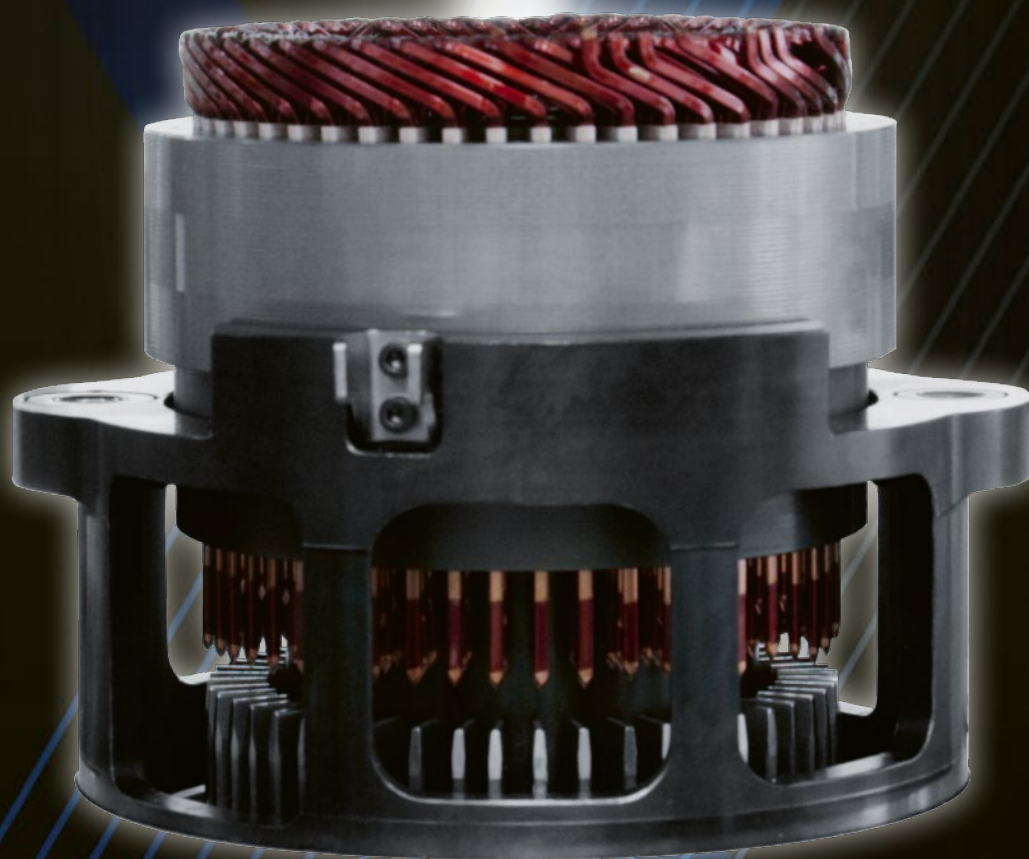


HAIRPIN TRACTION SOLUTIONS

WINDING AND ASSEMBLY TECHNOLOGY FOR E-MOBILITY



POWERED BY
IMA AUTOMATION

IMA EV-TECH
Technologies for E-Mobility



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IMA EV-TECH

IMA EV-TECH IS THE BUSINESS UNIT OF IMA AUTOMATION, ENTIRELY COMMITTED TO ELECTRIC VEHICLE ASSEMBLY TECHNOLOGIES. AS PART OF THE IMA GROUP IMA EV-TECH LEVERAGES THE GROUP'S STRENGTH AND OVER 60 YEARS OF INDUSTRY EXPERIENCE TO DRIVE INNOVATION AND EXCELLENCE IN AUTOMATION AND ASSEMBLY.

Established to enhance IMA's presence in the rapidly growing EV sector, IMA EV-TECH focuses on designing and manufacturing advanced assembly lines for key EV components, including battery cells (cylindrical and prismatic), fuel cells, e-axles, e-motors, stators and rotors.

The unit provides both standardized and fully customized assembly machines tailored to meet the needs of e-mobility manufacturers and suppliers. Additionally, IMA EV-TECH offers robotic systems, digital platforms, and virtual resources to enhance production efficiency and foster industry innovation.

Operating globally, IMA EV-TECH is supported by over 400 skilled professionals spread across five strategic locations: Italy, Switzerland, the United States, Malaysia, and China. This international footprint allows the unit to provide seamless customer support and tailor its solutions to meet the unique demands of different markets worldwide.

