VAF

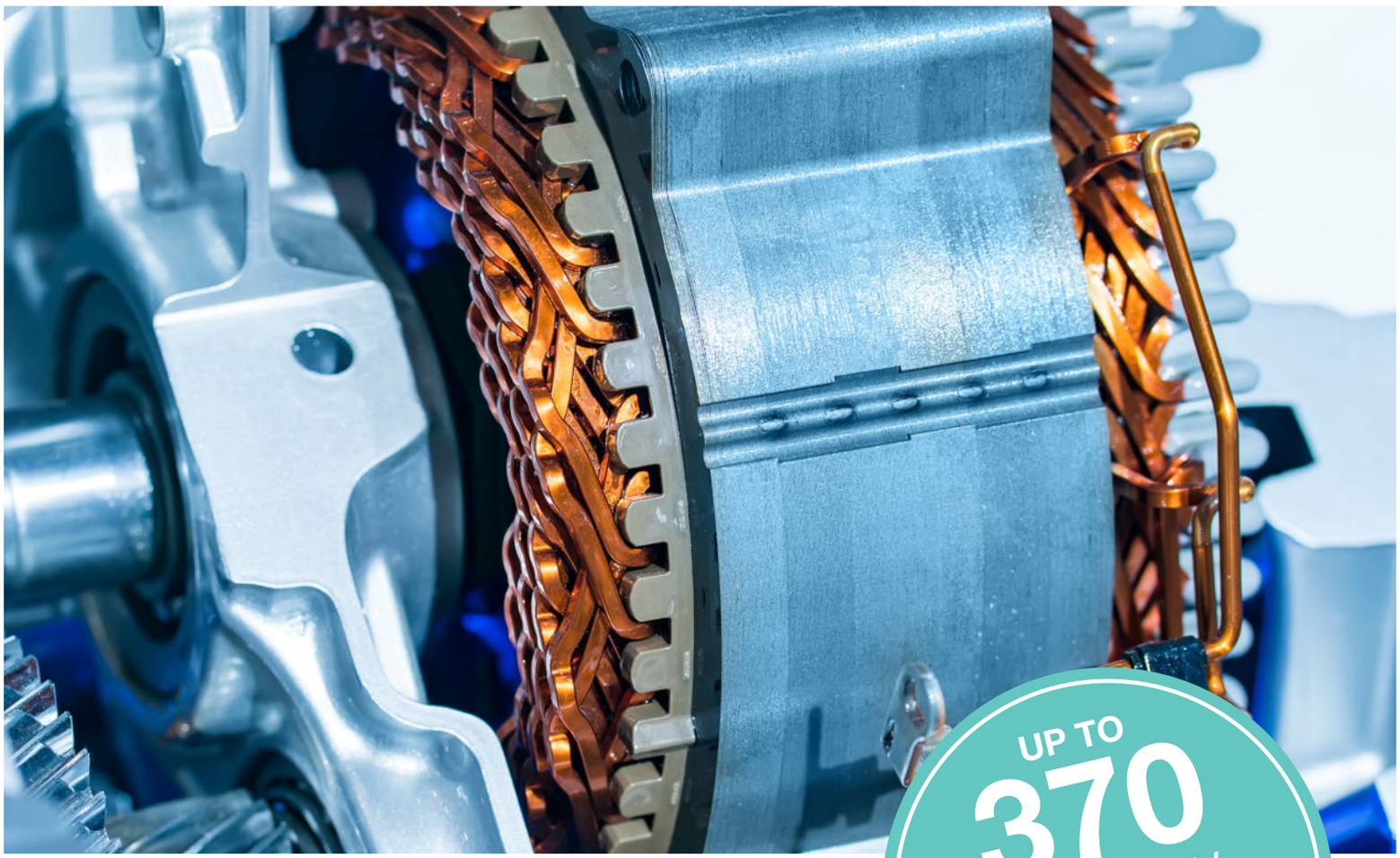
wir bewegen Zukunft

IMPREGNATION PROCESSES

for hot dipping and trickling

Hot dipping: i.HD-100, i.HD-4000, i.HD-8000

Trickling: i.TR-100, i.TR-4000, i.TR-8000



UP TO **370** UNITS / DAY / SYSTEM

Impregnating with VAF:
Energy-efficient and space-saving

Impregnation of windings with resin offers several advantages:

- It is used for solidification and caking of the individual components of the winding
- The winding resists the mechanical forces during operation
- The winding insulations are protected against the penetration of moisture and dirt
- Improved thermal conductivity.

