HERON
TECH

FLUSH SELF-PIERCE RIVETING TECHNOLOGY

HT FSPR®: Riveting Solutions For High-Strength Performance & Lightweighting Applications

Innovative Joining

Welding | Clinching | Riveting | Industry 4.0

About Heron Tech

We are Heron Technologies USA Inc., an exciting spinoff from the highly respected Heron Group, a leader in modern industrial technology. Building on our legacy of innovation and excellence, we are dedicated to shaping the future of manufacturing with high-tech industrial components & consumables, paired with Heron-engineered industrial equipment.

Our mission is simple: To help industry partners accelerate the transition to green and intelligent manufacturing with innovative products & solutions by Heron.

COMPANY TIMELINE

45+ Years

AKH over the years

1981-1990

1990 -2022

2023 - present

Partnering with Heron since 2019, AKH continues to innovate and maintains a strong commitment to excellence, customer satisfaction and innovation in rivet manufacturing.

2+ Years

HERON over the years

2025

After our rebrand in 2025, Heron Tech (HT) aims to become a trusted leader in the metal joining industry by serving a wide range of industries and providing reliable solutions that meet the demanding standards of modern manufacturing.

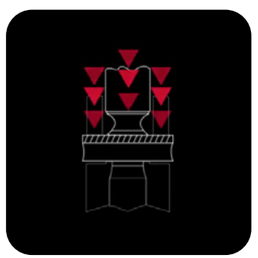
Flush Self-Pierce Riveting Technology

FSPR® or Flush-self pierce riveting technology is a mechanical joining technique for identical or dissimilar materials, allowing the joining of two or more layers of varying thicknesses, pre-painted or pre-coated; no pre-drilling required.

Technical Principle

The FSPR® self-pierce riveting process is realized by a simple punch and die operation which automatically feeds, punches, inserts and locks the self-piercing rivet to produce a solid join in one high-cycle operation. The three steps are as follows:

Step 1

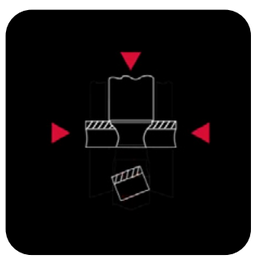


STAMPING

Step 2

PIERCING

Step 3



FORMING

An innovative solution for special materials

Across modern manufacturing sectors—automotive or general industry —production increasingly relies on advanced riveting solutions. As a robust and time-tested joining method, HT's FSPR® delivers permanent, high-integrity joining between metal components. Unlike threaded fasteners, rivets require no pre-drilled holes and thus eliminate risks of loosening, wear, or stripping. And in contrast to traditional joining methods, FSPR® enables the reliable joining of dissimilar or non-weldable materials.

For large-volume manufacturing pierce-based riveting processes without pre-drilled holes are standard. In these applications, the rivet punches through the material stack and forms its mechanical interlock in a single operation.

Special Materials	Joining Solutions for
Die-cast Aluminum + HSS	Automotive
Carbon Fiber + Mg	Transportation & Logistics
HSLA	General Industry & Hardware

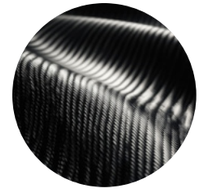
HT 2026

Applicable Riveting Materials

Deep drawing steels
with Rm up to 1000 MPa

High-strength steels
with Rm up to 1600 MPa

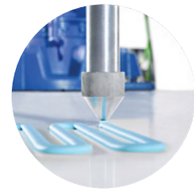
Hot-stamped steels
with Rm up to 1800 MPa



Non-ferrous metals & non-metallic materials
(copper, mag., and carbon fiber) as a middle layer

Aluminium and alloy
(pressure cast, extruded, sheet)

Multilayer stack-ups
with dissimilar materials



Adhesive
applied as a middle layer

Recommended material stack-up

Bottom plate thickness ≥ 1/5 of combined plate total thickness.

