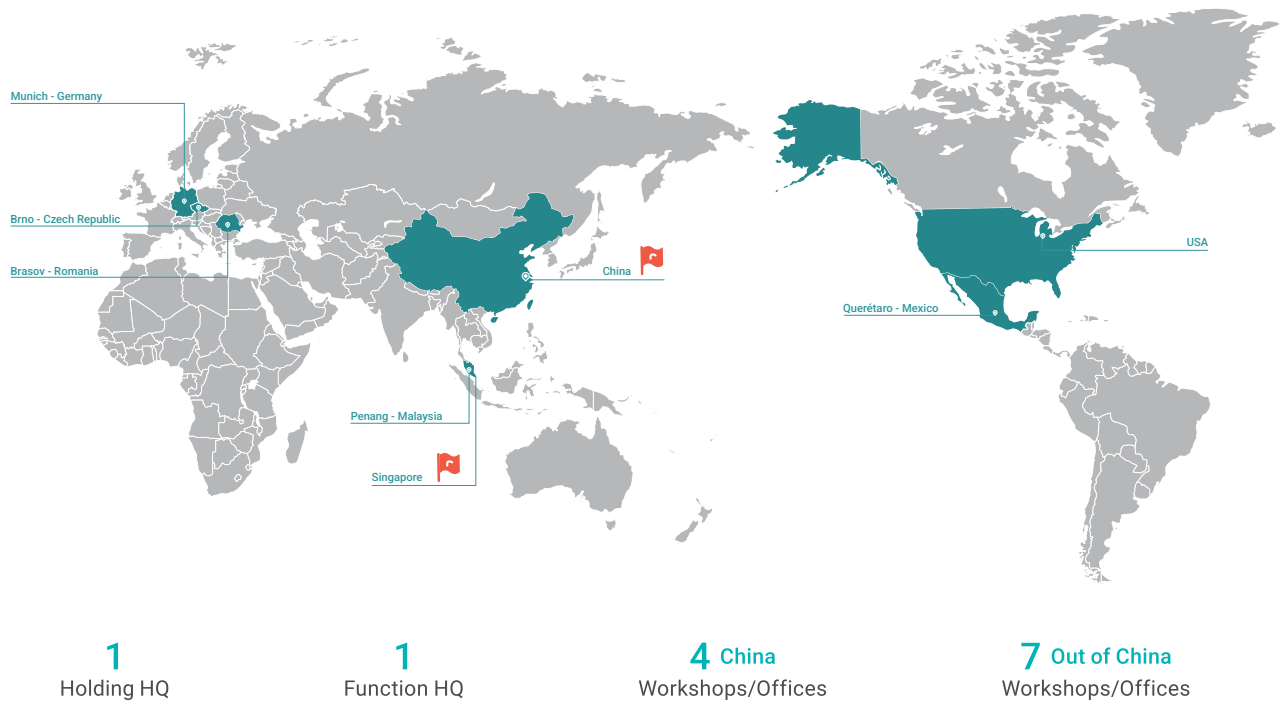
