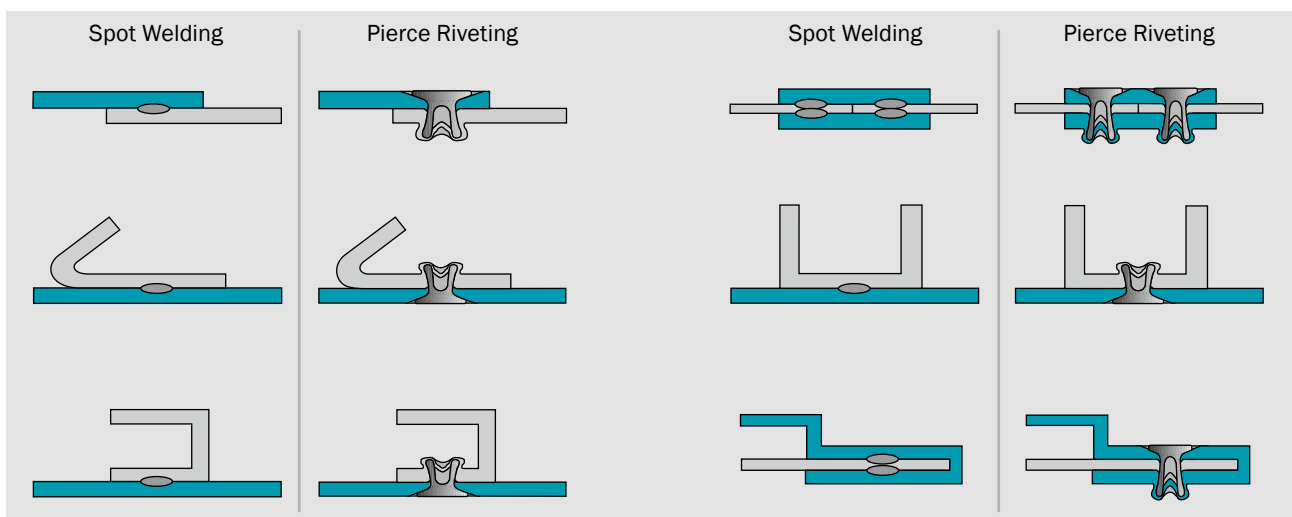
## System Comparison

### Benefits of Fastriv® pierce riveting system over other systems

- No heat-affected zone created in the assembly process
  - Material property changes of metal sheets is minimized. This is especially important when using high strength thin sheet steels, which can be degraded by thermal processing. It also avoids destruction of intermediate layers such as adhesives, sealants, or plastic, within the metal sheets.
- Suitable for joining dissimilar sheet materials
  - Spot welding cannot be used for joining dissimilar materials.
- Suitable for pre-coated, pre-plated and pre-painted sheet materials
  - Spot welding damages coated, plated and painted materials which must then be repainted to preserve their appearance.
  - Drilling or punching holes may also damage the surface of these materials.
- No preparation of sheet materials required
  - A Fastriv® joint relies upon a mechanical interlock between the materials being joined. The surface condition of the material is, therefore, not of primary importance.
- Ideal for automated assembly
- Provides high fatigue strength
- Produces joints with a high degree of reliability
- Additional monitoring equipment can check each joint as it is created
- No fumes, sparks or swarf generated in joining process



## Fastening Configurations



# Cost-effective Assembly

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## Installation Configured to your Assembly Line

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During installation, Fastriv® pierce rivets are fed automatically and pressed into the components. The installation tools or workstations are adapted to the respective production processes – from hand-operated systems to automated assembly lines. The surrounding work area is clean and operator friendly. The installation process is quiet and does not create heat or sparks.

Riveting modules and dies are configured to the respective application and can be combined with other Avdel installation systems.

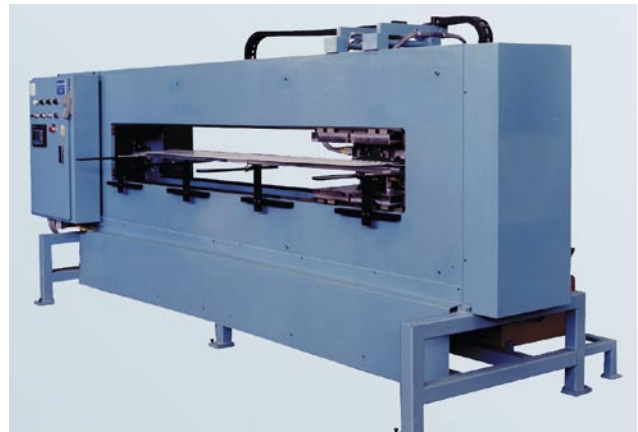
Due to their short cycle times, these systems provides a very efficient working process, reducing assembly times to a minimum. They are especially cost-effective for medium- and large-volume production.