A key strength of IMA EV-TECH is its integration within the IMA AUTOMATION network, which boasts nearly 600 patents and over 60 years of experience in assembly processes across different sectors. This extensive expertise enables IMA EV-TECH to develop turnkey solutions that cover all stages of production, from assembly to testing and system integration, ensuring technological leadership in the EV industry.



IMA, A SOLID LEADING GROUP IN PROCESSING, PACKAGING & AUTOMATION

Established in 1961, IMA is world leader in the development and production of automatic machines for the processing and packaging of pharmaceutical, cosmetic, food, tea and coffee products, as well as in the automation of industrial processes. With a turnover of more than 2,300 million euros, 7,100+ employees and more than 3,000 patents and patent applications worldwide, the Group is present in about 80 countries, supported by a sales network made up of several branches, representative offices in central-eastern Europe and more than 140 agencies. IMA Group has more than 54 production plants in Italy, Germany, France, Switzerland, Spain, the UK, the USA, India, Malaysia, China and Argentina.



SWITZERLAND

ITALY

NORTH AMERICA

CHINA

MALAYSIA

**A WIDE NETWORK OF LEADING COMPANIES,
A UNIQUE EXCELLENT OFFER.**



STATE-OF-THE-ART SOLUTIONS FOR HAIRPIN MOTORS IN E-MOBILITY FIELD

While covering the full spectrum of technologies, IMA EV-TECH is a state of the art player in hairpin, confirmed as the reference technology for large scale production of stators for traction electric motors. Focus on continuous e-traction technological development in hairpin stators and other winding technologies, with highest flexibility upon customer requirements.

Main applications of hairpin motors in e-mobility field, produced by IMA EV-TECH equipment:

- **M-HEV** MILD HYBRID ELECTRIC VEHICLE 48V
- **HEV** (FULL) HYBRID ELECTRIC VEHICLE
- **P-HEV** PLUG-IN HYBRID ELECTRIC VEHICLE
- **BEV** BATTERY ELECTRIC VEHICLE
- **FCEV** FUEL CELL ELECTRIC VEHICLE



TAILOR MADE
TECHNOLOGICAL
SOLUTIONS FOR
TRACTION HAIRPIN
STATORS.



From product design analysis and prototyping to series production:

- EARLY ENTRY IN PRODUCT DESIGN ANALYSIS AIMED AT OPTIMIZING THE PRODUCTION (PRODUCTIVITY AND QUALITY)
- LABORATORY FOR SAMPLES PRODUCTION AND PRODUCT DEVELOPMENT VALIDATION
- FULLY AUTOMATIC STATOR LINE WITH HIGH PRODUCTION RATE

PRODUCT DESIGN ANALYSIS

IMA EV-TECH approach is based on a win-win cooperation with our customers.



FROM CUSTOMER NEEDS IDENTIFICATION

Preliminary product design evaluation

PAMO: Product Analysis for Manufacturing Optimization

Manufacturing project definition from **LAB concept machines to Mass Production**

Dedicated facility for A,B,C stator construction at IMA EV-TECH

Customer product definition & manufacturing process flow





TO PROJECT ACQUISITION

- 
- Customer PO
 - **Dedicated Project Management Team**
 - Plant/machines Design review option
 - Sourcing & parts manufacturing, equipment assembling, pre testing
 - Commissioning at Customer & SAT
 - Training and support to production

PROCESS FLOW

OF HAIRPIN STATOR PRODUCTION LINE



**HAIRPIN FORMING
AND INSERTING**

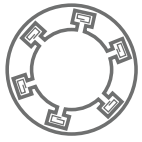


**STATOR
ASSEMBLY**

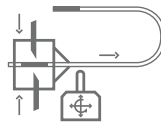
**TAILORED SOLUTIONS WITH HIGH TECHNOLOGICAL
CONTENT TO MEET SPECIFIC CUSTOMER REQUESTS,
EVEN THE MOST COMPLEX, WORLDWIDE.**