With our customized modular solutions in the field of hot dipping and trickling, we offer you both a high degree of flexibility and maximum process reliability when planning your system.

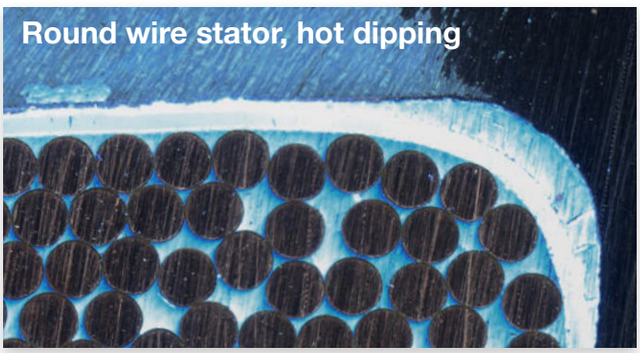
Thanks to the optimized arrangement of all components on one frame (plug & play), our systems require almost 45% less space than comparable systems.

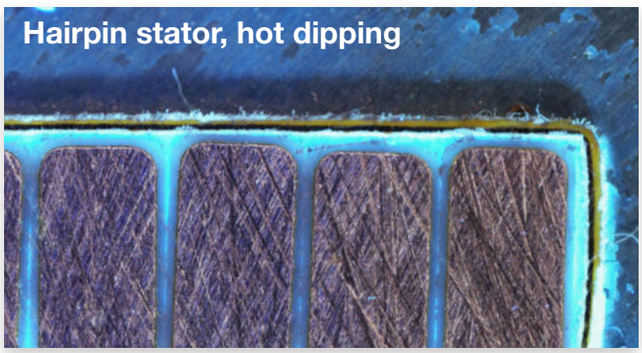
Our systems can be configured with different loading options:

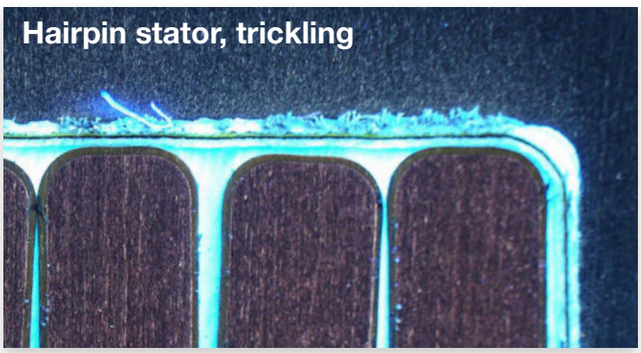
- manual loading by hand,
- automatic loading by robot, interlinking or gantry.

In our technical center, we show you the different possibilities and present our technical solutions.

Together, let's talk about your next projects.