Convex side:
High-strength metals (plated steel, hot-formed steel, high-strength steel, etc.)

Middle layer:
Medium/low-strength metals & non-metals (carbon fiber, medium/low-strength steel, aluminum alloy, etc.)

Concave side:
Medium/low-strength metals (medium/low-strength steel, aluminum alloy, etc.)

1 Two-layer riveting:

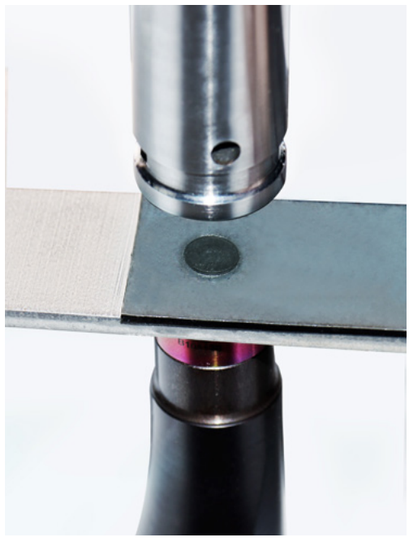
- Convex side material allows pull strength ≤ 1800MPa
- Concave side material allows pull strength ≤ 1000MPa

2 Multi-layer riveting:

Concave side material pull strength&Middle layer material pull strength ≤ 250MPa

- Positive difference: Concave material harder than middle layer
- Negative difference: Concave material softer than middle layer

Thin plate on punch side + thick plate on concave side = better riveting strength, but thick plate on punch side is allowed.

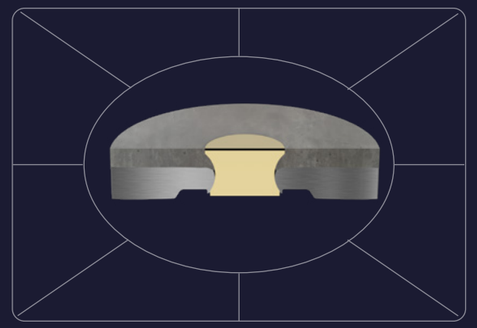


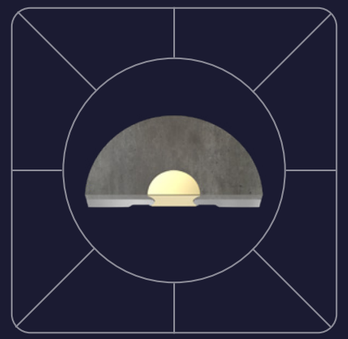
HT 2026

High joint integrity. Fatigue resistant.

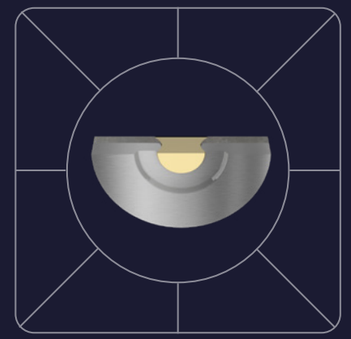
Preferred process for mixed-material bodies, lightweight architectures, and optimized structural designs.

Cross Section





Punch Side

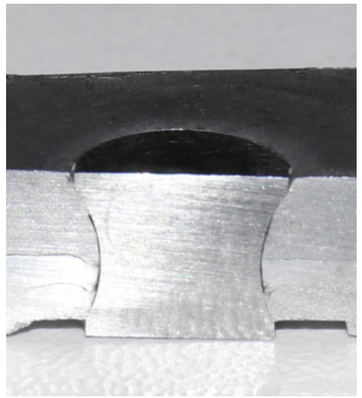


Die Side

Why use our FSPR System?