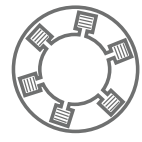
**OTHER
PROCESSES
INTEGRATION**



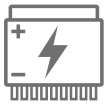
**SLOT
INSULATION**



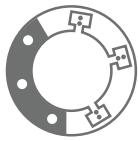
**HAIRPIN
FORMING**



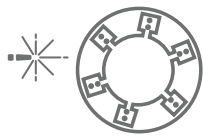
**HAIRPIN
INSERTING**



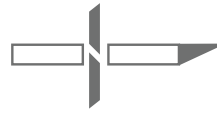
**ELECTRICAL
TEST**



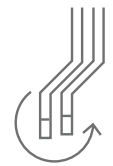
**BUS-BAR
ASSEMBLY
AND
WELDING**



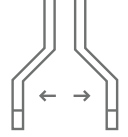
**HAIRPIN
LASER
WELDING**



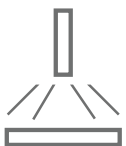
**WIRE
CUTTING**



TWISTING



WIDENING



**HAIRPIN
QUALITY
CONTROL**



**MANUAL
OPERATIONS**



**VISUAL
INSPECTION**



PALLETIZING

A WIDE RANGE OF SOLUTIONS

AT EVERY STEP OF MANUFACTURING PROCESS

HAIRPIN FORMING AND INSERTING

STATOR INSULATING



HIM

Hairpin
Insulating
Machine

HAIRPIN FORMING



HFM

Hairpin
Forming
Machine

HAIRPIN INSERTING



HSI

Hairpin
Shuttle and
Inserting

WIDENING



HWM

Hairpin
Widening
Machine

TWISTING



HTM

Hairpin
Twisting
Machine

STATOR ASSEMBLY

**OTHER
PROCESSES
INTEGRATION**

WIRE CUTTING

LASER WELDING

BUSBAR ASSEMBLY AND WELDING

ELECTRICAL TESTING

OTHER PROCESSES INTEGRATION



- Hairpin Quality Control
- Manual Operations
- Visual Inspection
- Hairpin Palletizing Station