Round wire stator, hot dipping


Hairpin stator, hot dipping



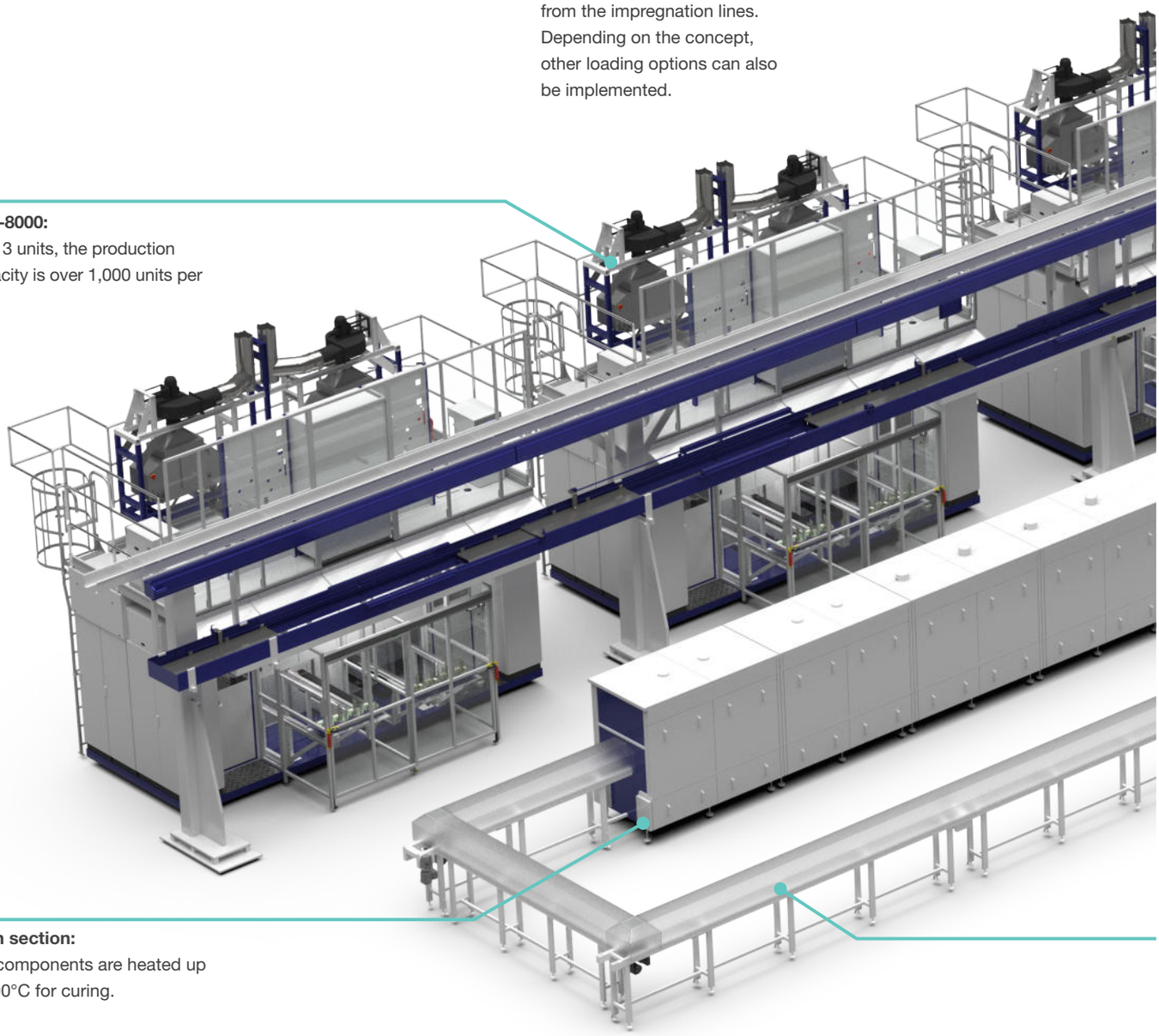
Hairpin stator, trickling

Complete system for the process
Hot dipping

Example of an impregnation line for stators with a production capacity of over 1000 units per day. The line is modularly scalable and can be extended as required with the addition of system elements.

Gantry loading: A gantry loads and unloads stators to and from the impregnation lines. Depending on the concept, other loading options can also be implemented.

i.HD-8000:
With 3 units, the production capacity is over 1,000 units per day.