The following pages cover some of our standard installation equipment for pierce rivets. All systems are scaled to meet specific customer applications, regardless of size.

Large C-frame throat depth, hydraulic die lift mechanism and servo-driven XY-table for complex fastening patterns. Rotary actuation option allows fastening of complex shapes. System can be scaled to meet specific application parameters.



Stationary system in H-frame designed for assembly of large sheet metal panels. Ideal for simpler fastening patterns; can be scaled down as required. Can be combined with a material handling system for maximum productivity.



Two-hand, manual-actuated C-frame on gimbal mounting allows operator to rotate the riveting module a full 360°.





# Installation Equipment

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## ESN50 Battery Tool

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### Features

- Electro-hydraulic operation
- C-frames with various throat depths are available which can be changed quickly
- Joining force can be continuously adjusted from 20 – 50 kN (4,500 – 11,240 lbf)
- With special tooling the ESN50 can also be used for removing pierce-riveted joints
- Motor automatically turns off after joining force is reached

### Benefits

- Wide range of uses, from sampling, prototyping and repair use to low volume production
- Can also be used for placing clinch nuts and studs and also pierce nuts and studs



## SN2 Tool with Hydraulic Intensifier

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### Features

- Hydraulic intensifier with hand-operated or stationary C-frame
- Adjustable pressure setting
- Various C-frames, either hand-operated or stationary, can be connected by a quick-fitting coupling

### Benefits

- Can be used in a large range of applications, from sampling to low-volume production
- The C-frames can be equipped with different tooling, so the SN2 can be used for riveting and pressing
- Can also be used for placing clinch nuts and studs and pierce nuts and studs



## SR-NAE Remote Hydraulic Powered Tool

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### Features

- Low cost, hydraulic hand tool
- Portable 2HP 208VAC Power
- Joining force can be continuously adapted from 20 – 50 kN (4,500 – 11,240 lbf)
- Suitable for medium volume applications with manual feed
- Can be equipped with various tooling to set clinch studs and nuts and pierce rivets



# Installation Equipment

## Portariv® Pierce Riveting Equipment

The Portariv® pierce riveting equipment consists of three modular assemblies: power pack and control system, head assembly and feed assembly. Two modular standard systems are available: a high-volume system which can be equipped with a process monitoring system, and a medium-volume system that combines performance with compact design.

The installation systems are adapted to specific production processes – from operator-actuated systems to automated assembly lines. Riveting modules and lower dies of the head assembly can be engineered into different configurations to accommodate difficult accessibility conditions or to assemble large or awkwardly-shaped components.

Due to their short cycle times, these systems provide a very efficient working process, reducing assembly times to a minimum. They are especially cost-effective for medium- and large-volume production.

### Key features and benefits

- Two standard systems available:
  - high-volume system which can be equipped with a process monitoring system
  - medium-volume system for series production that doesn't require process monitoring
- Cycle times between 2.0 and 5.0 seconds under normal operating conditions, dependent on feed tube length and cylinder stroke
- Hand-actuated or robot-mounted systems available
- Flexible integration into existing production lines
- Multi-head and other custom modules available
- Vibratory bowl feed system and proprietary pneumatic components ensure reliable feeding
- Increase of productivity
- Ensures a quality joint

Medium-volume system



High-volume system



Stationary C-frame for Portariv®



C-frame for difficult to access areas  
e.g. wheel house



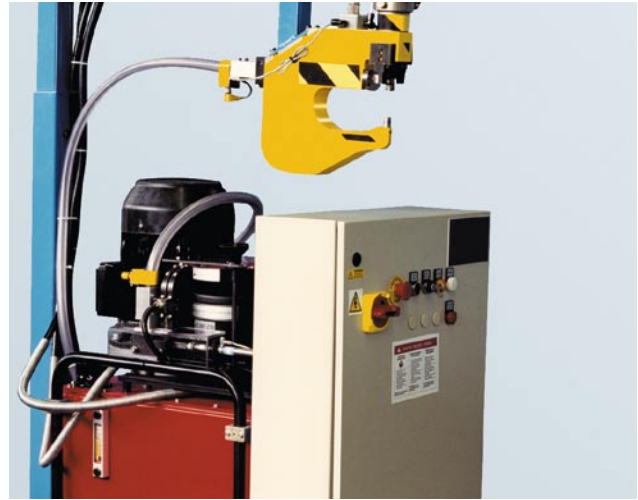
Control Panel for Portariv®  
(only available in Europe)



# Installation Equipment

## Examples for Portariv® Configurations

Robotic-controlled (left) or foot-pedal activated (right) tools are just a few of the configurations possible with the Portariv® system.