HCM

Hairpin Cutting Machine

HWW

Hairpin Wire Welding

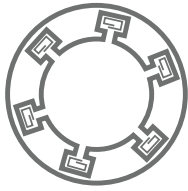
HBW

Hairpin Busbar Welding

HTS

Hairpin Testing Station

STATOR INSULATING

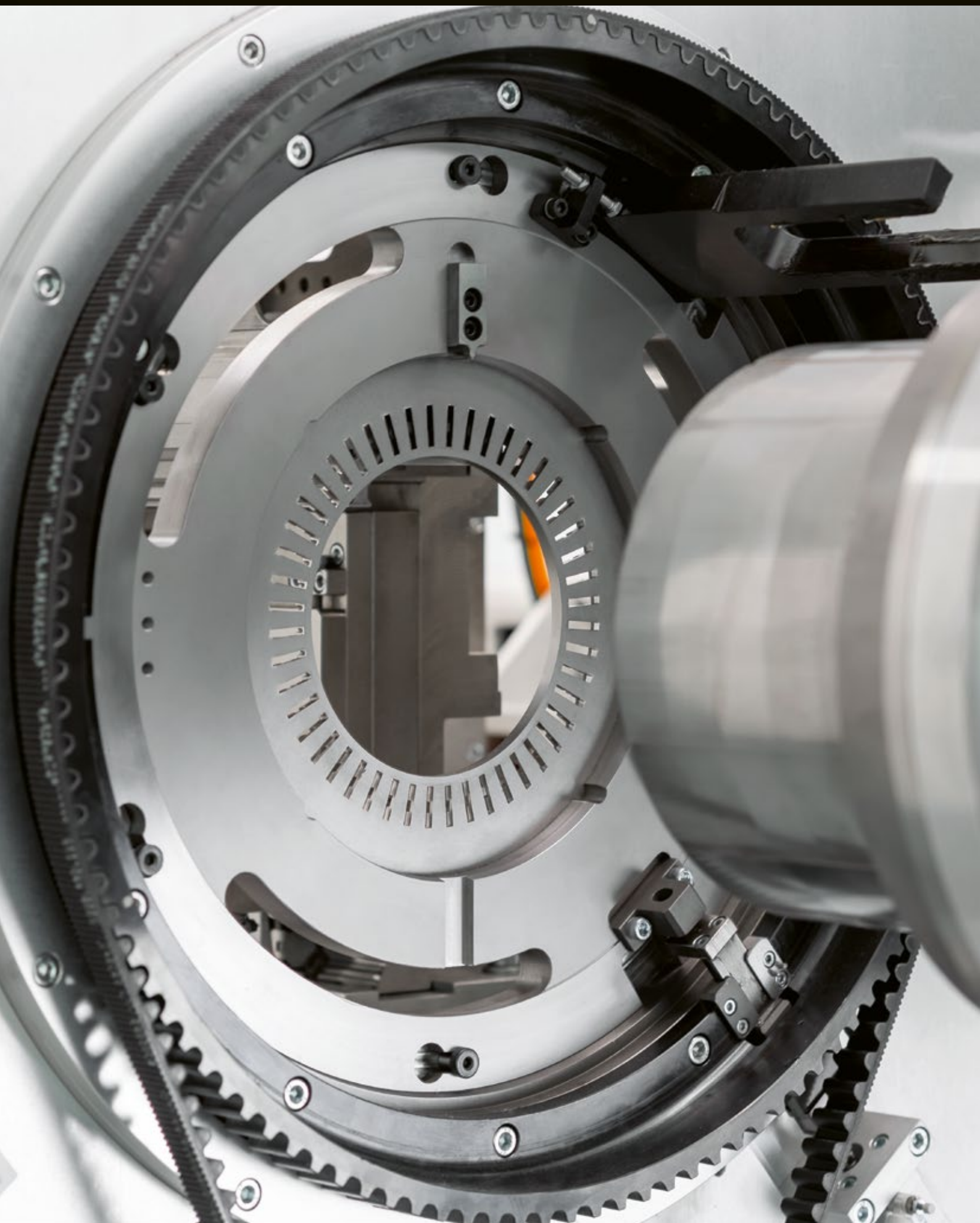


AUTOMATIC MACHINE FOR SLOT INSULATION FORMING AND INSERTING.

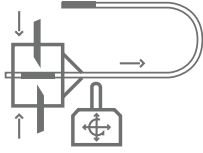


HIM Hairpin Insulating Machine

- Paper forming unit based on insulation material specification and specific product design
- Stack length measurement for correct paper length
- Paper length cut through CN motor according to stack length
- Paper position guaranteed by the inserting process mechanism and by specific tooling
- Paper presence and final position (on one side only) controlled with a dedicated sensor



HAIRPIN FORMING



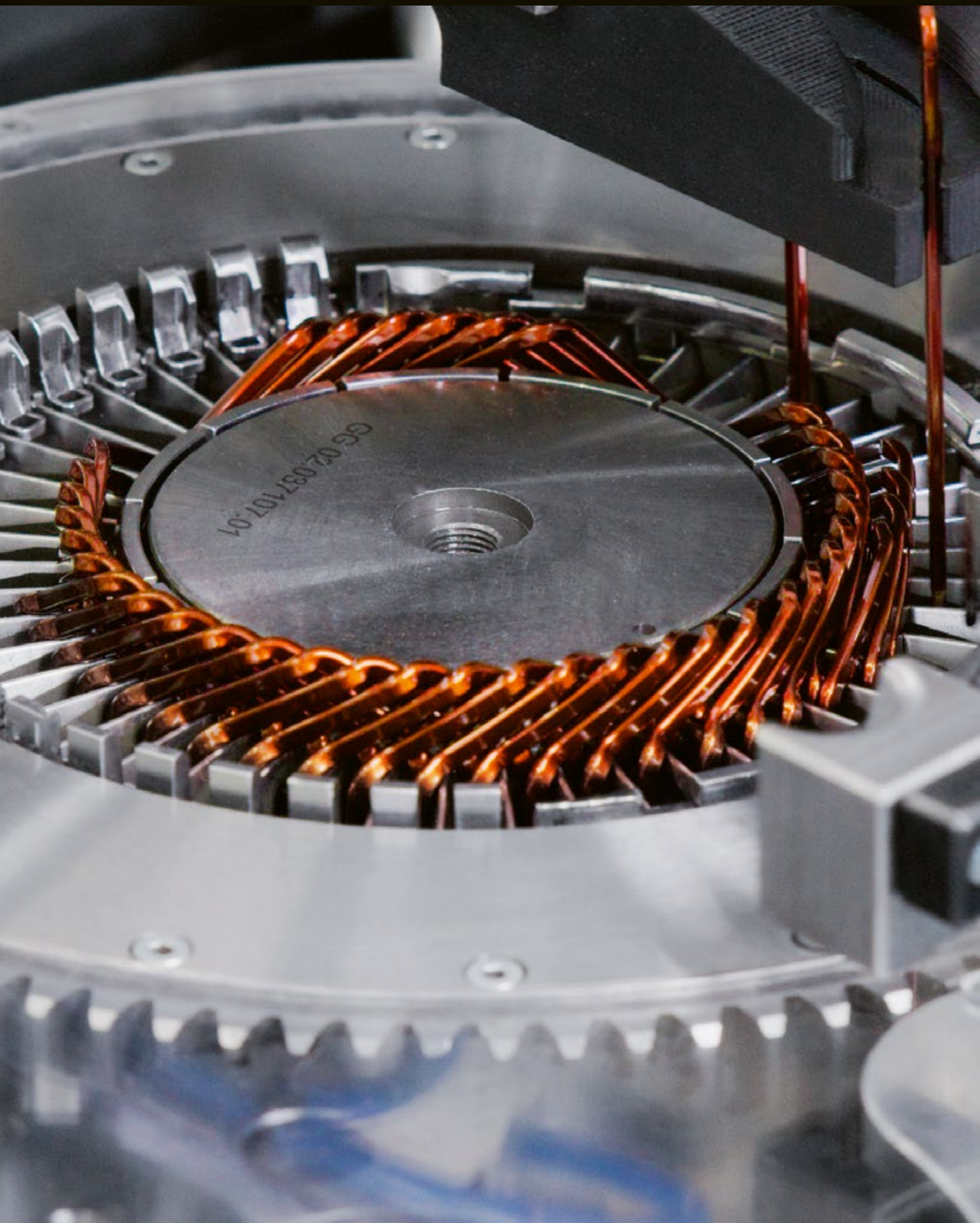
HAIRPIN FORMING MACHINE WITH CONDUCTOR FEEDING SYSTEM, LASER OR MECHANICAL WIRE DECOATING, HAIRPIN CREATING AND INSERTING STATIONS.