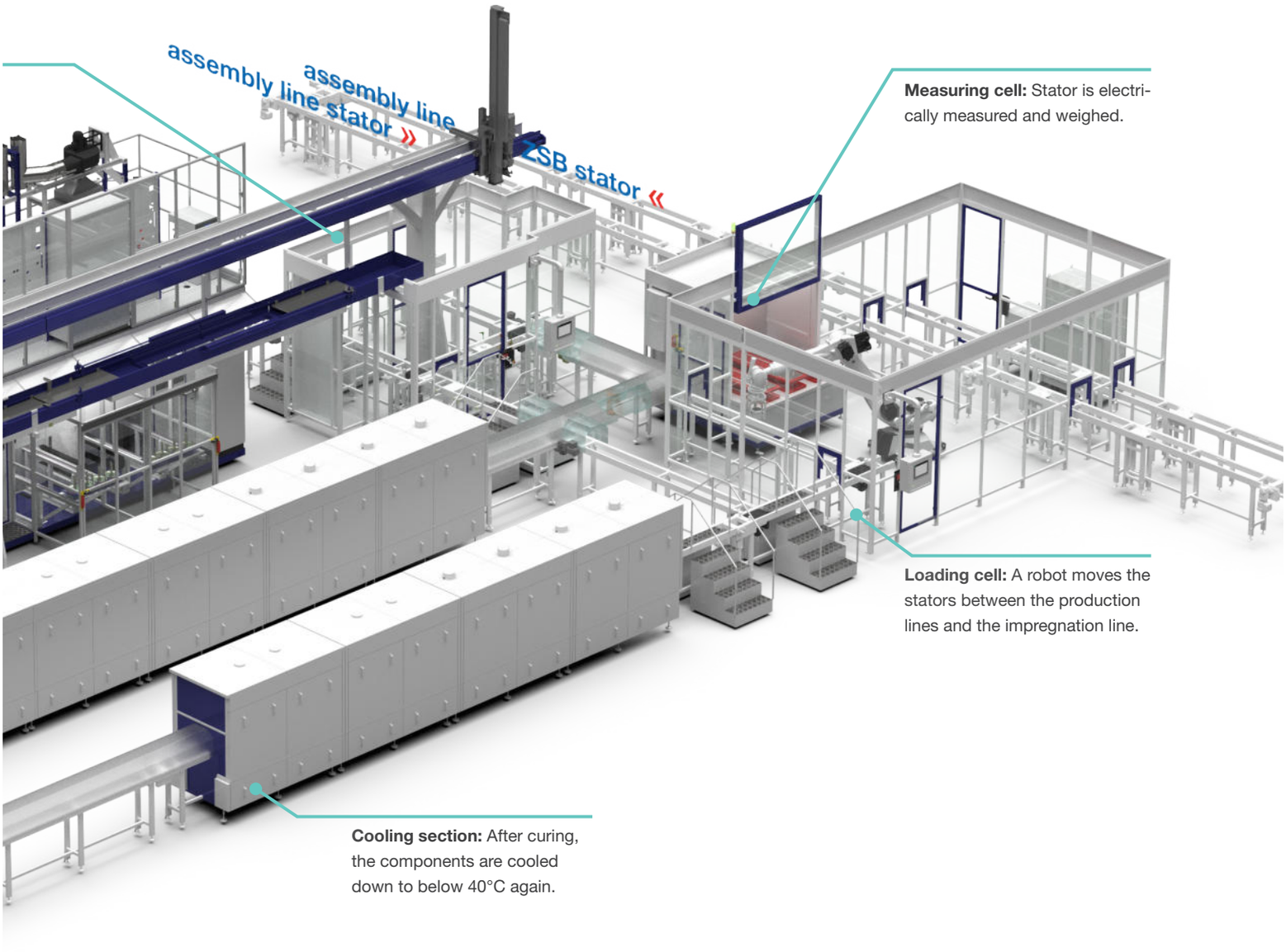


Oven section:
The components are heated up to 200°C for curing.

Process steps i.HD 8000 or i.HD 4000

Loading → **Weighing / electrical measurement** → **Impregnating** → **Final heating**

Production line ZSB stator/stator
Contact us!



Measuring cell: Stator is electrically measured and weighed.

Loading cell: A robot moves the stators between the production lines and the impregnation line.

Cooling section: After curing, the components are cooled down to below 40°C again.

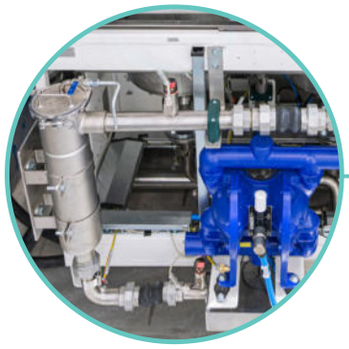
Protective enclosure: Protects workers from contact with hot components.