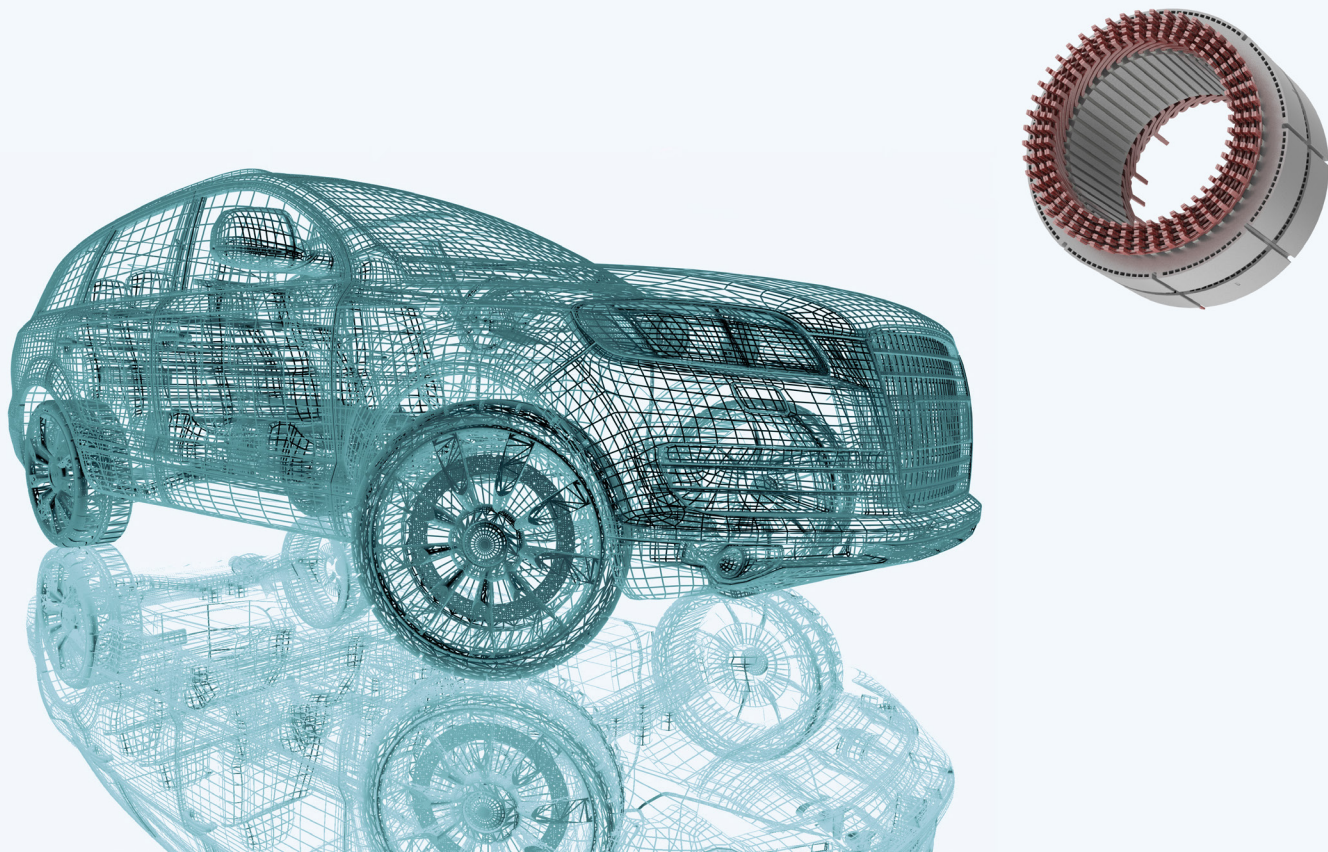