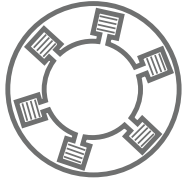
HFM

Hairpin Forming Machine

- Machine capable to perform all hairpin shape, pitches and lengths as per product specification
- Wire insulation removal
- IMA EV-TECH proprietary flexible system for the creation of hairpins by means of a 6 axis automatic manipulator
- Integrated handling system to transfer the formed hairpins towards the next assembly tool



HAIRPIN INSERTING



SHUTTLE WITH TRANSFER HEADS,
MOVING NESTS TO THE INSERTION STATIONS
THROUGH A PORTAL SYSTEM.



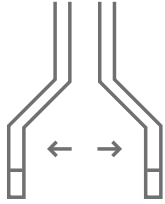
HSI

Hairpin Shuttle and Inserting

- Transfer heads move and insert inner and outer layer nests into the stator at the insertion stations
- Insertion stator tooling holding hairpins during insertion and protecting insulation
- A load/unload device transfers the stator between pallet and insertion station
- Different configurations are available



WIDENING AND TWISTING



AUTOMATIC MACHINE WITH HAIRPIN WIDENING AND TWISTING STATIONS INTEGRATED.



HWM Hairpin Widening Machine

- Loading/unloading with a two positions rotating table
- Widening group to widen the hairpins and prepare them for the twisting operation
- Motor torque monitored and limited to a max value
- 100% control stations after process

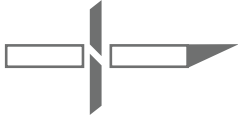


HTM Hairpin Twisting Machine

- Loading/unloading with a two positions rotating table
- Twisting group bending the conductors according to the twisting angle as per customer's diagram
- Motor torque monitored and limited to a max value
- 100% control stations after process



WIRE CUTTING



THREE-STATION MACHINE FOR SINGLE WIRE CUTTING, STATOR TILTING AND MULTIPLE WIRE CUTTING.



HCM HAIRPIN MULTIPLE CUTTING MACHINE

- Machine for multiple conductors cutting at constant length by means of NC mandrel



