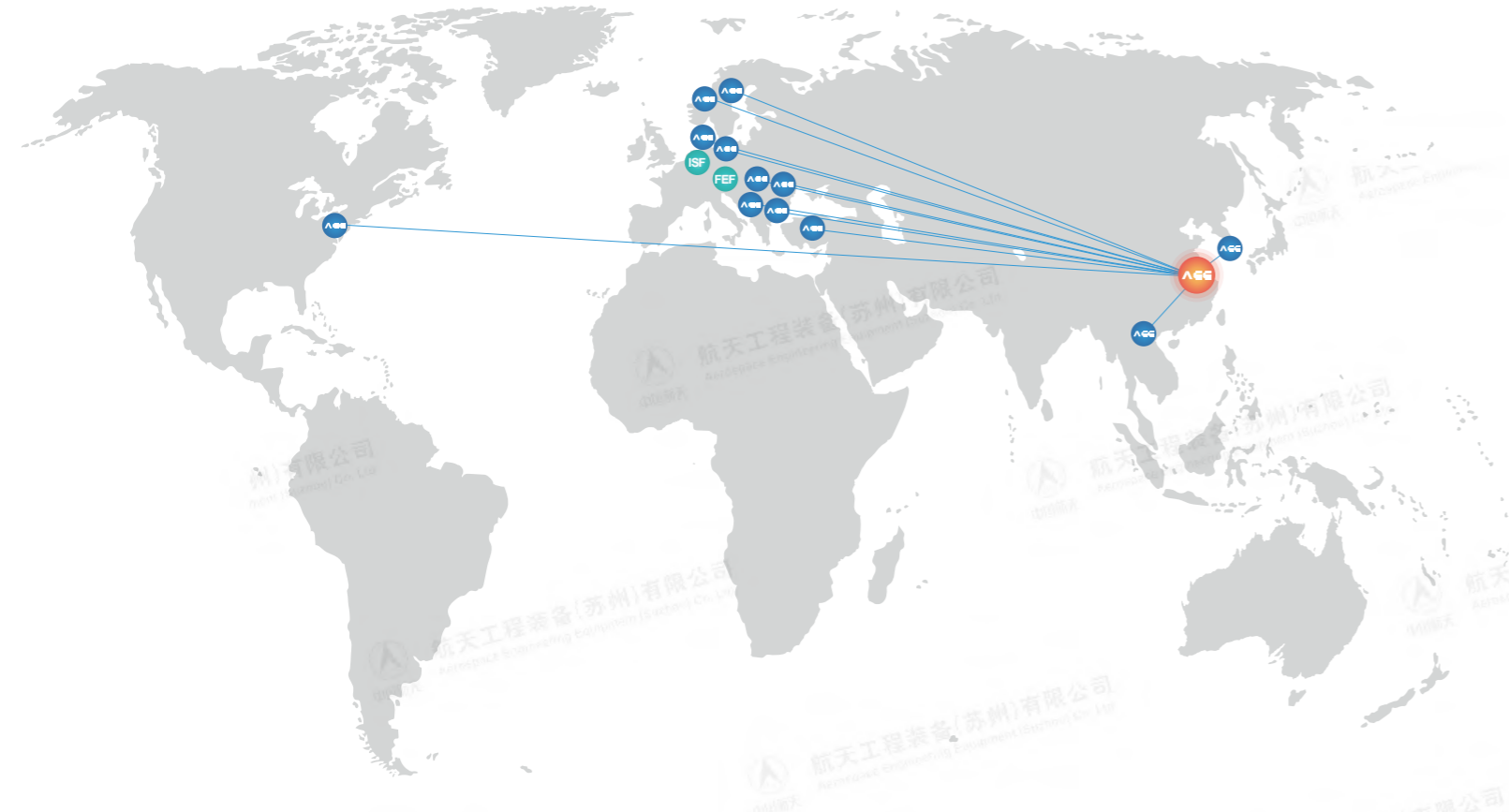




AEE ALUMINUM JOINING SOLUTION

FRICITION STIR WELDING

MACHINE CATALOG



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- 🇩🇪 FEF: Forschungs-und Entwicklungsgesellschaft Fügetechnik GmbH(Germany)



www.a-fsw.com

FRICTION STIR WELDING

MACHINE CATALOG

VALUE FOR
INNOVATIVE
JOINING
SOLUTION

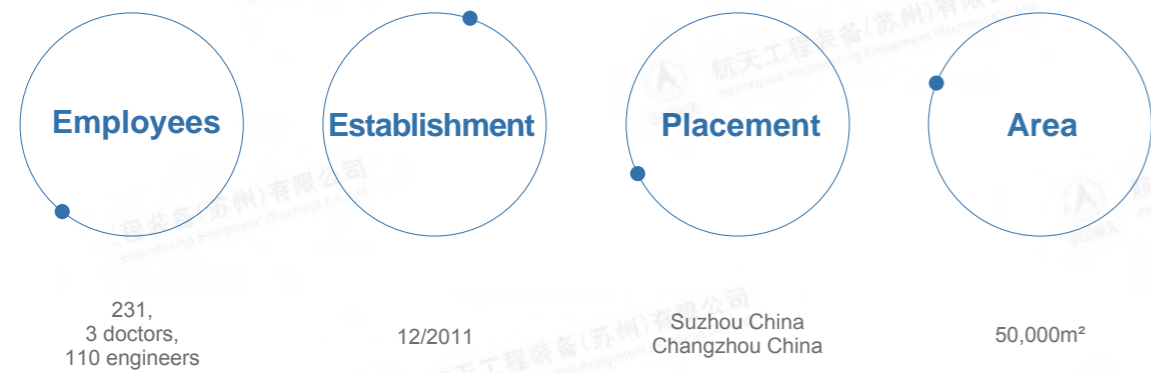


ABOUT AEE

Aerospace Engineering Equipment (Suzhou) Co., Ltd. ("AEE"), as one of the world's leading companies focused on FSW technologies, has developed not only FSW equipment and processes, but also the whole manufacturing solutions for lightweight components and structures.