Global Layout



Bar-Wound Stator
Smart Manufacturing Solution Provider





COMPANY PROFILE

Ruhlamat Group is a globally leading one-stop smart manufacturing solutions provider. Comprising Ruhlamat Automation Technology (Suzhou) Co., Ltd. and its global subsidiaries and affiliates across Asia-Pacific, Europe, and North America, the Group delivers turnkey automation and digital solutions to manufacturing clients worldwide.

Founded in Germany, Ruhlamat established its China headquarters in Suzhou in 1998. After over two decades of industry dedication, it has evolved into a global group with eight production bases in Romania, Malaysia, the Czech Republic, Germany, Mexico, the United States (planned), and China, along with three sales and service centers.

Ruhlamat Group's business scope encompasses automation solutions, digital solutions, and standard products (servo presses, conveyor systems, and industrial aluminum profiles). Integrating process R&D, design, assembly, testing,

sales, and service into a comprehensive workflow, we deliver end-to-end services to clients across traditional automotive components, new energy vehicle parts, hydrogen energy, medical devices, consumer electronics and home appliances, and other industrial sectors. Our reach spans over 20 countries and regions across Europe, the Americas, and Asia-Pacific.

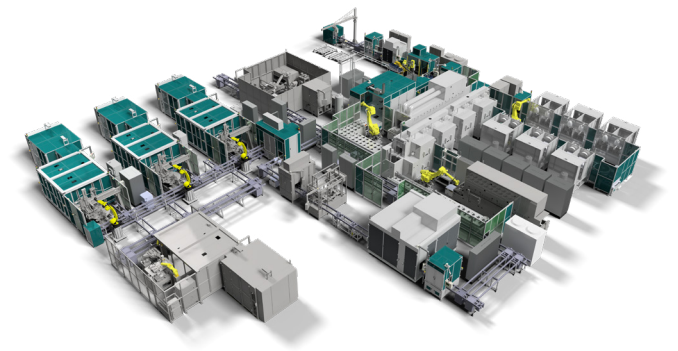
Leveraging the excellence of German engineering and the efficiency of Chinese manufacturing, Ruhlamat Group has earned high recognition from numerous globally renowned automotive parts and medical industry clients. Through continuous technological innovation, exceptional operational philosophy, comprehensive global footprint, and efficient business synergy, the Group will deliver high-quality services to global customers, drive industry advancement, and jointly create a better future through intelligent manufacturing.

BUSINESS SCOPE

To provide bar-wound stator manufacturers worldwide with smart production line and services, with OEM services in the second phase

Bar-Wound Stator Automation Line

- Flexible automation solutions
- Converged digital solutions



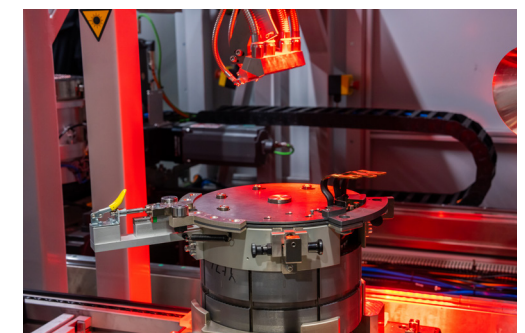
Bar-Wound Stator Sample Production

- Trial production
- Compatible with stators of multiple diameters (120-280mm)
- Compatible with bar-wound of multiple layers



Bar-Wound Stator R&D and Service Support

- Provide manufacturability analysis and collaborative R&D services for new products
- Lean improvement enables rapid production ramp-up
- Personnel training, production support, and skill enhancement



Extensive experience - Stator specifications

Voltage	48 V	48 V	400 V	400 V	400 V	400 V	400 V	800 V
Cooling type	Air cooling	Air cooling	Liquid cooling	Liquid cooling	Oil cooing	Liquid cooling	Oil cooing	Oil cooing
Pin layers	2	4	4	6	6	8	8	8
Stator slots	72	48	48	54	48	48	48	48
Dimension of copper wire	6.445×1.745 mm	2.2×3.2 mm	4.15×3 mm	2.3×5.2 mm	4.31×2.69 mm	3.82×1.77 mm	3.4×1.7 mm	4×1.76 mm
Quantity of PIN types	6	5	9	5	4	11	16	13
Diameter of lamination stack	144 mm	140 mm	208 mm	230 mm	220 mm	220 mm	226 mm	230 mm
Height of lamination stack	65 mm	100 mm	120 mm	120 mm	98 mm	120 mm	113 mm	111 mm



Bar-Wound Stator Mass Production Line Gen1 (CT:75s)