Quality

- Reliable industry-trusted joining method for 40+ years
- Joins up to 7 layers
- Works across steel, aluminum, copper, brass, magnesium,
- HSS and die-cast aluminum



Efficiency

- No pre-punched or drilled holes required
- Less handling, faster prep
- Fully compatible with automated production lines

New Design = Cost Savings

- Optimized rivet magazine reduces feed travel and minimizes downtime
- Re-engineered tooling for multiple rivet sizes
- Enhanced quality monitoring for joint integrity

Style of Rivets

HT Rivets are available in a range of twelve standard sizes, across three styles – Headed (H), Double-Headed (DH) and Headed Painted (HP) Series.

The rivet geometry supports reliable performance in multi-layer stacks, while offering options for color customization and enhanced corrosion resistance.

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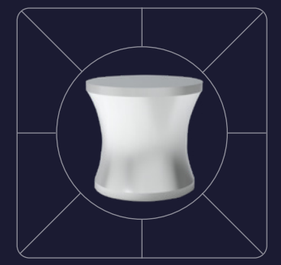
H SERIES

Headed Rivet

A new rivet that enables consistent joint quality in multiple layers of die-cast materials& high-strength steel



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DH SERIES

Double-Headed Rivet

Designed for ultra-secure joints in applications requiring extra grip or visual balance on both sides of a material

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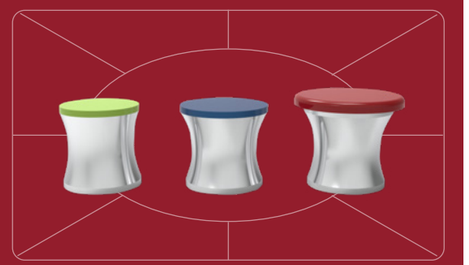
HP SERIES

Headed-Painted Rivet

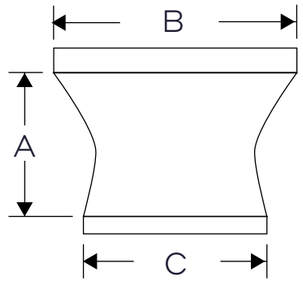
Pre-painted rivets offering structural integrity and visual appeal for exterior panels & painted assemblies



FSPR Rivet Selection

The FSPR rivet is made from hardened steel or aluminum and available in a range of standard sizes.

The typical rivet shape is shown. For accurate selection and customization of rivets, please consult HERON.



RIVET SIZES

	01	02	03	04	05	06	07	08	09	10	11	12
A	1.9 mm	2.1 mm	2.5 mm	2.8 mm	3.2 mm	3.5 mm	3.9 mm	4.2 mm	4.6 mm	5 mm	5.1-9.1 mm	5.5-8.1 mm
B	5.3 mm							7.1 mm				7.6 mm
C	4.7 mm							6.3 mm				7.9 mm

Comparison: SPR vs FSPR

Rivets	Self-pierce Rivet(SPR) 	Flush Self-pierce Rivet(FSPR) 
Measurements of the typical rivets	Φ = 3 – 3.35mm Rivet length 3.5 – 5.0mm Φ = 5 – 5.3mm Rivet length 4.0 – 9.0mm	Φ = 4.7mm Rivet length 1.9 – 2.8mm Φ =6.3mm Rivet length 4.2 – 9.1mm Φ =7.9mm Rivet length 5.5 – 8.1mm
Material strength	< 1600MPa	< 1800MPa
Material ductility requirements	≥10%	≥3%
Typical number of sheets	2 – 3	2 – 7
Pull strength (typical)	Up to 2.5KN	Up to 4KN
Shear strength (typical)	Up to 4.3KN	Up to 19KN
Multirange capacity (different joining tasks)	low	very good
Flush surfaces	punch side	two sides
Minimum flange width	18mm	12mm
Gas-tight	yes, die side	yes
Liquid-tight	yes, die side	yes
Layers cut	all except on die side	All
Minimum sheet thickness on die side	1.0mm	0.5mm
Punched piece (slug) removal	×	√
Electrical conductivity	average	average
Joined Materials	Hot-stamped steel (Softening treatment required)	Hot stamped steel
	High strength steel (≥1000 MPa)	High strength stee (≥1000 MPa)
	Die-cast aluminium (Elongation ≥ 10 %)	Die-cast aluminium (Elongation ≥ 3 %)
	Aluminium alloy	Aluminium alloy
	Carbon brazing(high risk of cracking)	Carbon brazing
	Low and medium strength steel	Low and medium strength steel
	Universal steel	Hot stamped steel
	Galvanised sheet	Galvanised sheet
	-	Die-cast magnesium
	-	Magnesium alloy
	-	PP material