AEE offers the customers a series of FSW machines to handle a wide variety of one, two and three-dimensional components, and also develops customized concepts to satisfy the individual demands. We invest continuously in research and development in order to provide comprehensive know-how extending from concept design, production processes right up to the automation solutions.

With the development in over 10 years, AEE has built up an excellent brand image in the automotive, railway, marine, aerospace and electronics industries. Following the philosophy of continuing innovation and customer focus, AEE is on its way to become a successful global player. Relying on our experiences and services, many customers from different countries and different industries have already developed long-term business relationships with AEE.



Suzhou Headquarter

1000m², the executive, sales and R&D center



Changzhou Plant

4000m², set parts, component assembly, final assembly, machine testing, turn-key solution

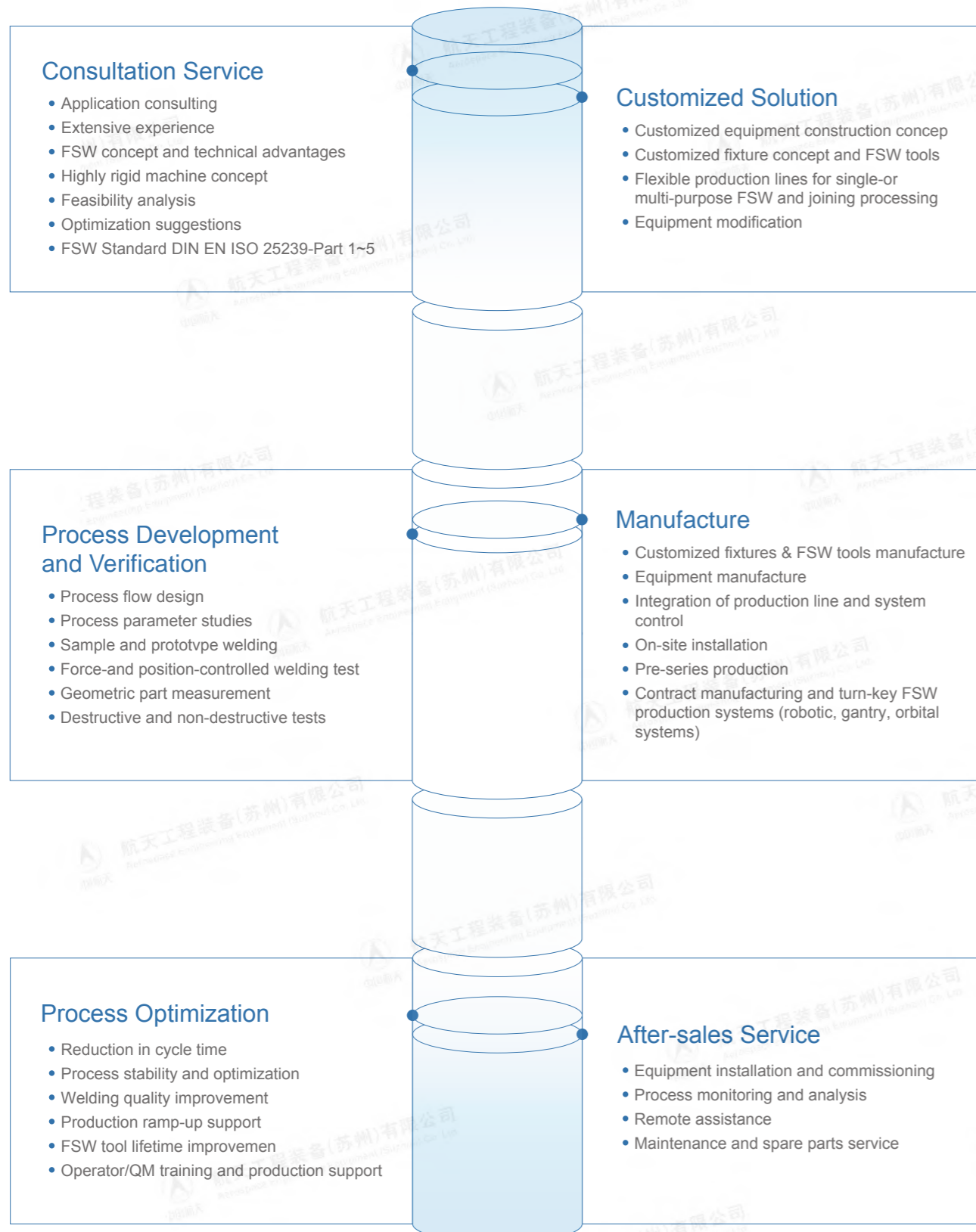


AEE Test Center Certified by CNAS



AEE has established an independent and professional test center which has been certified by CNAS, the total square is about 500m². It is equipped with standardized test site, advanced instruments and equipment, complete supporting facilities, perfect quality management system, occupational health and safety system, environmental system and laboratory management system, to provide customers with professional, standardized, safe, efficient and quality testing services. The test equipments include dimensional testing, macro & micro structure analysis of materials and welding structures, mechanical properties testing, Non-destructive testing such as X-ray testing, ultrasonic testing, Leakage and blasting testing, etc.