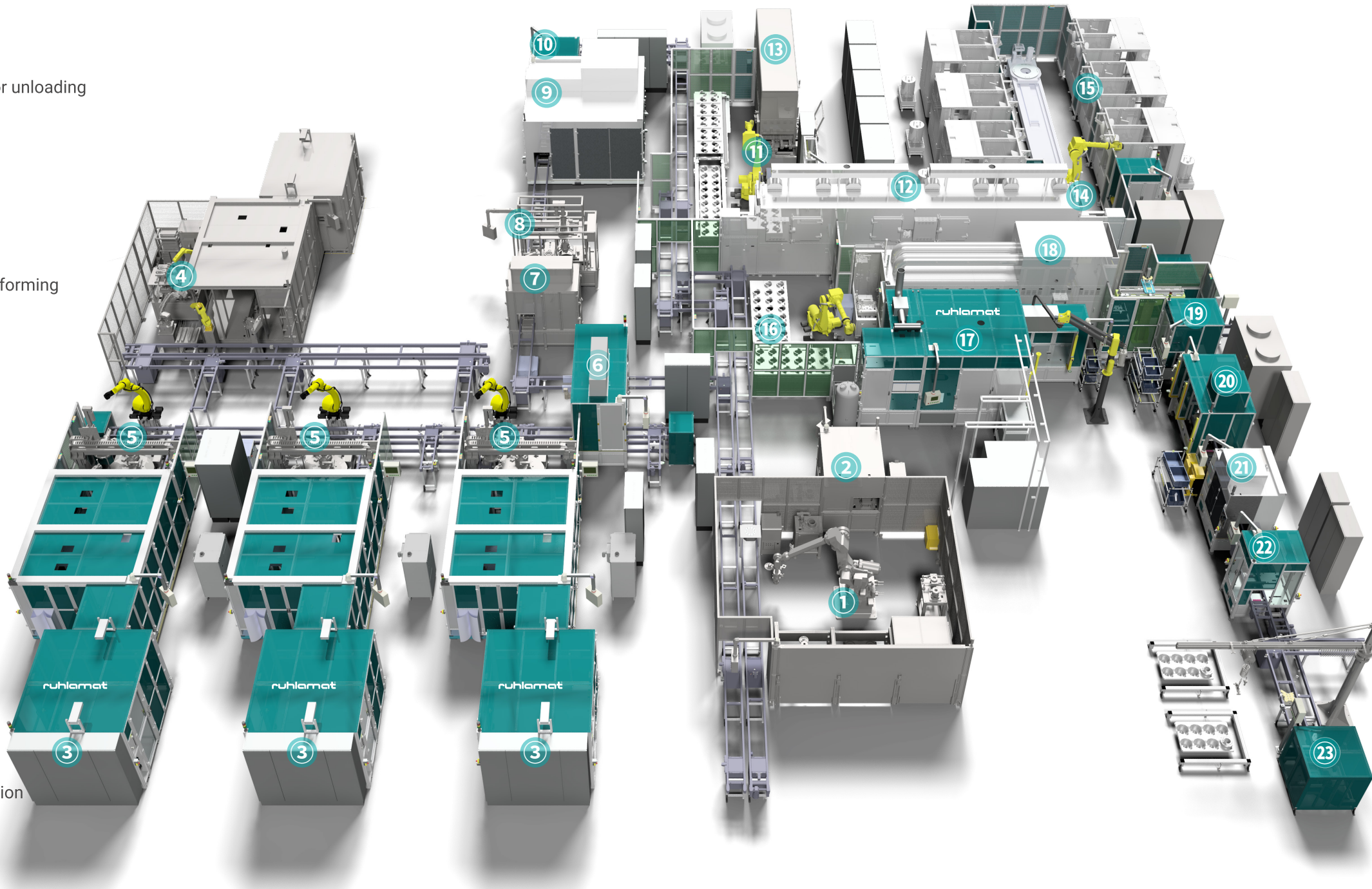
CT 75s

OEE≥85%

98%
First-pass yield

90-180mm
Lamination stack

- ① Lamination loading & stator unloading
- ② Insulation paper insertion
- ③ Common U-pin forming
- ④ Cross-layer U-pin and I-pin forming
- ⑤ Basket insertion
- ⑥ Pin insertion
- ⑦ Expanding
- ⑧ Twisting
- ⑨ Pin cutting and laser welding
- ⑩ AOI test
- ⑪ Robot-1 & Lamination surface cleanliness inspection