Robot Riveting Unit

Main Features

The Actuator housing of the ZM6 servo riveting system follows a lightweight design and includes a strain gauge force transducer with an integrated amplifier circuit board. Press fitting is carried out by a servo motor driving a threaded screw via a belt and gearbox. The encoder for precise positioning is integrated in the drive motor.

ZM6 servo riveting system adopts HRC-670 riveting quality monitor for riveting quality control. Communication between the monitor and the servo controller is via a real-time fieldbus. The monitor interfaces to fieldbus types commonly used in the industrial field, such as PROFIBUS, PROFINET, EtherNet/IP, EtherCAT, and the Ethernet port of the monitor enables the transfer of historical data files in a variety of formats. Data backup is also possible.

Electric Cylinder Parameter

Rated power	KW	5
Electric cylinder stroke	mm	200/300 (Optional)
Nominal Pulling Force	KN	20
Nominal Pressing Force	KN	80
Maximum velocity	mm/s	300
Repeated positioning accuracy	mm	±0.01
Overall weight (including servo motor)	kg	73
Protection class IP54		IP54
Operating temperature		Temperature: -5 ~45°C; Humidity: ≤90%
Operating humidity		≤75%

Riveting Unit Parameters

Throat depth	mm	200/300/400/450/500/ customized
Operating Opening	mm	130
Maximum pressure	KN	80
Weight	Kg	Refer to table on p10
User field installation conditions		
Power supply		380V / 480V
Air source	MPa	≥0.6

(1) Measurement standards assume same temperature working conditions.

(2) The specific weight of Riveting unit is subject to the final design.

(3) If the user site installation conditions are special, please contact us.

Riveting Applications: Lightweight and Compact Design

The ZM6 Servo Riveting system with integrated internal strain gauge force sensor (80 KN) is particularly suitable for high precision Riveting processes based on force and displacement monitoring. The weight of the whole machine is significantly optimized and requires little installation space. At the same time, excellent weight-center-of-gravity optimized design can be demonstrated when integrating with robot arms.

- ✔ Lightweight and optimized range for robotic applications.
- ✔ Compact design .
- ✔ Servo motors with single cable technology for the easiest possible mounting process.
- ✔ High speeds with ultra-short beats.
- ✔ Active compensation of the riveting process to ensure precise positioning.

Applications

The ZM6 servo riveting system is suited for modern, fully automated production riveting lines. Due to its lightweight and compact design, the ZM6 has excellent suitability for assembly applications where the robot arm is used. Examples include clinching, punching and pressing.

Model: ZM6-080

Sample Combinations

FSPR

The Optimal Riveting Technology for Lightweight Vehicle

▲ Make Material Joining Simple

Enables joining of Al alloys, HSS (High-Strength Steel), and UHSS (Ultra-High-Strength Steel), while being compatible with heterogeneous combinations like CFRP (Carbon Fiber Reinforced Polymer) , cast Al and cast Mg , breaking the bottleneck in lightweight material joining.

▲ Make Vehicle-Design Flexible

Supports riveting of 2-4 material layers, suitable for complex multi-layer structures such as body frames and battery packs.

▲ Make Quality Reliable

Adapts to a stacked thickness of 2.6-8.0mm, ensuring stable joining from thin materials to thick materials for axles and girders.