AEE Joining Solution



Friction Stir Welding

Friction stir welding (FSW) is a solid-state joining process developed at TWI Ltd in 1991. FSW is based on a solid-state joining process which uses frictional heat and mechanical deformation to create strong, high-quality bonds between materials. As the tool rotates and moves along the joint, it generates friction between the materials, causes them to soften without reaching their melting point. The softened materials are then mechanically stirred together, creating a solid-state weld which boasts excellent structural integrity and minimal distortion.

High Quality

- High joint strengths, good consistency
- Dense microstructure, no formation of hydrogen pores and hot cracking
- Low heat input and low distortion
- Low residual stress
- Excellent surface quality

Wide Applicability

- Applicable for various materials, such as Al, Mg, Cu, Ti, Zn, Pt, steel, plastic and metal-matrix composite
- Enables joining of different product forms
- Dissimilar joint

High Efficiency

- Simple process, fully automated
- No pretreatment requirement
- Welding speed up to 6,000 mm/min
- Welding thickness up to 100 mm

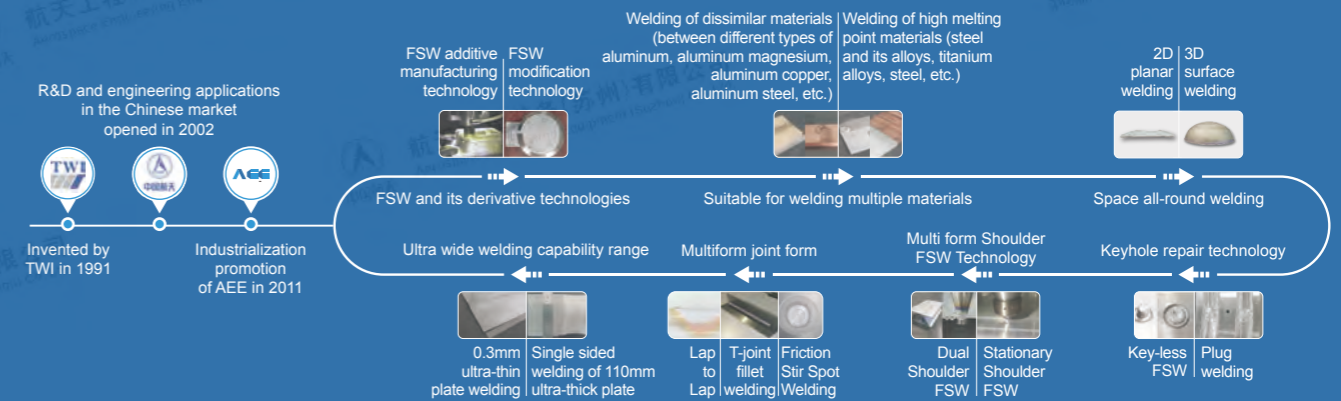
Automatic Control

- Position control
- Force control
- Torque control

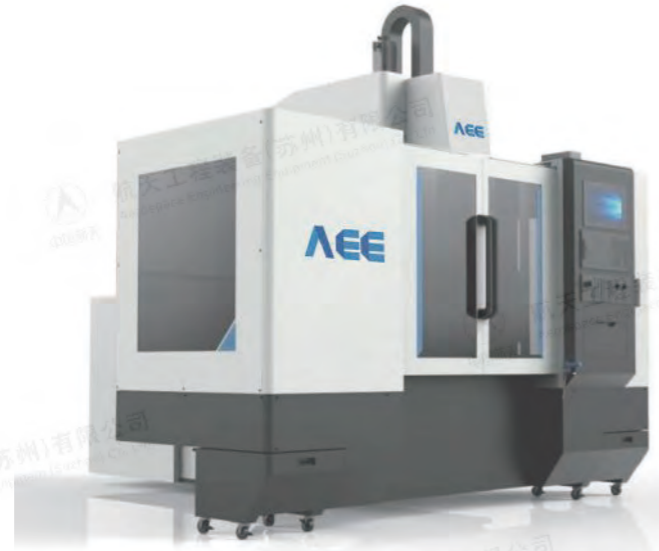
Environmentally Friendly

- Solid-state joining
- No shielding gases or filler wire requirement
- No filler material
- No fume, spatter, ultraviolet and electromagnetic radiation
- Low energy consumption and noiseless

Development and Evolution of FSW



C-type FSW Machine



Technical Data

Machine Type	AEE FSW 8 × 10/2	
Basic parameters	Working table(width × length) (mm)	600 × 1200
	Machine length × width × height (mm)	3050 × 2900 × 2700
	Machine weight (kg)	6000
	Compressed air request	0.6Mpa, 1m ³ /min, φ8
Welding parameters	Max. welding thickness (mm)	8
	Welding Dimension	2D
Traverse stroke	X-axis (mm)	1000
	Y-axis (mm)	600
	Z-axis (mm)	300
	C-axis (°)	N × 360
	B-axis (°)	5 (Manual)
Feed rate	X-axis (m/min)	10
	Y-axis (m/min)	10
	Z-axis (m/min)	3
Axis accuracy	Positioning X/Y/Z(mm)	0.03
	Repeatability X/Y/Z(mm)	0.03
Spindle parameters	Spindle Speed (rpm)	4000
	Spindle Torque (Nm)	112
	Spindle power(KW)	12
Force parameters	Max. force in Z-axis (kN)	30
	Max. force in X-axis (kN)	15

Features

- High-quality seams
- Parameter traceability system
- Full security guard
- Customized fixture
- Remote assistance
- Force control system

Application

- Research
- Electronics(Radiator, Water cooling plate)
- Automotive
- Communication
- 3C industrial