- ⑫ Preheating and curing oven
- ⑬ Cooling machine
- ⑭ Robot-2
- ⑮ Trickling by electric heating and gelling
- ⑯ Buffer after trickling
- ⑰ Housing assembly
- ⑱ Cooling oven
- ⑲ Leakage test
- ⑳ Busbar assembly
- ㉑ Busbar welding
- ㉒ EOL test
- ㉓ Unloading

Bar-Wound Stator Mass Production Line Gen1 (CT:120s)

CT 120s

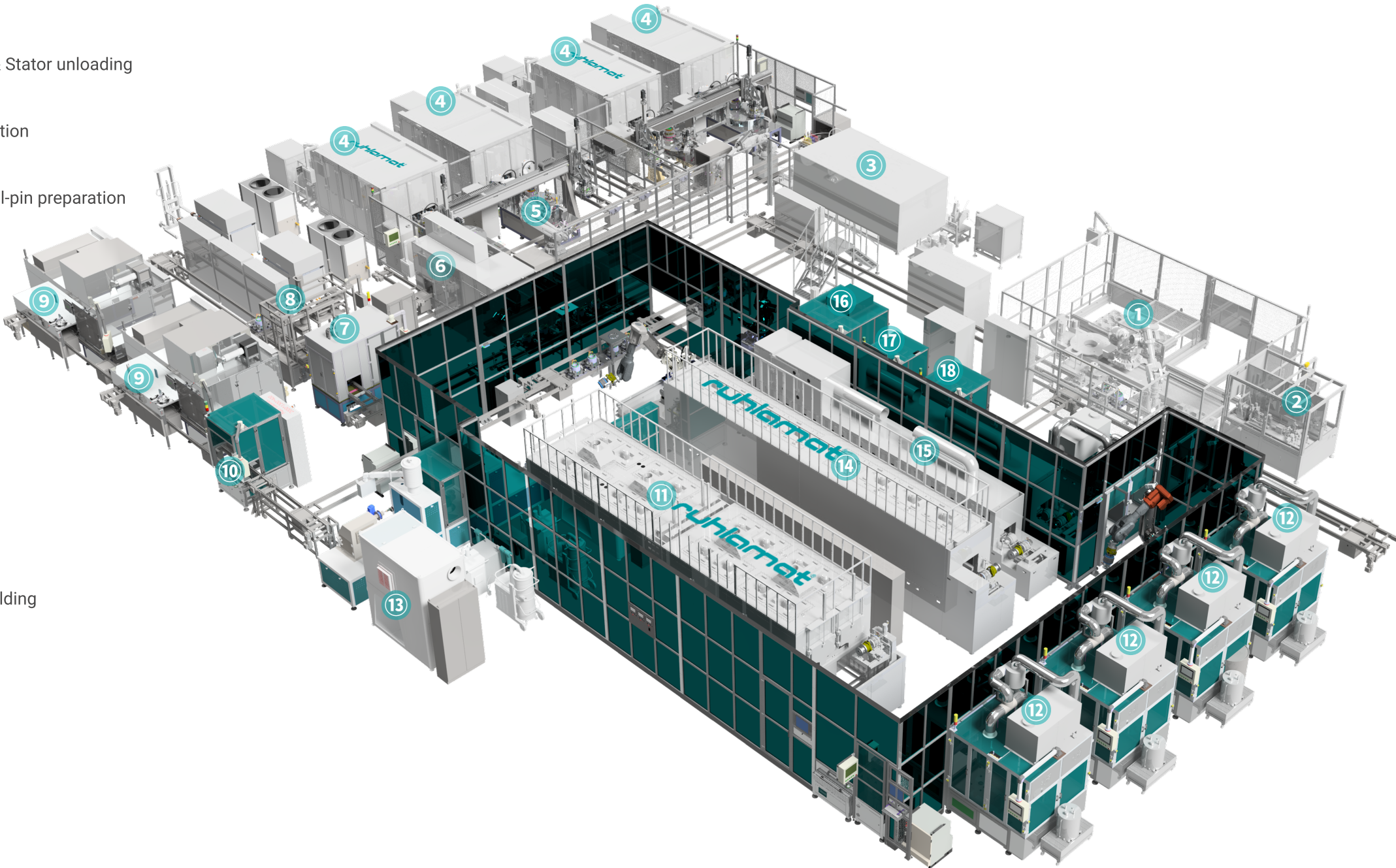
OEE≥85%

98%
First-pass yield

90-180mm
Lamination stack

- ① Lamination Loading & Stator unloading
- ② Insulation paper insertion
- ③ Cross-layer U-pin and I-pin preparation
- ④ Pin forming
- ⑤ Basket insertion
- ⑥ Pin insertion
- ⑦ Expanding
- ⑧ Twisting
- ⑨ Pin cutting & laser welding

- ⑩ AOI test
- ⑪ Stator preheating & Glue curing & Coating preheating oven
- ⑫ Trickling by electric heating and gelling
- ⑬ Coating
- ⑭ Coating curing oven
- ⑮ Cooling oven
- ⑯ Typhoon cleaning
- ⑰ NTC assembly and EOL test
- ⑱ Final Inspection



Bar-Wound Stator Mass Production Line Gen2 - High Flexibility

- Bar-wound stator mass production line Gen2 features high flexibility, with modular design. High-speed automatic changeover can be realized in 50% of the stations, with that for whole line less than 45 minutes.
- The process stations for pin forming, stripping, automatic basket insertion, automatic PIN insertion and welding are upgraded and iterated, thus achieving a significant increase in the OEE and automation rate of the whole line.