HRD HAIRPIN REVOLVING DEVICE

- Machine for 180° stator revolving

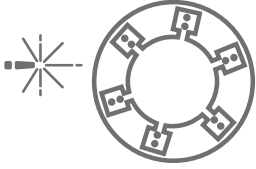


HCM
HAIRPIN SINGLE CUTTING
MACHINE

- Machine for single conductor ends cutting



HAIRPIN LASER WELDING

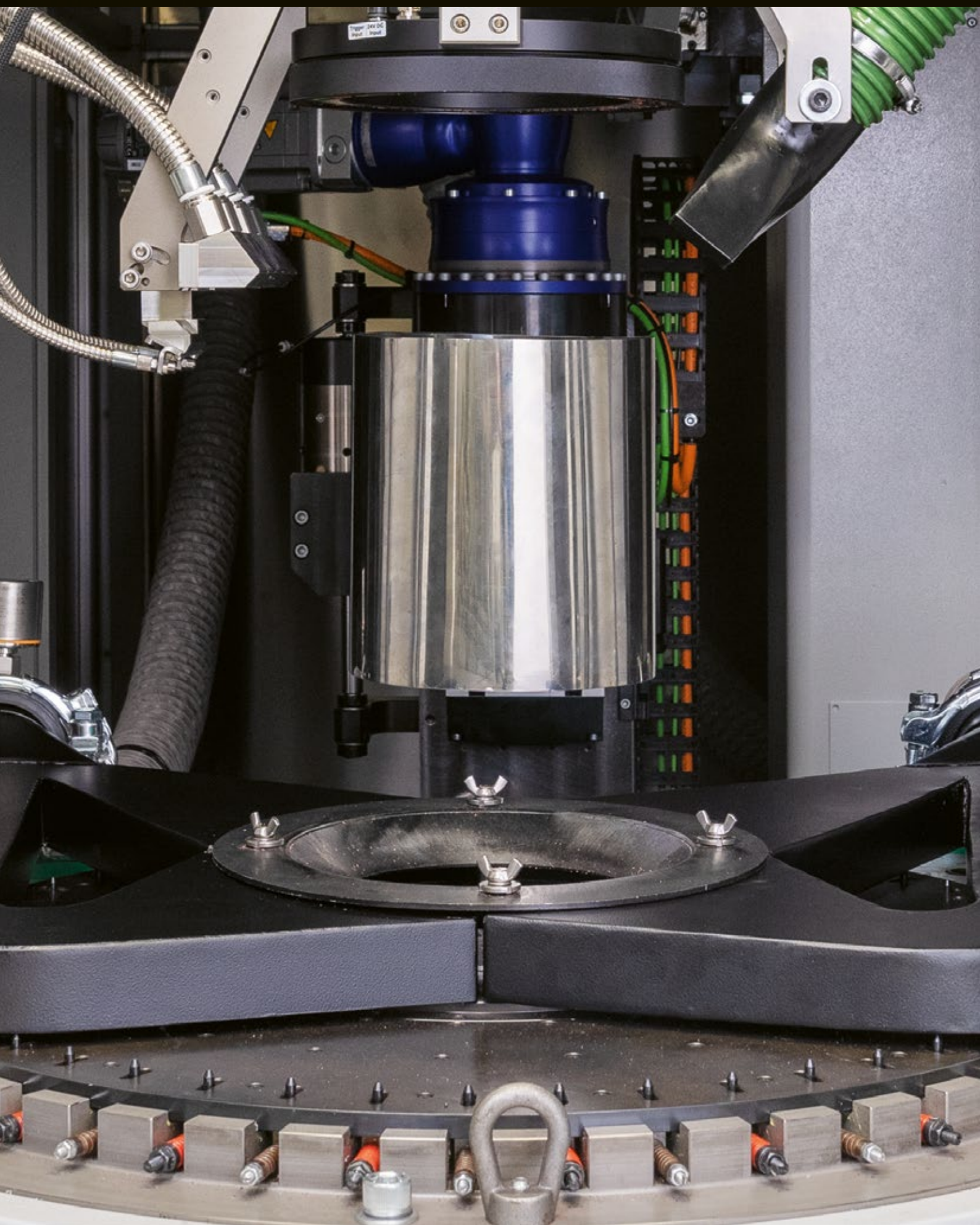


HAIRPIN LASER WELDING MACHINE
WITH OPTICS USING LASER BEAM DEFLECTION
WITH MOTORIZED MIRROR SYSTEM.

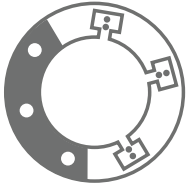


HWW Hairpin Wire Welding

- Multi axis device for welding optic support
- Optical tracking system for accurate welding target detection with integrated camera in the welding head for welding position correction
- The system allows to maintain each couple of wires under constant pressure
- Integrated laser unit including generator, coaxial fiber, PFO head
- Galvanometric welding head for laser beam orientation
- 3D System for welding joint preparation with axial containment during tangential and radial alignment
- Quality control with photodiode sensor