Dual Worktable C-type FSW Machine



Technical Data

Machine Type	AEE FSW 8 × 10/2S	
Basic parameters	Working table(width × length) (mm)	600 × 1000 × 2
	Machine length × width × height (mm)	4600 × 4200 × 2700
	Machine weight (kg)	10,000
	Compressed air request	Min.0.4, 1m ³ /min, φ8
Welding parameters	Max. welding thickness (mm)	8
	Welding Dimension	2D
Traverse stroke	X-axis (mm)	1000 × 2
	Y-axis (mm)	600
	Z-axis (mm)	300
	V1 (mm)	1200
	V2 (mm)	1200
	C-axis (°)	N × 360
	B-axis (°)	5 (Manual)
Feed rate	X-axis (m/min)	7
	Y-axis (m/min)	7
	Z-axis (m/min)	3
	C-axis (r/min)	20
Axis accuracy	Positioning X/Y/Z(mm)	0.05
	Repeatability X/Y/Z(mm)	0.03
Spindle parameters	Spindle Speed (rpm)	6000
	Spindle Torque (Nm)	65
	Spindle power(kW)	15
Force parameters	Max. force in Z-axis (kN)	30
	Max. force in X-axis (kN)	15

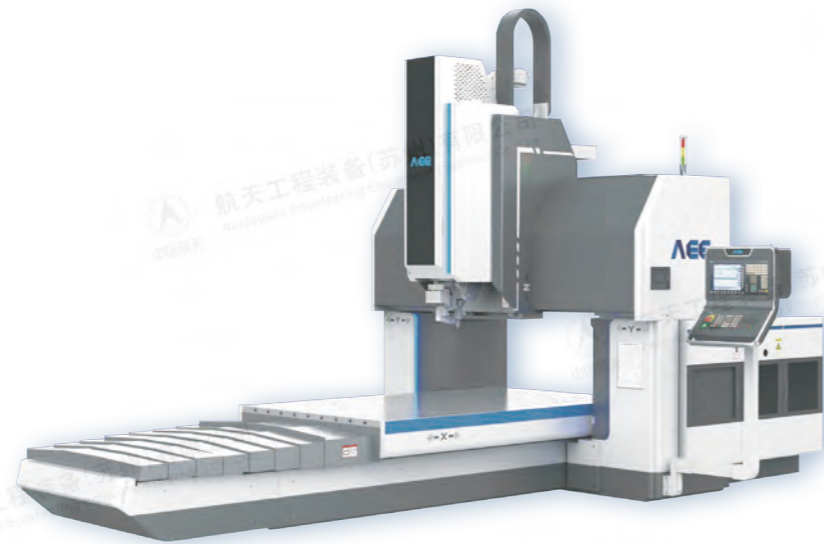
Features

- High-quality seams
- Parameter traceability system
- Full security guard
- Customized fixture
- Remote assistance
- Force control system

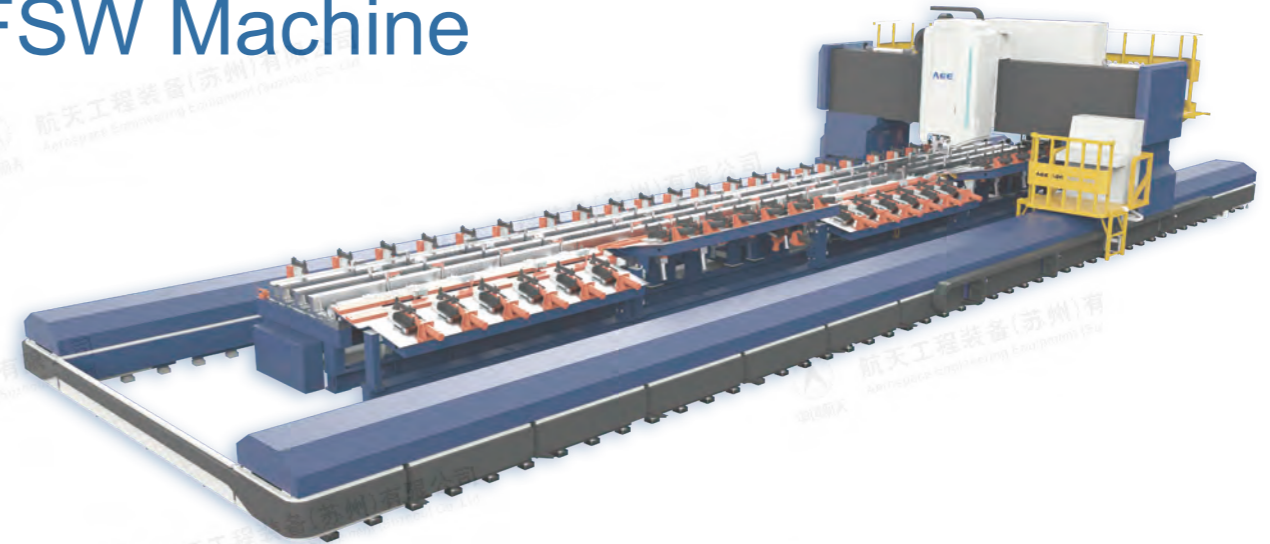
Application

- Research
- Electronics(Radiator, Water cooling plate)
- Automotive
- Communication
- 3C industrial