Material	Stack-ups Thinkness/ mm	Max. Layer	Max. Shear Strength/ KN	Max. Pull strength/ KN
Al(+Cast Al)	4.2-8.0	3	19	5
Cast Al +HSS	4.35-4.8	3	7	3.6
Al+HSS/UHSS	3.2-5.2	4	9	11
Al+Cast Mg	3.9-6.0	3	10	4
Cast Al+ Galvanized Steel	3.65-5.1	3	7	2.5
Cast Mg(+Steel)	3.7-5.0	2	3	1.6
Carbon Fiber	2.6	2	1	0.3

Sample Combinations for Al

The trend of automotive lightweighting has driven a continuous increase in the usage of Al alloys and die-cast Al. However, Al alloys—especially die-cast Al, which has an elongation of only 3%-10%—are prone to cracking, poor joining, and other issues during the joining process, plaguing numerous auto OEMs and Tier 1s.

Developed specifically for the joining of lightweight materials like Al, the FSPR technology not only enables crack-free and reliable joining of Al alloys and die-cast Al, but also performs exceptionally well in combinations of hard-to-join dissimilar metals, such as multi-layer Al alloys, Al with high-strength steel (HSS), and Al with die-cast Mg.

Compared with traditional SPR, it further breaks through the upper limit of riveting thickness, reaching up to 8.0mm, perfectly meeting the joining needs of lightweight vehicle bodies.

Al — AL ALLOY DIE-CAST AL

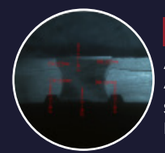
TENSILE STRENGTH: 90-690MPA
ELONGATION: 1-30%

TYPICAL RATIO: >8%

- Varies significantly by vehicle model
- New energy vehicle models have a higher proportion due to lightweighting requirements

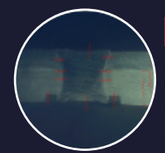
Car doors, engine hood, bumper, front and rear shock towers, torsion box, front and rear longitudinal beams, sill beams, seat cross members, instrument panel frame, battery pack frame, floor, front bulkhead, etc.

Sample Combinations

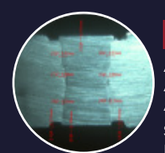


H8
Al(5182-O) 1.2mm
Al(7075) 3.0mm
Shear Strength:10KN
Pull Strength:1KN

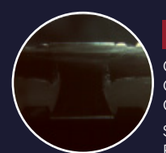
H 7-195
Steel 1.0mm
Galvanized Steel 0.65mm
Cast Al 1 3.0mm
Shear Strength:4KN
Pull Strength:2KN



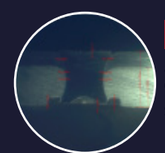
H8
Al(6014) 1.0mm
Cast Mg(Am50)3.0mm
Shear Strength:10KN
Pull Strength:2KN



H11-334
Al Alloy(6111-BH2)2.0mm
Al(S650)3.0mm
Al(7075)3.0mm
Shear Strength:19KN
Pull Strength:4KN



H11
Galvanized Steel 0.7mm
Galvanized Steel 1.4mm
Cast Al 3.0mm
Shear Strength:7KN
Pull Strength:2KN



H9
Al(5182) 1.2mm
Cast Mg(Am50)3.0mm
Shear Strength:8KN
Pull Strength:2KN

Sample Combinations for HSS

HSS, with its core advantages of high strength, excellent fatigue durability, and outstanding cost-effectiveness, has become a mainstream material in vehicle body manufacturing, widely supporting the demands for lightweighting and safety.

However, its high strength (≥700 MPa) and high hardness also present significant challenges for joining processes.

Developed specifically for lightweight materials, FSPR technology not only achieves crack-free and reliable joining of HSS, but also efficiently addresses the joining needs of complex dissimilar hard-joining metal combinations such as multi-layer HSS, HSS-to-Al, and HSS-to-cast Al, perfectly meeting the joining needs of lightweight vehicle bodies.