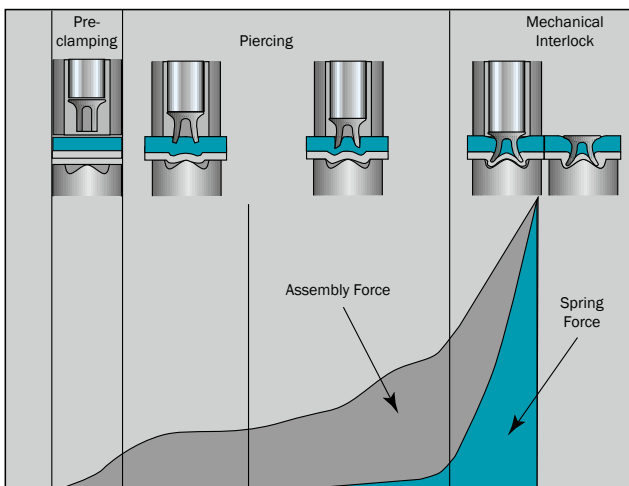
## Process Monitoring Equipment

Portariv® installation equipment blow-feeds the rivet directly from the feeding system to the tooling of the head assembly in one single action.

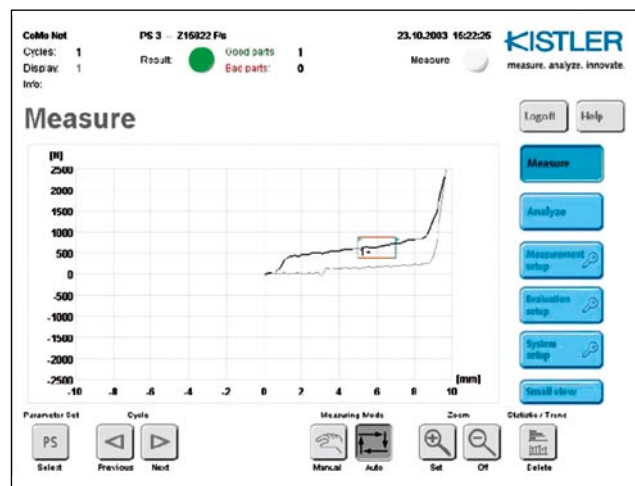
The system can be equipped with a process monitoring system to record each rivet placement in real time. This ensures that each joint falls into the programmed parameters for correct installation. The monitoring system consists of load cell and a PC unit that controls and analyzes the transducer data. The software has been designed so that the sensors can be calibrated.

The system monitors the setting force and plunger displacement during the placement of every rivet. The data is converted into a force displacement graph for each placement. The software compares this graph against tolerance limits, determined by previous controlled placements. If the graph falls outside of the tolerance limits, the machine cycle is stopped and the software will display a fault warning notice. The data of each placement is recorded and a complete history of all joints is available.

Force displacement graph



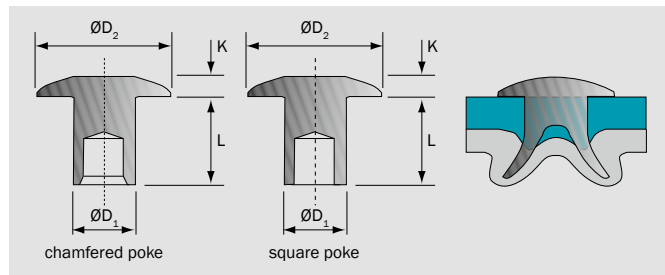
Setting force measuring curve



# Fastriv<sup>®</sup> Pierce Rivets

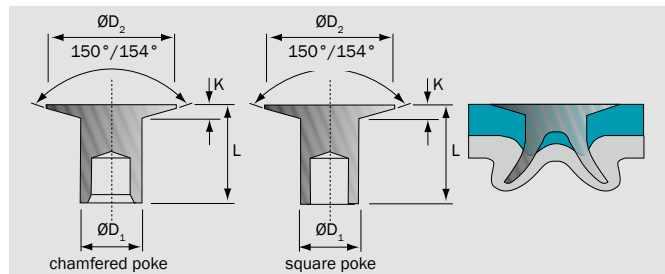
## Dome Head

- FSD Series: Steel, chamfered poke
- FSE Series: Steel, square poke
- FBD Series: Stainless steel, chamfered poke
- FBE Series: Stainless steel, square poke