Gantry FSW Machine



Extra-length Straight Profile FSW Machine



Technical Data

Machine Type	AEE FSW 16 × 8/1	AEE FSW 25 × 40/1	AEE FSW 8 × 25/2	AEE FSW 8 × 30/2	
Basic parameters	Working table(width × length) (mm)	800 × 1000	2500 × 4000	1800 × 2500	2000 × 3000
	Machine length×width×height (mm)	2500 × 2000 × 2700	10000 × 7000 × 3200	7000 × 5000 × 2900	9000 × 6000 × 3000
	Machine weight(kg)	10000	30000	14000	18000
	Compressed air request	0.6Mpa, 1m³/min, φ8	0.6Mpa, 1m³/min, φ8	0.6Mpa, 1m³/min, φ8	0.6Mpa, 1m³/min, φ8
Welding parameters	Max. welding thickness(mm)	16	25	8	8
	Welding Dimension	1D	1D	2D	2D
Traverse stroke	X-axis (mm)	800	4000	2500	3000
	Y-axis (mm)	600	2500	1700	2000
	Z-axis (mm)	500	500	500	500
	C-axis (°)	/	/	N × 360	N × 360
	B-axis (°)(Manual)	5 (Manual)	5 (Manual)	5 (Manual)	5 (Manual)
Feed rate	X-axis (m/min)	3	5	10	10
	Y-axis (m/min)	3	5	10	10
	Z-axis (m/min)	2	2	4	4
	C-axis (r/min)	/	/	10	10
Axis accuracy	Positioning X/Y/Z(mm)	0.03	0.05	0.05	0.05
	Repeatability X/Y/Z(mm)	0.02	0.03	0.03	0.03
Spindle parameters	Spindle Speed (rpm)	2500	2000	4000	4000
	Spindle Torque (Nm)	160	257	112	112
	Spindle power(kW)	17	31	12	12
Force parameters	Max. force in Z-axis (kN)	50	60	30	30
	Max. force in X-axis (kN)	30	40	20	20

Technical Data

Machine Type	AEE FSW 8 × 160/1	
Basic parameters	Working table(width × length) (mm)	6600 × 1200
	Machine length × width × height (mm)	20000 × 7000 × 3100
	Machine weight(kg)	75000
	Compressed air request	0.6Mpa, 1m³/min, φ8
Welding parameters	Max. welding thickness(mm)	8
	Welding Dimension	2D
Traverse stroke	X-axis stroke(mm)	16000
	Y-axis stroke(mm)	4000
	Z-axis stroke(mm)	500
	C-axis stroke(°)	N × 360
	B-axis stroke(°)(Manual)	5
Feed rate	X-axis (m/min)	10
	Y-axis (m/min)	10
	Z-axis (m/min)	3
	Positioning X/Y/Z(mm)	0.03
Axis accuracy	Repeatability X/Y/Z(mm)	0.03
	Spindle Speed (rpm)	4000
Spindle parameters	Spindle Torque (Nm)	112
	Spindle power(kW)	12
	Max. force in Z-axis (kN)	30
Force parameters	Max. force in X-axis (kN)	15

Features

- High-quality seams
- Parameter traceability system
- Full security guard
- Customized fixture
- Remote assistance
- Force control system

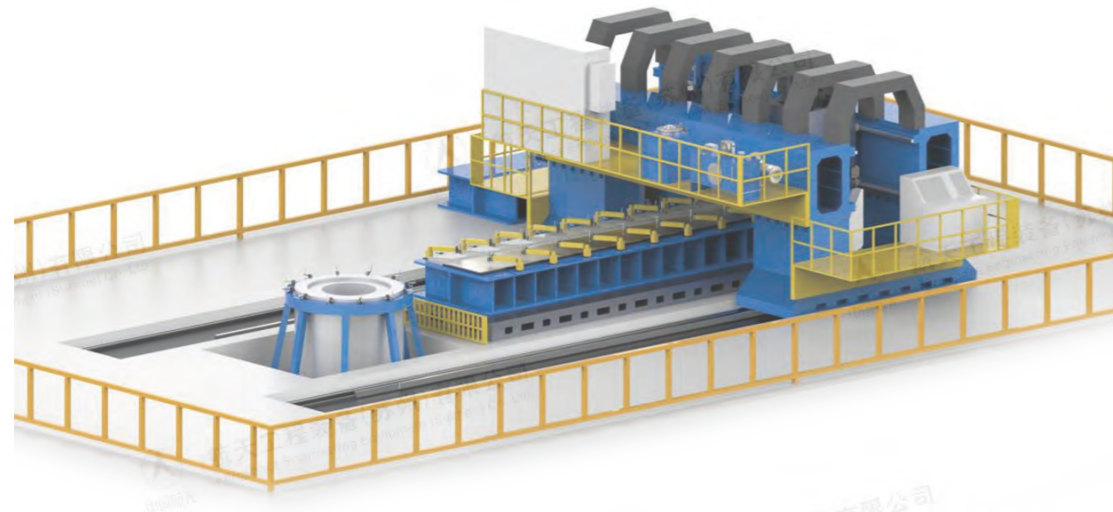
Application

- Automotive(Battery tray)
- Communication
- Electronics
- Rail transit
- 3C industrial
- Semi-conductor
- Energy storage
- Photovoltaic - PV

Features

- Stable structure and excellent rigidity
- A axis automatic deflection function is added to the machine, which can realize 1D linear welding in any spatial position, covering the whole series of rail transit car body structural parts welding
- The machine is equipped with large torque spindle, good rigidity machine bed, and extensible functions like constant pressure control, automatic laser weld tracking, starting point automatic tool-setting, welding parameters acquisition and extracting