Cooling → Weighing / electrical measurement → Unloading

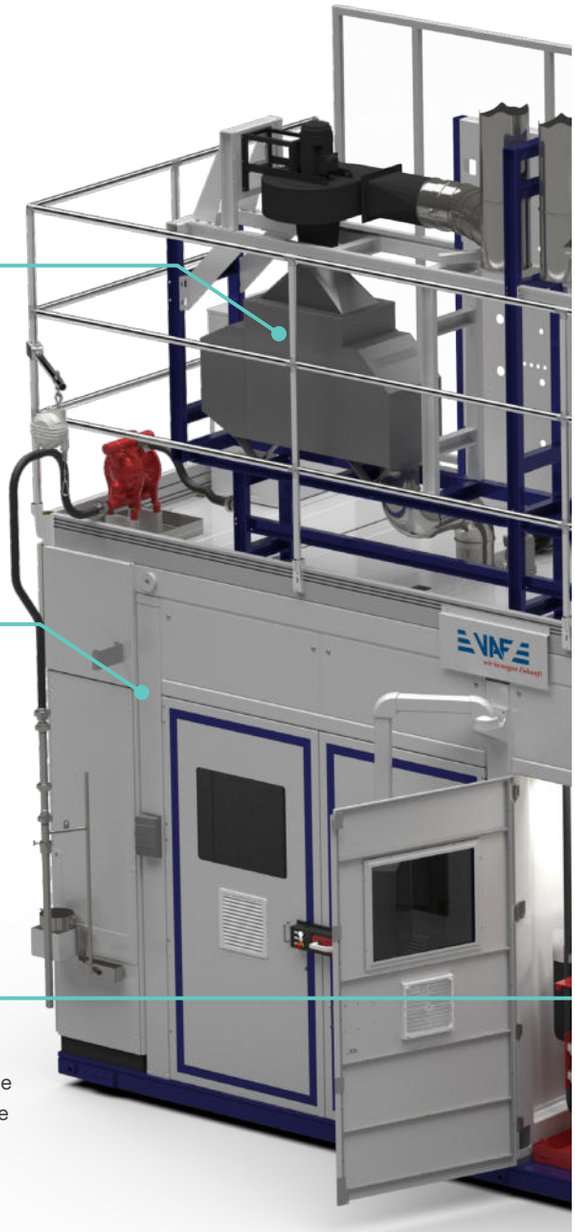
The flexible series solution: our **i.HD-8000**

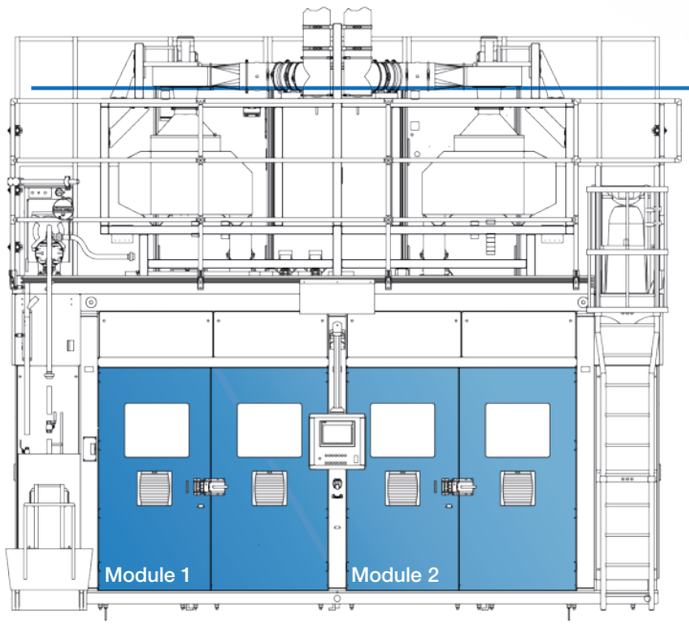
System design: Due to the modular system design, different stator types can be impregnated simultaneously with one system.

Cleaning: Innovative and patented cleaning technology for best impregnation results with minimal air consumption.



Save resin system: Lowest resin consumption thanks to innovative cleaning technology, eliminating the need for waste resin disposal in the system.



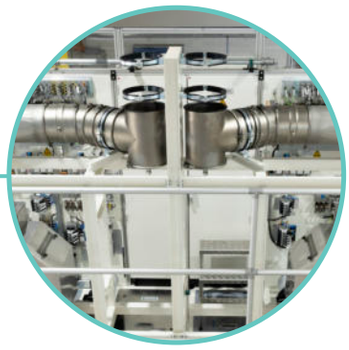


The divided system design allows module-independent production. Dividing the process results in optimal utilization of the system. Ease of maintenance and energy efficiency are unified with perfect impregnation quality.