- The innovative pin forming station can meet the production of all types of pins in one stator.
- Compatible for Hair-pin & X-pin.

① Loading lamination

② Insulation paper insertion

③ Pin forming

④ Basket insertion

⑤ Pin final insertion

⑥ Expanding

⑦ Twisting

⑧ Cutting

⑨ Laser welding

⑩ Inspection and cleaning

⑪ AOI Test and measurement of welding height

⑫ Flipping/Installing busbar welding fixtures/Crown side forming

⑬ EOL Test

⑭ Typhoon 1 and HV Test

⑮ Heating oven & Trickling

⑯ Curing

⑰ Typhoon2

⑱ GP12

⑲ Final Inspection



CT 90s



High Compatibility
4/6/8 layers, 48/54/72 slots



40%
Area saved



50-270mm
Lamination Stack



OEE **89%**



90%
Automation rate



High Flexibility
A single machine can meet the production of all types of pins in one stator



2-3%
Copper wire saved



98%
First-pass Yield



120-280mm
Lamination Diameter



Automatic Changeover
by Software

Bar-Wound Stator Automated Mass Production Line Gen3 - High Compatibility

- The production line consists of 92 process stations, achieving an automation rate of 95%.
- The welding process utilizes fully automatic clamping, achieving a first-pass yield of up to 99%.
- Designed to prevent a single device failure from leading to a complete line shutdown.
- The production line is designed with quick-change interfaces, providing multiple options for future modifications and enabling flexible production.