HSS HIGH STRENGTH STEEL

TENSILE STRENGTH: 700-900MPA
(Ahss Reaches 1800-2000MPA)
ELONGATION: 10-20%
(Low-carbon Steel: 30-40%)

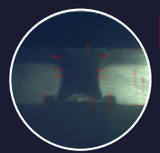
TYPICAL RATIO:
60%

- Differs significantly between different vehicle models, gradually increasing as cars become lighter

The chassis, body frame, A-pillars, B-pillars, door impact beams, roof frame, center tunnel, rear impact beams, and other components that bear significant external forces and ensure the structural integrity of the vehicle body.

Sample Combinations

H10
HSS 1mm
Galvanized Steel 0.65mm
Die-Cast Al 3mm
Adhesive
Shear Strength:6KN
Pull Strength:3KN



H10
HSS 0.7mm
Galvanized Steel 0.65mm
Die-Cast Al 3mm
Adhesive
Shear Strength:4KN
Pull Strength:2KN

H10
HSS 1mm
HSS 0.65mm
Die-Cast Al 3mm
Shear Strength:6KN
Pull Strength:3KN

H10
HSS 1mm
Galvanized Steel 0.65mm
Die-Cast Al 3mm
Shear Strength:6KN
Pull Strength:3KN

H10
HSS 0.7mm
Galvanized Steel 0.65mm
Die-Cast Al 3mm
Shear Strength:4KN
Pull Strength:2KN

Sample Combinations for Carbon Fiber

As the advancement of vehicle body lightweighting accelerates, carbon fiber demonstrates enormous market potential in automotive manufacturing, thanks to its core advantages of high strength and extreme lightweight properties.

However, carbon fiber exhibits significant brittleness (with an elongation of only 1%-2%), which leads to issues such as cracking and joint failure during the joining process—becoming a key bottleneck restricting its large-scale application.

Developed specifically for lightweight materials, the FSPR technology can efficiently solve the joining challenges between carbon fiber and other materials, providing core support for the innovation of future lightweight vehicles.

C CARBON FIBER

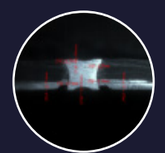
TENSILE STRENGTH: 3,500-4,500MPA
ELONGATION: 1-2%

TYPICAL RATIO:
<5%

- Mainly used in high-end or performance vehicles

Body panels, chassis components, roofs, doors, etc. can significantly reduce vehicle weight and improve performance.