The i.HD-8000 is, therefore, the ideal choice for economical production of high volumes. Our use of in-house developed current-heat units featuring the latest semiconductor technology and currents of up to 1,000 amperes results in homogeneous heating of the windings.

Sustainability is ensured by optimized processes and recycling of cleaned resin (save resin system).

Extraction: Integrated extraction technology as well as temperature control during the impregnation process.



Setup time: Quick-change systems for short setup and maintenance times.

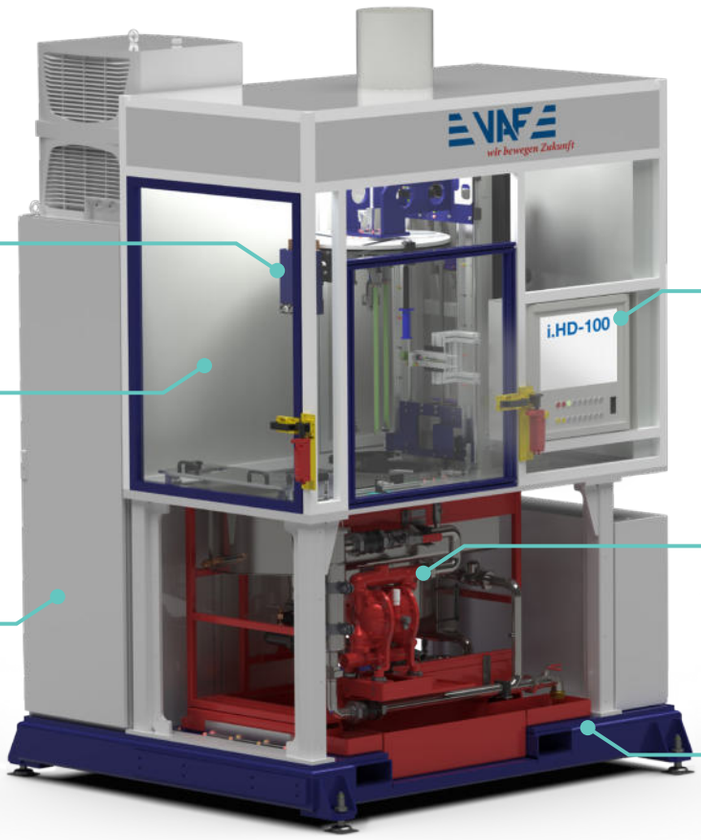
Flexibility: Flexible loading options due to modular system design.

up to **40%** energy saving

Product advantages:

- Module-independent production
- Low air consumption (approx. 1 m³/stator)
- High availability
- Save resin system
- Modular extensibility
- Flexible loading options
- Quick-change systems
- Minimal layer thicknesses on the stack of sheets

Process development in the smallest space: the **i.HD-100**



Contact: Manual contacting for connecting the stators.

Flexibility: Simple and fast mechanical adjustment possibilities. This provides the possibility to adjust a wide range of stator sizes.

Process monitoring: Built-in module for integration of a variety of temperature measurement sensors.

Database: Extensive database for teaching different stator types and sizes.

Resin system: Temperature-controlled and monitored system with resin filtration.

Design: Small footprint, best possible accessibility, as well as transportability.

The i.HD-100 is ideally suited for use in a test environment or for small-batch production.

The focus is on user-friendliness and flexibility in operating the mechanical system equipment. This allows the system to be perfectly suited to impregnate a wide range of stator types and sizes.

The resin system is tuned for quick media change. One of the purposes of this is to test different types of resin.