① I-pin forming

② Inner I-pin welding

③ U-pin forming

④ Auto-basket setting

⑤ Loading lamination stack

⑥ Insulation paper inserting

⑦ Paper winding

⑧ Basket insertion

⑨ Pin extension

⑩ Twisting

⑪ Welding fixture assembly

⑫ Pin cutting

⑬ Laser welding hair pin

⑭ Welding fixture disassembly

⑮ AOI test

⑯ Trickling

⑰ Paint curing

⑱ Pre-heating for coating

⑲ Coating

⑳ Curing after coating

㉑ Cooling

㉒ Busbar welding

㉓ EOL testing

㉔ Laser marking & Typhoon cleaning

㉕ Final inspection

㉖ Oil spray



CT 31.5s



1,940 m²
Land area (Including curing & coating)



99%
High first-pass yield



OEE **85%**



8%
Equipment material cost savings



95%
Automation rate



€ 229,500
Copper wire cost savings
Calculated based on a 5-year life cycle with the production capacity of 200,000 units/year



35 minutes
Changeover time

Standard Station

High-Flexibility Pin Forming Station



Specifications & Features

- CT: 1.25-1.5s/pin
- Wire feeding length error $\pm 0.1\text{mm}$
- The software-empowered changeover enables all types of pins in one stator to be produced by a single machine
- Modular design, with mould/milling/laser peeling optional to the customer
- Integrating straightening, insulation stripping, 2D/3D forming, pre-insertion and other processes into one station. Our modular solution can be flexibly configured according to customer's capacity requirements, enabling agile production while providing interfaces for future capacity expansion
- Non-destructive cut-off chamfering
- Automatic insulation testing of the pin on line (optional)

Standard Station

Insulation Paper Insertion Station

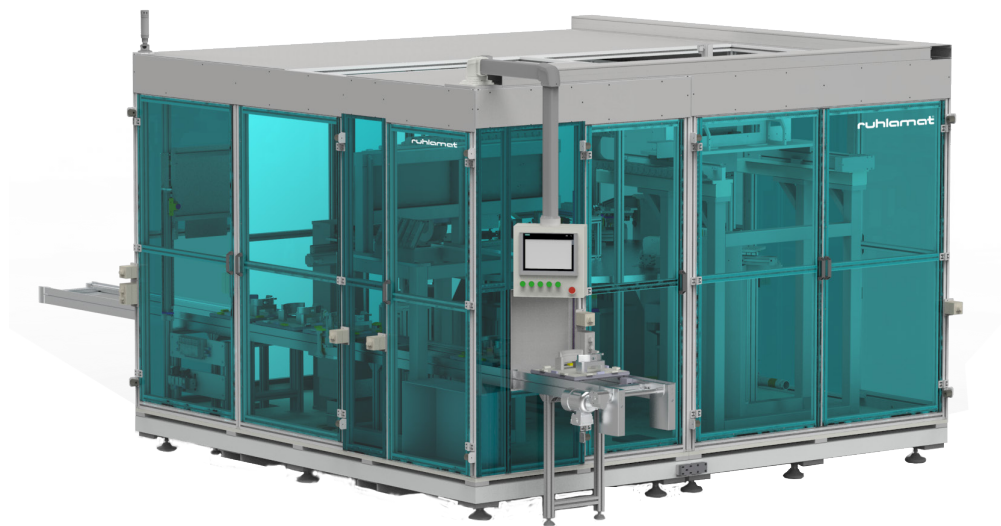


Specifications & Features

- CT $\leq 60\text{s/pcs}$ (48 slots)
- Forming size accuracy: $\pm 0.15\text{mm}$
- Paper insertion length varies from the core thickness, with the accuracy: $\pm 0.15\text{mm}$
- Forming heating function with the temperature control $\pm 3\text{ }^{\circ}\text{C}$
- Automatic unwinding and tension control
- Insertion of anti-warping
- Paper scrap cleaning
- Paper jam alarm

Standard Station

Basket Insertion Station



Specifications & Features

- CT $\leq$ 1.5s/pin
- Pin type anti-error
- Pin anti-deformation
- Compatible with multiple winding designs
- Combing pins to prevent the disorder of layers or feet of pins
- Flexible design of basket tooling, enabling efficient changeover