Heavy Load FSW Machine



Technical Data

Machine Type	AEE FSW 100 x 100/2	
Basic parameters	Working table(width × length) (mm)	3000×8000
	Machine length × width × height	25000×8000×3500
	Machine weight(kg)	120000
	Compressed air request	0.6Mpa, 1m³/min, φ8
Welding parameters	Max. welding thickness(mm)	100
	Welding Dimension	2D
Traverse stroke	X-axis (mm)	10000
	Y-axis (mm)	4200
	Z-axis (mm)	500
	C-axis (°)	360
	B-axis (°)	5 (Manual)
Feed rate	X-axis (m/min)	10
	Y-axis (m/min)	3
	Z-axis (m/min)	1
	C-axis (r/min)	5
Axis accuracy	Positioning X/Y/Z(mm)	0.05mm
	Repeatability X/Y/Z(mm)	0.03mm
Spindle parameters	Spindle Speed (rpm)	1000
	Spindle Torque (Nm)	872
	Spindle power(kW)	105
Force parameters	Max. force in Z-axis (kN)	200
	Max. force in X-axis (kN)	100

Highlights

- Welding depth up to 100mm (single-side) 190 mm (double-side) (6xxx) High-quality seams
- Dual heads welding
- Passable height 644~1,144 mm
- Passable width 4,500 mm
- Customized fixture
- Remote assistance

Features

- Double gantry structure, heavy-load head, high load capacity
- Rigid structure, high precision and stable process
- High-quality spindle with hydraulic cooling system
- Force control/position control/Integrated data acquisition, laser tracking and weld monitoring systems
- Safety guarding system

Application

- Rail transit
- Aerospace
- Ship building
- Semi-conductor
- Photovoltaic-PV

3D FSW Machine



Technical Data

Machine Type		AEE FSW 12 × 40/3	AEE FSW 20 × 80/3
Basic parameters	Working table(width × length) (mm)	3000 × 4000	4200 × 8000
	Machine length × width × height (mm)	10000 × 7000 × 4500	20000 × 9000 × 4500
	Machine weight(kg)	35000	55000
	Compressed air request	0.6Mpa, 1m³/min, φ8	0.6Mpa, 1m³/min, φ8
Welding parameters	Max. welding thickness(mm)	12	20
	Welding Dimension	3D	3D
Traverse stroke	X-axis stroke(mm)	4000	8000
	Y-axis stroke(mm)	3000	4500
	Z-axis stroke(mm)	1500	1500
	A-axis stroke(°)	±100	±100
	C-axis stroke(°)(Manual)	±360	±360
	Feed rate	X-axis (m/min)	6
Y-axis (m/min)	6	6	
Z-axis (m/min)	2	1	
A-axis (r/min)	2	2	
C-axis (r/min)	2	2	
Axis accuracy	Positioning X/Y/Z(mm)	0.05	0.05
	Repeatability X/Y/Z(mm)	0.03	0.03
Spindle parameters	Spindle Speed (rpm)	3000	1500
	Spindle Torque (Nm)	200	300
	Spindle power(kW)	20.9	28
Force parameters	Max. force in Z-axis (kN)	40KN	60KN
	Max. force in X-axis (kN)	20KN	30KN

Features

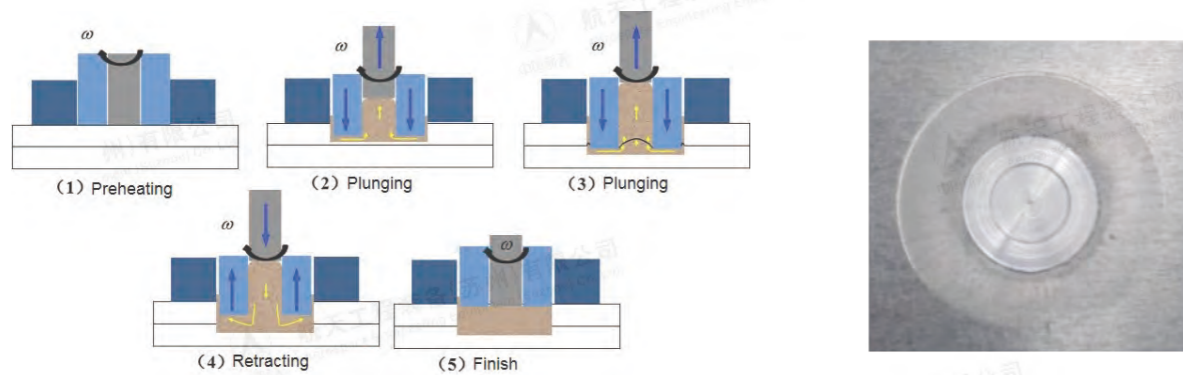
- The machine can realize 3D spatial curved welding with thickness of 2-20mm
- The machine adopts high rigidity AC swing-head with big bearing capacity, which can meet the requirement of the large forward resistance and upset force during welding process
- A&C-axes lead rail adopts self-adaption molding technology, which can improve the rotation accuracy of A-axis and C-axis

Application

- Automotive
- Communication
- Electronics

FSSW Machine

Friction stir spot welding adopts a specially designed welding tool, which is composed of a stir pin, a stir sleeve, and a clamping sleeve. Through multiple extrusion and forging processes of welding tools, a keyhole-free FSSW is achieved.