Product advantages:

- Fast stator integration
- Quick-change systems
- Extensive process monitoring
- Extensive process parameterization and evaluation
- Flexible contacting design
- Fast resin change possible
- Quick adjustment of the cleaning unit
- Save resin system

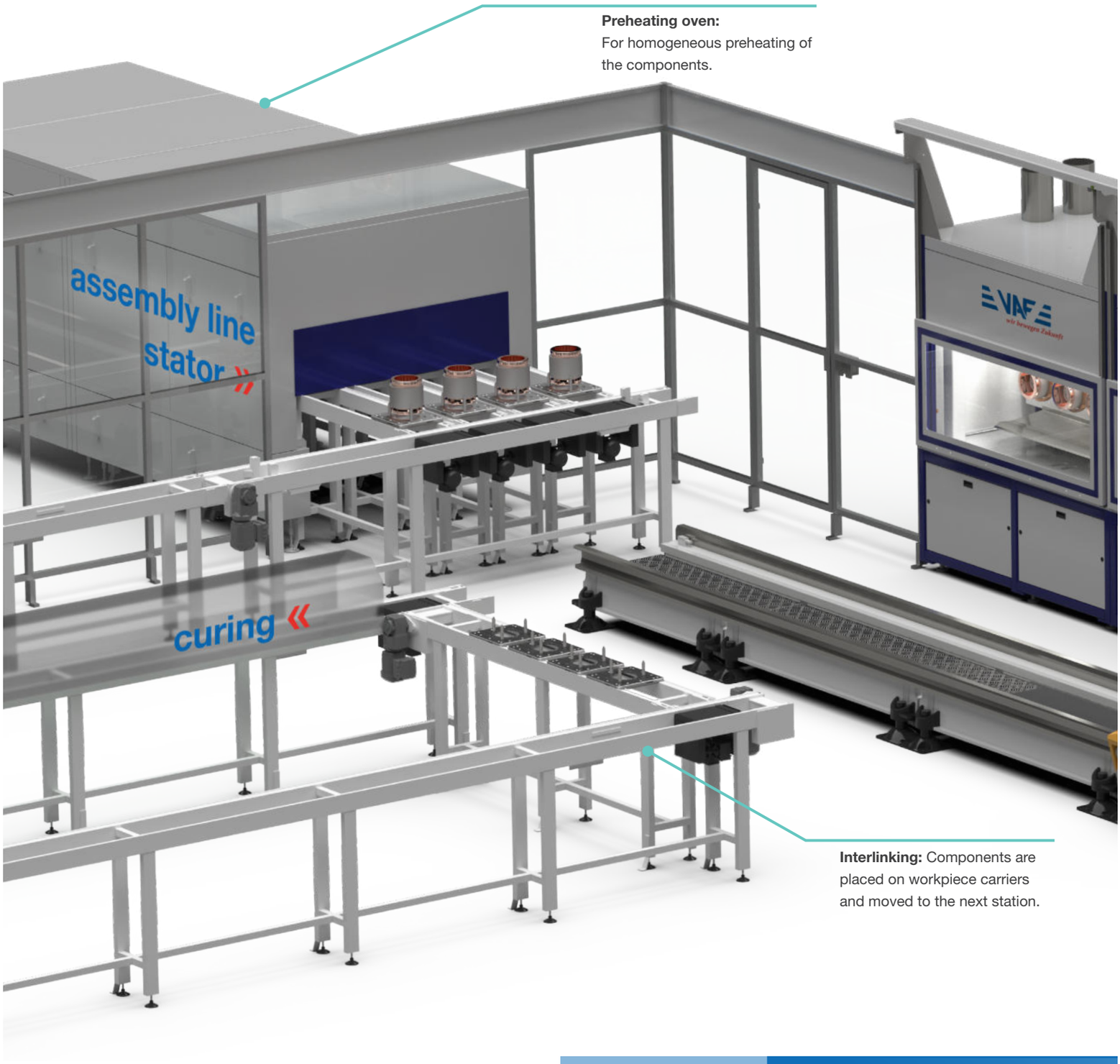
	Laboratory unit i.HD-100	I.HD-4000 series	I.HD-8000 series
Dimensions			
Length [mm]	2060	3000	6000
Width [mm]	1915	2400	2400
Height max [mm]	2931	5057	5057
Height min [mm]	2931	3540	3540
Space requirement [m²]	3.9	7.2	14.4
Weight [kg]	3000	10000	18000
Loading	**manual**	**automatic**	**automatic**
Production capacity * [E/h]	1-2	8	16
Production capacity * [3-shift, E/d]	25-40	185	370
Total air consumption [Nm³/h]	4	22	40
Component dimensions (up to)			
Length incl. winding head [mm]	50-450	50-280	50-280
Width [mm]	100-400	100-280	100-280
Max. Weight [kg]	60	50	50
Impregnation stations	1	2	4
Max. current [A]	1000	1000	1000
Flexibility			
Process control	★★★	★★★	★★★
Ease of maintenance	★★	★★★	★★★
Lot size 1	★★★	★	★★
Accessibility	★★★	★★★	★★★
Modularity	★	★★	★★★
Maintenance intensity	★★★	★★	★★