BUSBAR ASSEMBLY AND WELDING

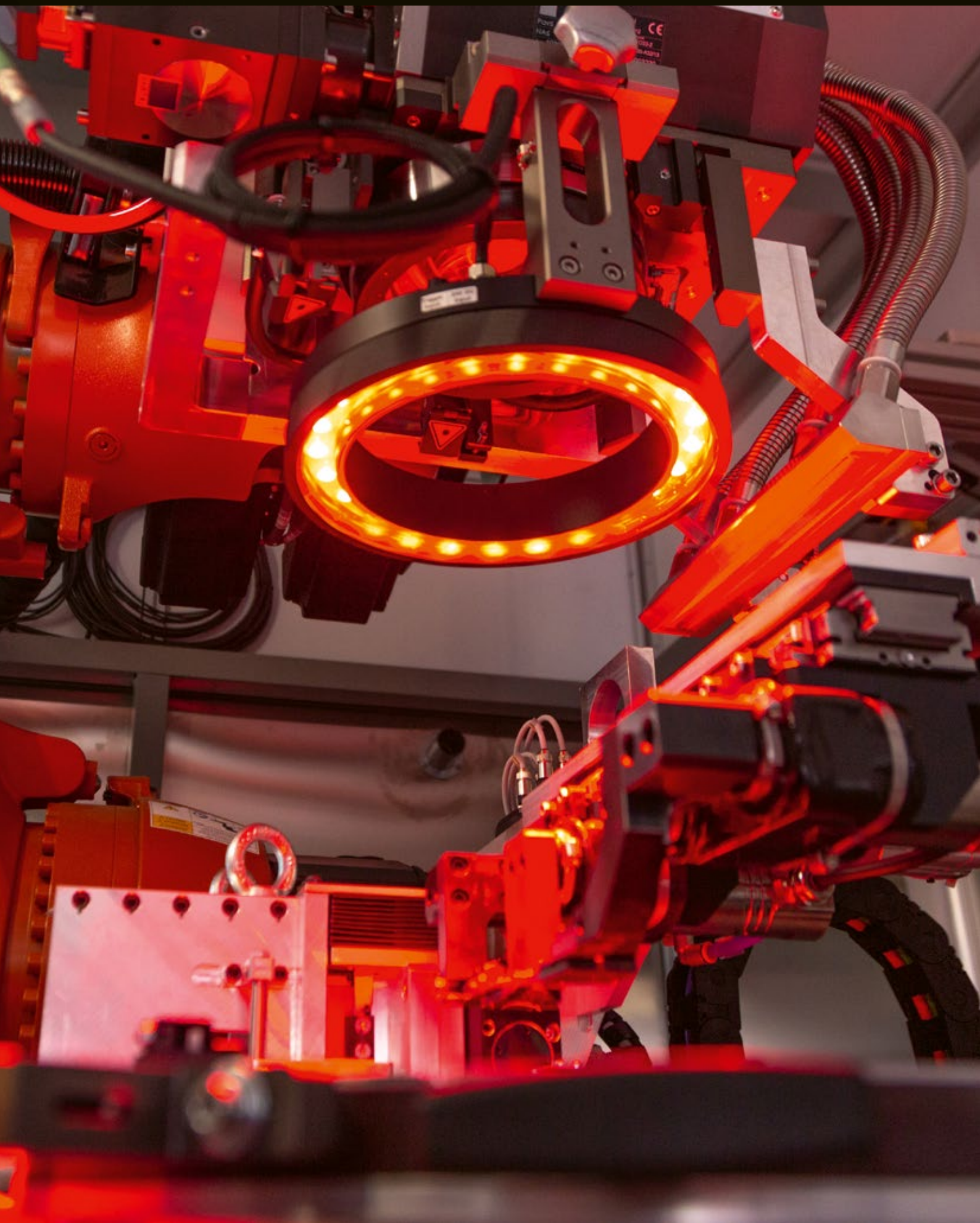


AUTOMATIC MACHINE FOR BUSBAR ASSEMBLY
AND WELDING WITH LASER SYSTEM.

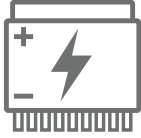


HBW Hairpin Busbar Welding

- Optical tracking system or welding target with camera integrated into the welding head
- Other customized solutions are available