The Advantages of FSSW Technology

Compared to Resistance Spot Welding

- Economically achieving spot connections of 3 mm or more
- Connecting dissimilar materials
- Connecting multi-layer foils
- Good appearance of welding spots with stable internal quality
- Achieving shear strength increased by more than 30%
- Less equipment investment with a reduction in energy consumption by over 90%
- Easy inspection of welding spot quality

Compared to Riveting

- Higher fatigue strength
- No increase in weight
- Aesthetically pleasing appearance of welding spots
- Very low noise levels
- Elimination of the need for additional rivets, resulting in cost reduction



Features

- The welding spot surface is smooth and aesthetically pleasing
- The load-bearing area of the weld nugget is larger
- The bonding strength is higher
- The process is relatively simple



Double-head FSW Machine



Highlights

- Double-head welding on both sides
- Customized fixture
- Force control/position control
- Welding parameters traceability system
- FSW tool inspection and management
- Laser tracking
- Remote diagnosis

Features

- Double-sided welding thickness up to 8mm
- Welding speed can be up to 2.5m/min
- Maximum spindle speed up to 6000rpm
- Double dynamic gantry structure, double-head for welding
- High-quality spindle with hydraulic cooling system
- Loading & unloading automatically

Application

- Battery tray



Automatic FSW Production Line for Aluminum Alloy Wheel

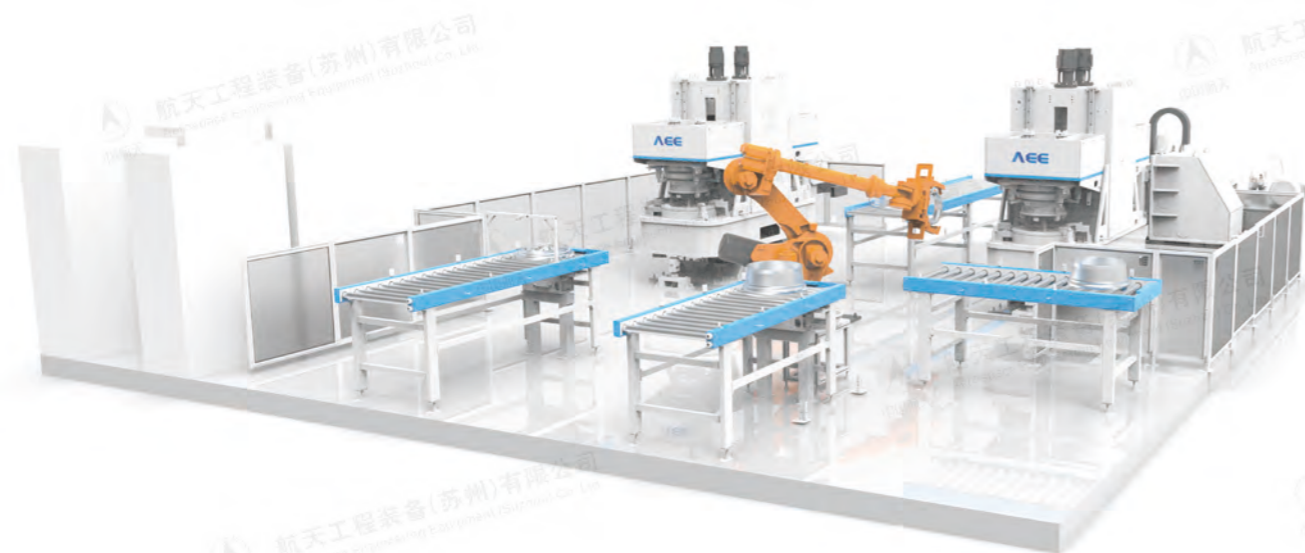


Highlights

- Welding depth 1.2~10 mm for wheels diameter 17~22 inch
- Welding speed up to 2500 mm/min and rotating speed up to 6000 rpm
- Cycle time 45 JPH
- Retractable FSW tool without keyhole
- Traceability

Application

- Fully automatic process including loading, clamping, FSW, and unloading
- With laser tracking, constant pressure control, welding start point positioning, welding quality judgment and other functions



Fully Automatic double-head FSW Production Line



Highlights

- Welding depth 1.2~16 mm
- Max. length up to 18,000 mm
- Max. width up to 3,500 mm
- Simultaneous welding with double sided head
- Water cooling FSW tool

Features

- Fully automatic process including loading, clamping, seam pre-inspection, FSW, unloading, cutting etc
- With laser tracking, force control and other functions