Sample Combinations

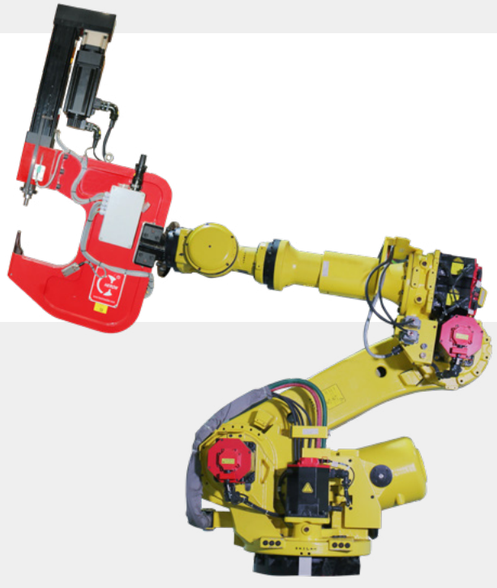


H10
CFRP Similar 2mm
Steel 0.6mm
Shear Strength:1KN
Pull Strength:0.3KN

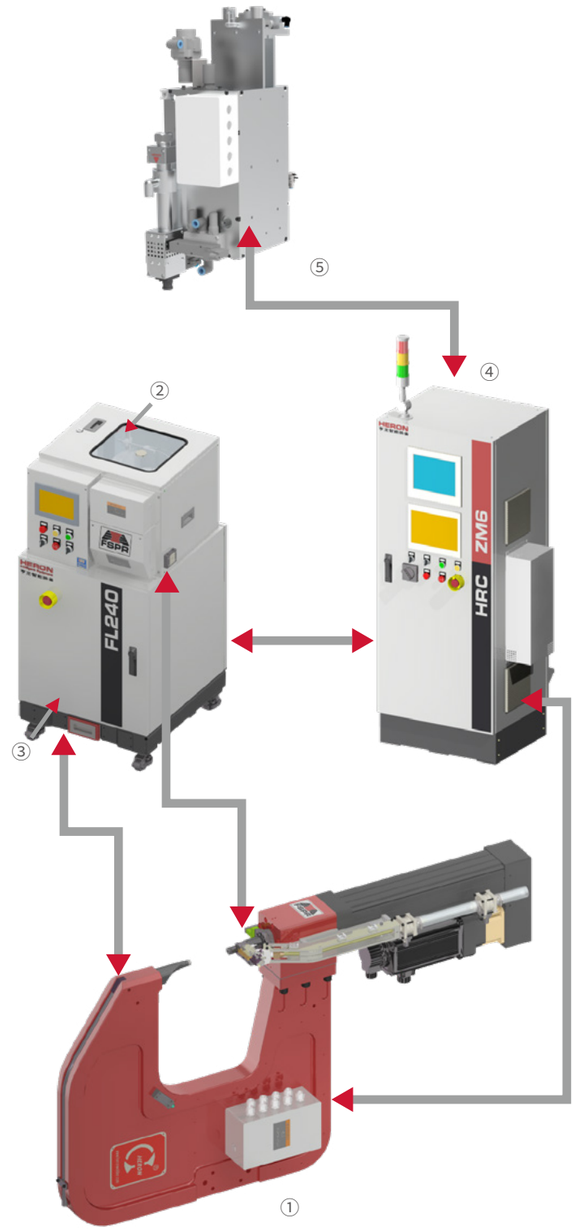
Riveting System

Heron's Flush Self-Pierce Riveting (FSPR) Systems range from standard machines to fully automated turn-key operations. We partner with our customers to manage the design, integration and commissioning of assembly systems from concept to production.

In today's market, companies want to improve efficiencies and product quality as well as decrease manufacturing time and labor. Meeting these demands, our customizable multiple-hit automated servo riveting systems make up the majority of riveting equipment sales.

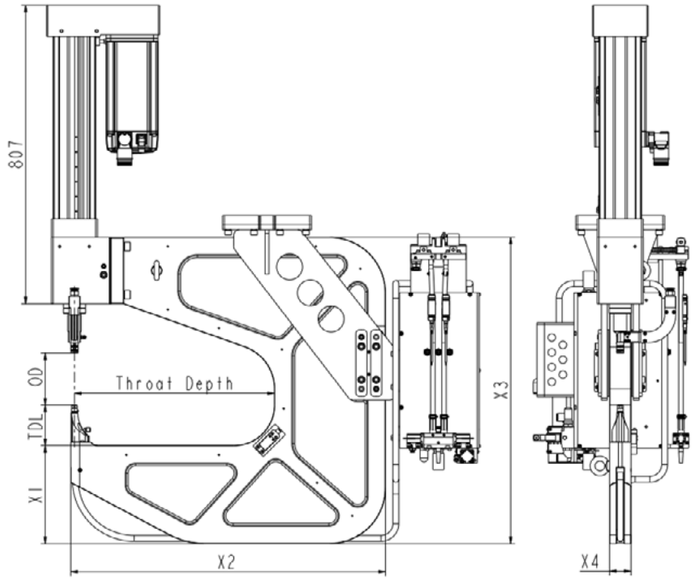


HT FSPR® System: ZM6 Intelligent Platform



① Servo riveting unit
② Rivet feeding system
③ Waste collection system
④ Electrical control system
⑤ Magazine