ELECTRICAL TESTING

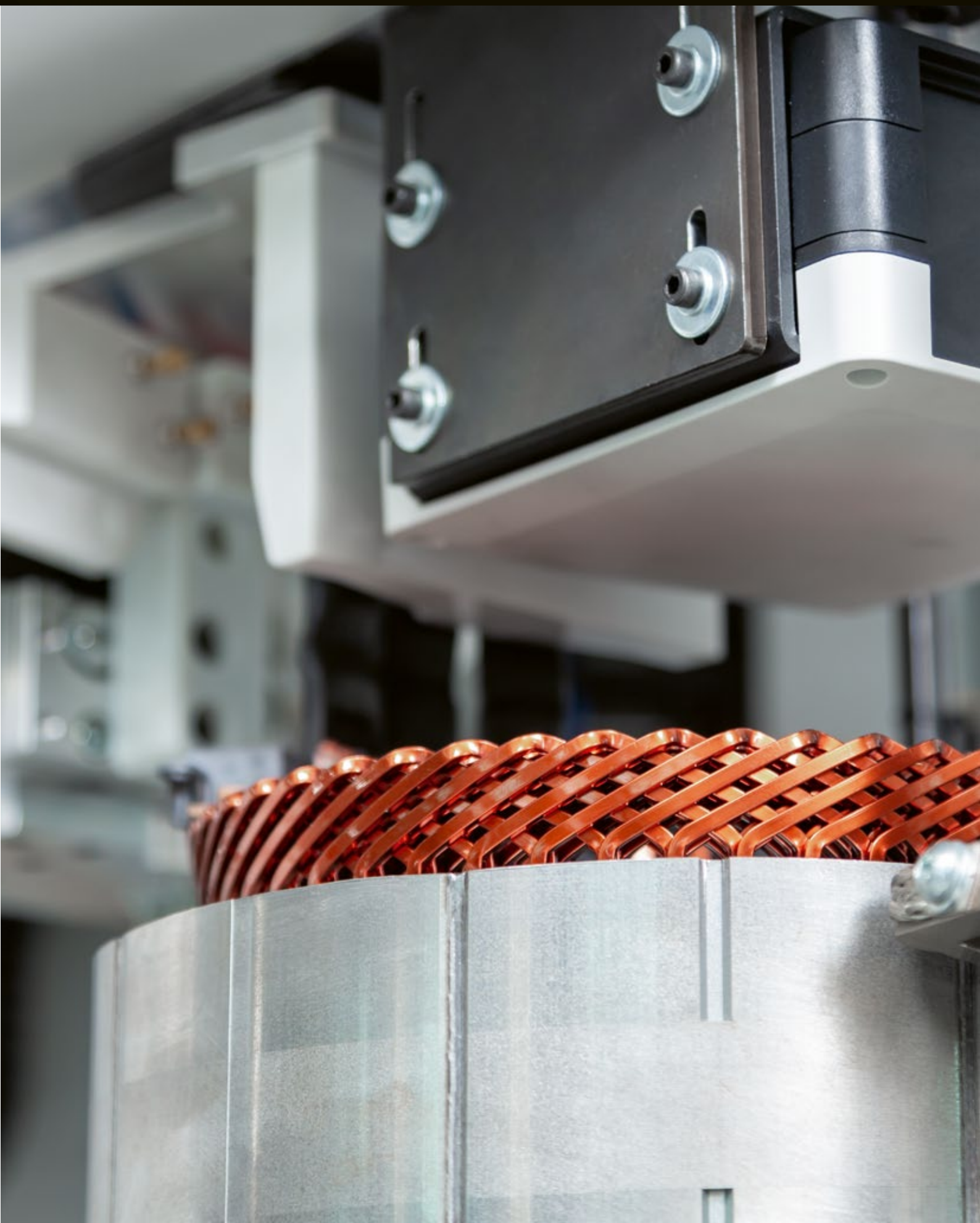


TESTING MACHINE, INSTRUMENTS, HW AND SW
BASED ON IMA AUTOMATION ATOP KNOW-HOW
AND TECHNOLOGY.



HTS Hairpin Testing Station

- Stator electrical testing system operating on conveyor
- Hi-pot test up to 3500 V at 30 mA
- Surge test up to 6000 V
- RL test for resistance and field measurement
- Hi-current test up to 200 A
- Insulation resistance up to 200 M Ω
- NTC sensor measurement and insulation vs. winding test
- Partial discharge - surge test/high-voltage measurements
- Pyrometer/environmental sensor for temperature compensation



OTHER PROCESSES INTEGRATION

Based on customer request and product specification, IMA EV-TECH proposes dedicated and customized process solution.



HAIRPIN QUALITY CONTROL

3D vision systems for stator inspection:

- In-process control
- End-of-line control



MANUAL OPERATIONS

Dedicated manual station based on customer request.



VISUAL INSPECTION

Manual station for stator inspection and rework.



HAIRPIN PALLETIZING STATION





Automatic systems for loading and
unloading of stators and components.

i m a u t o m a t i o n . c o m

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