Product Applications

Battery Tray



Motor Shell



Electric Control Box & Water Cooling Plate



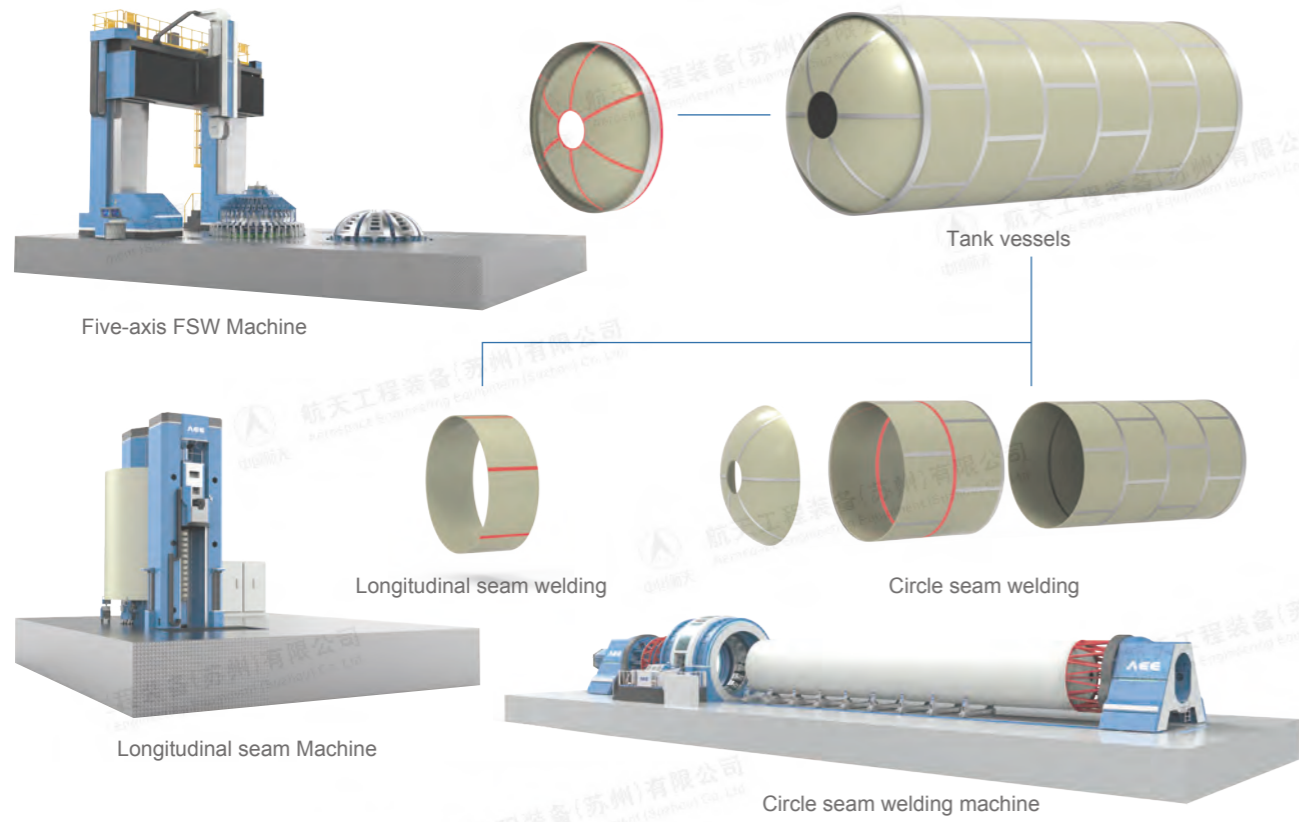
Wheel Hub



Copper Welding



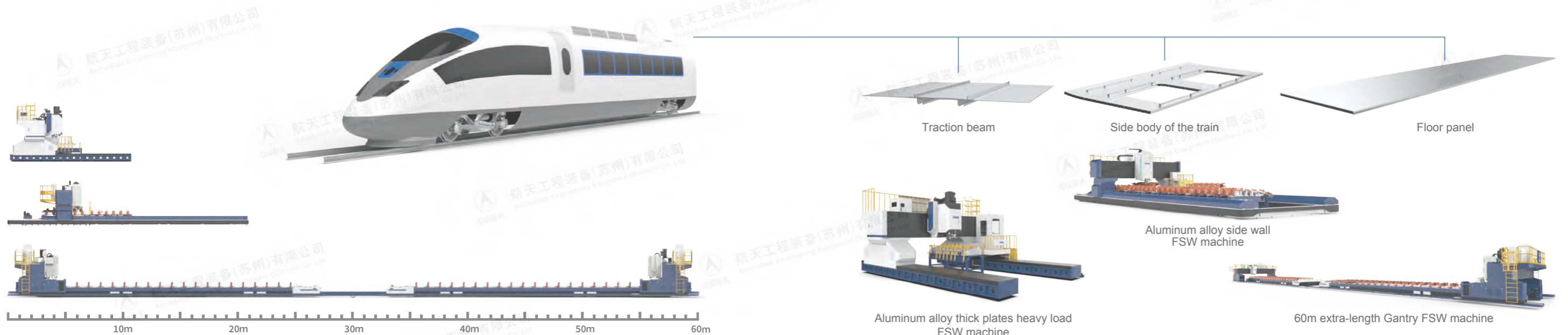
Application —— Tank Vessels



Application —— EV Components



Application —— Rail Transit



Friction Stir Welding Series Spindle

Model	AEE-S125	AEE-S119	AEE-S112	AEE-S065	AEE-S076	AEE-S064	AEE-SE12	AEE-SE20
Welding Thickness (mm)	1-8	2-12	2-16	2-25	2-40	2-100	2-12	2-20
Max.Rotation Speed (rpm)	4000	4000	2500	2000	1500	1000	3000	1500
Power(kw)	12	25	25	31	58	105	20.9	28
Lubrication Type	Grease Lubrication	Grease Lubrication	Grease Lubrication	Grease Lubrication	Grease Lubrication	Grease Lubrication	Grease Lubrication	Grease Lubrication
Tool Holder Spec	BT40	BT40	BT50	BT50	BT50	BT60	FLANGE	FLANGE
Troque(Nm)	112	208	208	257	482	874	200	300
Max. force(kN)	30	40	50	60	80	200	40	60

AEE can also provide Customized spindle design and manufacturing for Customer, below are included but not limited to:

- Auto tool changing
- Oil/water cooling for spindle and FSW tool
- Retraction FSW process(No-key hole)
- Heavy load FSW process



Conventional Spindle Series



AC Spindle Series



Electric Spindle Series

Friction Stir Welding Tools

As a new-style solid phase connection method,the appearance of Friction stir welding technology makes the connection of aluminum alloy obtain transformation progress,friction stir welding can weld nearly all aluminum alloy(included connection of 2000,7000,8000 and dissimilar alloy),with many advantages of good welding quality,high strength joint and small deformation.

Pin tool is one of the core technologies for friction stir welding,it's honored to be the "heart"of friction stir welding,and pin tool is also the special consumable of friction stir welding.According to different aluminum alloy, developed kinds of standard pin tools to meet different thickness and different structure type for aluminum alloy friction stir welding.



Material	Thickness/(mm)	Type Of Pin Tool
All Series Aluminum Alloy	2-3	Conventional Pin Tool
	3-10	Retraction Pin Tool
	10-25	Bobbin Tool
	25-50	Static Shoulder Pin Tool
	50-100	FSSW Pin Tool
Copper, Magnesium, Titanium, and Dissimilar material Combination	Depends on the material combination	Conventional Pin Tool