Standard Station

Expanding Station

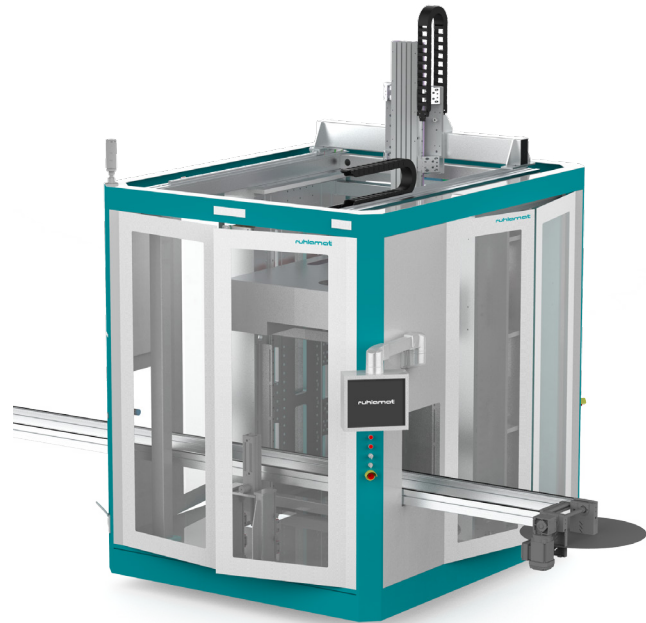


Specifications & Features

- CT $\leq$ 3.5s/pin/gripper
- Z-direction compensation when expansion
- Pin position correction
- Pin position testing after correction
- Coating destruction free for bar-wound stator
- Flexible design, compatible with different diameters and grooves of the stator, and the number of clamping jaws can be increased/ decreased up to 18 groups at most

Standard Station

Twisting Station

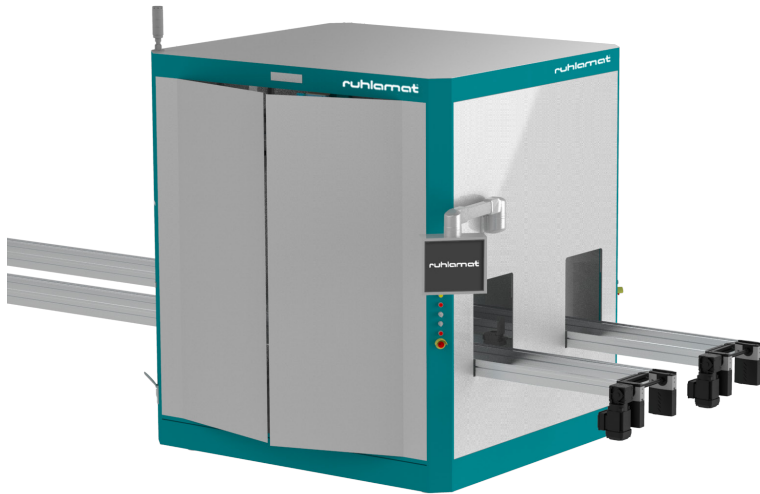


Specifications & Features

- CT $\leq$ 1.5s/pin
- Torque monitoring
- Moulding force monitoring to ensure that the product is not damaged
- The angle of rotation of each layer is controlled by an independent servo
- Each layer of the twisted head mould can be made independent of the Z compensation to ensure that the height of the welded end of the twisted head, no need to cut the head, which can save copper costs
- Before twisting the pin and in the process of twisting the pin should be prevented from U/I pin tampering
- After the head of the twisted head pin position detection and product cleaning

Standard Station

Laser Welding Station



Specifications & Features

- CT = 0.2s/welding point
- The advanced welding fixture design precisely fixes the PIN position, achieving a first-pass yield of 99%
- Welding fixture has independent power for each slot, no gap for clamping
- Shielding gas is protected during welding with a welding fume extracting system
- Automatic disassembly of welding fixture
- AI visual inspection of welding quality