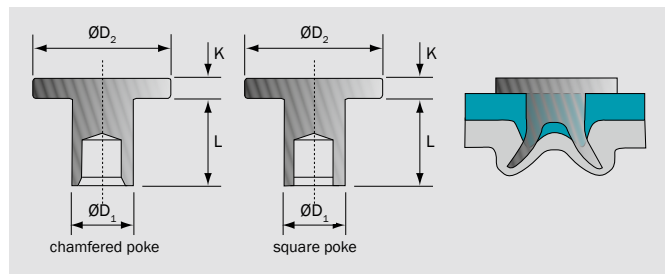
## Countersunk Head

- FSC Series: Steel, chamfered poke
- FSS Series: Steel, square poke
- FBC Series: Stainless steel, chamfered poke
- FBS Series: Stainless steel, square poke



## Tinman Head

- FST Series: Steel, chamfered poke
- FSU Series: Steel, square poke
- FBT Series: Stainless steel, chamfered poke
- FBU Series: Stainless steel, square poke



## Note

Optimal performance is dependent on material thickness and hardness. Testing is required to determine proper rivet selection and die configurations for specific applications. Please contact an Avdel application engineer for assistance. Customized fasteners can be produced on special request (e.g. Ø 5.3 mm, longer lengths, different heat treatments, additional finishes).

ØD <sub>1</sub>	L	ØD <sub>2</sub>	K
	± 0.15	± 0.3	± 0.1
3.2	3.0	6.5	1.0
	3.5		
	4.0		
	4.5		
	5.0		
	5.5		
3.9	6.0	8.0	1.2
	4.5		
	5.0		
	5.5		
	6.0		
4.8	6.5	9.5 (8.5 <sup>1</sup> )	1.5
	7.0		
	7.5		
	8.0		
	8.5		
	9.0		
	9.5		

all dimensions in mm; 1) for countersunk

# Success with Fastriv<sup>®</sup> Systems

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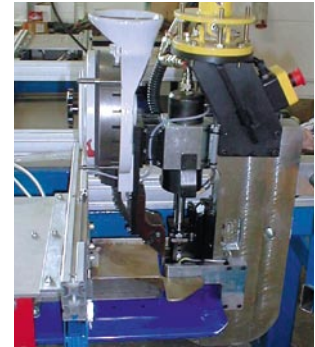
Fastriv<sup>®</sup> pierce rivet systems are raising productivity and lowering costs in a wide range of automotive and commercial industries, from sheet metal assembly to building construction to plastic products.

## Air Cargo Equipment

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The shoulders and corner stiffenings of this air cargo transportation pallet are joined with Fastriv<sup>®</sup> countersunk pierce rivets. Due to the large dimensions of the pallet, the C-frame is supported on a gantry system.

All rivet positions are manually driven. A hopper system feeds the rivets automatically. The elimination of drilled holes and automatic feeding of rivets have reduced cycle times significantly.



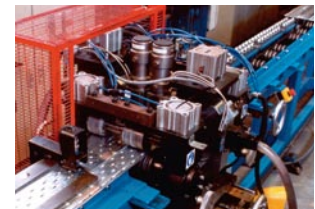
## Construction Components

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These heavy-duty lintels can carry loads up to 45 kN (10,000 lbs). They are produced in two steel sections with a combined material thickness of up to 6.4mm (0.25"). Spot welds were initially used for assembly, but this method provided poor joint consistency and required rework to correct the damaged coated surface.

The Fastriv<sup>®</sup> pierce rivet system produces the high strength joints required for this critical application and does not damage the coated sheets.

Steel lintels up to 2 meters long are assembled on a customized 2-head riveting machine. The placement of the rivets is staggered left and right at a distance of 30 cm (11.81"). At the ends of the lintels, rivets are placed parallel to each other. Twin bowl feeders allow the system to be fully automated, resulting in increased productivity.



## Consumer Products

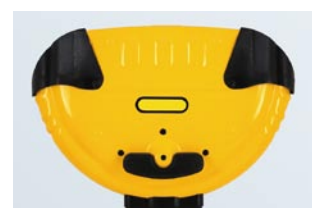
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A 12-head riveting system is integrated into an automatic production line for assembling aluminum ladders. Each ladder step is fastened simultaneously to the ladder frame.

The machine can be used for different ladder sizes. Other benefits include shorter cycle times, cost-effective production, elimination of insertion holes, and a stronger and more reliable end product.