HT FSPR® System: ZM6 Intelligent Platform



Type	Model No.	Throat Depth (mm)	Weight (kg)	Open Distance (mm)	Total Die Length (mm)	X1 (mm)	X2 (mm)	X3 (mm)	X4 (mm)
C-Frame Options	1	200	198	140	110	200	485	753	50
	2	300	217	140	110	235	585	788	50
	3	400	238	140	110	255	685	808	54
	4	450	276	140	110	260	735	813	56
	5	500	292	140	110	270	810	823	58

1. Basic parameters of standard C-Frame: 200mm Actuator stroke + 150mm open distance.
2. If you need to customize the C-Frame and need more information, please feel free to contact us.

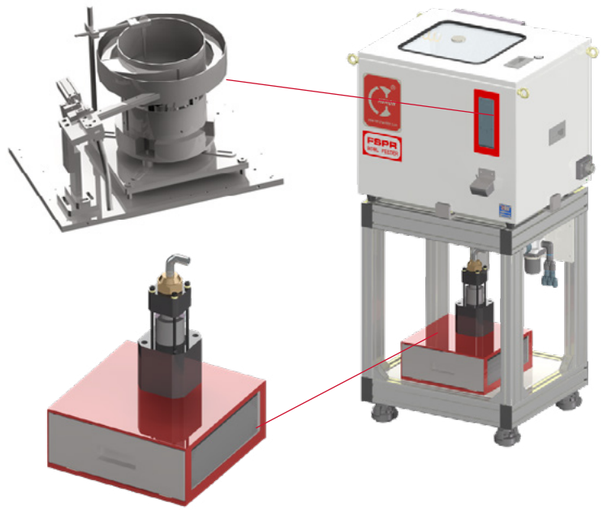
Rivet Feeder / Waste Collection System

Rivet Feeder

The system is an automatic vibrating tray type sorting and feeding system. Its function is to vibrate the disordered rivets to be arranged neatly and accurately in accordance with the set direction to the riveting unit, including full material detection, in place detection and no material alarm and other functions.

Waste Collection System

This system is an automated collection system for FSPR punched and cut scrap. It has functions such as counting and alarming.



Electric Control System

ZM6-080-XXX-D0 Controller

The control system is used for the overall control of the riveter and the communication with the robot.

HRC-670 Monitor

HRC-670 monitor can be used for real-time monitoring of riveting, press-fitting, assembly, spring testing and other processes, and form the correlation curve of force, displacement and time to detect and evaluate the production quality or production steps, which can ensure the quality of assembly and achieve defect-free production and assembly parts process. Widely used in the following production tasks:

- FSPR/SPR
- Clinching
- Press fitting
- Spring testing
- Fatigue testing

FSPR Tooling Selection

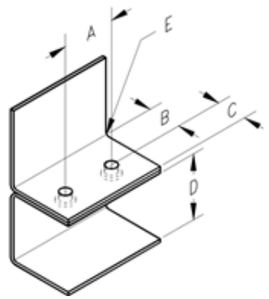
Minimum Space Design Specification

When the size of "E" increases, the size of B should be increased accordingly.

Unless otherwise specified, the values in the table are the minimum values required.

The value of C in the table applies to ordinary mild steel, if riveting low elongation, brittle materials need to appropriately increase the value (* For example, the die side is about 10% elongation of aluminum, C value is greater than 15mm)

If the size of C increases, the size of D needs to be increased accordingly.



Tooling	Dim	SIZE#		
	MJ	mm	MSD-1~7	MSD8~11	MSD12~
	A	13	17	20
	B	7.5	8.8	10.8
	C	6	8	10
	D	30	52	65
	*E	0.8	0.8	0.8

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