This steering wheel lock requires consistent, high-strength fastening to meet tamper-resistance requirements. Fastriv<sup>®</sup> fasteners met these requirements, plus they could be used after the components were painted, increasing manufacturing flexibility and minimizing cycle times.

The Fastriv<sup>®</sup> pierce rivets are processed on a stationary riveting system with an automatic feeding module. The system was easily integrated into the existing production line.



# Success with Fastriv<sup>®</sup> Systems

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## Automotive Space Frames

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This space frame is assembled with Fastriv<sup>®</sup> pierce rivets and a lightweight C-frame. This C-frame has a throat depth of 850 mm (30") and can be manipulated with a robot due to its low weight of 140 kg (310 lbs). This C-frame is used for all rivet positions.

This body component consists of an aluminum sheet, a casting, and an extrusion with different material thicknesses. Due to the higher fatigue strength of the pierce-riveted joint (compared to a spot weld), the number of joints was reduced dramatically.



## Automotive Subassemblies

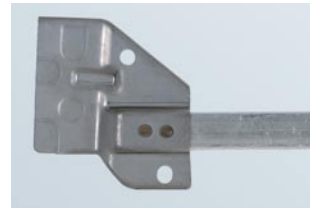
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The innovative, weight-saving introduction of a side impact bar made of an aluminum bar and steel bracket demanded an efficient alternative to welding. A shear strength of 16 kN (3,597 lbf) also had to be achieved. Together with a machine integrator, Avdel designed a fully-automated production machine with process monitoring that produces 18 side impact bars per minute.

Fastriv<sup>®</sup> pierce rivets allow the components of this car seat to be joined after painting. For aesthetics, the rivets are painted to match the color of the component, eliminating the need for color caps. The assembly machine manufactures two models in one cell, using two different rivets fed to a robotically-mounted C-frame. The lower portion of the C-frame that contains the die rotates 180°, allowing the use of two different dies to provide optimum joint strength.

The plastic and steel materials of this airbag component require joints with high shear strength to meet rigorous performance requirements. Fastriv<sup>®</sup> pierce rivets were chosen to meet these needs.

The components are assembled automatically with a process monitoring system, controlling the quality of the joint and ensuring the correct number of placed rivets in their proper positions.



# Repair Concept for self-piercing Joints

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## Operation

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In principle, a joint made with self-piercing rivets is a “non-removable joint”. Sometimes it will be necessary to disassemble these joints. This may occur in re-work or in service repairs, for example due to damage to the components being joined. The choice of the disassembly procedures needs to be made on a case-by-case basis after the consideration of the access to the fastening point. An Avdel applications engineer can assist you in determining the correct method of repair.

## The Avdel Concept

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Avdel offers repair kits that are suited to your specific needs. The basis of each kit is the ESN50 battery tool with an adjustable force of 20 to 50 kN. The tool can be equipped with different C-frames to accommodate varying tooling access in the application. Tooling sets can be combined as the addition of more applications occurs in the future.

Example of a complete repair kit with extensive accessories.

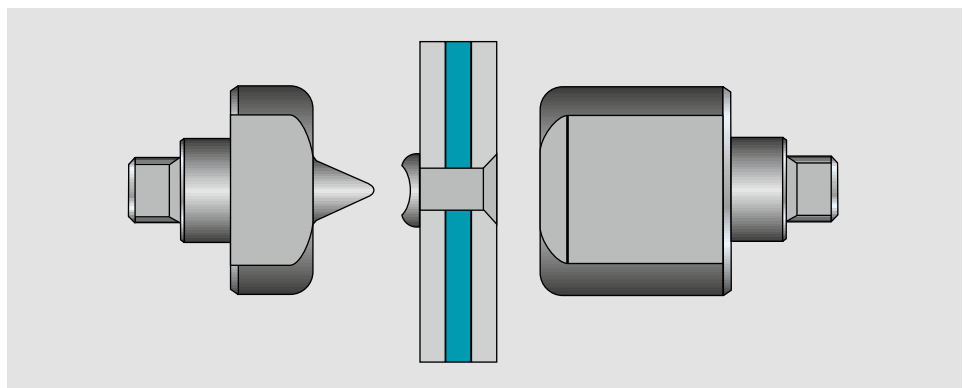
The kits are adapted to the customers requirements.



## Example

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Operation: Press out the self-piercing rivet in case of three-layered sheet joint. After removing all joints a new component can be assembled using for example new self-piercing rivets, solid or blind rivets.



# Holding your world together®

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