Other component sizes on request

* Cycle time measured on the basis of a reference component

Standard production modularly expandable: Trickling with the **i.TR-8000**

Example of an impregnation line for stators with a production capacity of over 1400 units per day. The line is modularly scalable and can be expanded as required by adding further modules.



Preheating oven:
For homogeneous preheating of the components.

Interlinking: Components are placed on workpiece carriers and moved to the next station.

Process steps i.TR 8000 or i.TR 4000

Loading → Weighing / electrical measurement → Preheating → Trickling → Gelling

Production line stator or rotor **Contact us!**

i.TR-8000: Modular, fully automated trickling and gelling station.

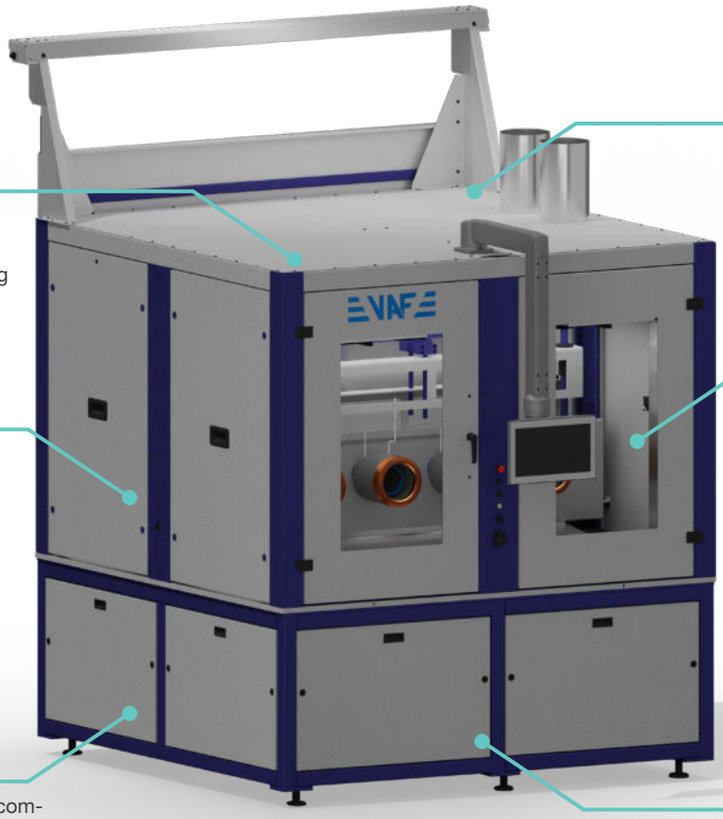
7-axis robot: Loading of preheated components, unloading of dribbled and gelled components. Alternatively, other loading concepts can be implemented.

Optional process steps

Curing → Cooling (passive/active) → Weighing / electrical measurement → Unloading

Trickling rethought: The VAF innovation **i.TR-8000**

System concept **patent** pending



Modularly expandable:
If required: simply increase production capacity by adding more modules.

One-place process:
Heating, trickling, and gelling in one module.

Individual loading: Different components per module possible.

Autonomous operation:
Reduction of personnel costs to a minimum.

Traceability: Assignment of the component to a dosing point.

High availability: Individual modules can be selected and deselected.

The complete impregnation process is realized at one position (one-place process). This enables highly flexible process design, as no further cycling is required. Reclamping and irregularities in the rotary motion are avoided, resulting in high and consistent component quality.

Another advantage of the system is that each component in production can be traced back to a defined dosing point. Thus, in case of process fluctuations, the cause can be determined easily and quickly.

Thanks to the associated low reject rate, the i.TR-8000 helps to make your production resource-saving and sustainable.

Product advantages:

- Process suitable for stators and rotors
- One-place process
- High availability
- Modular structure
- Increase in production capacity possible without any problems
- Excellent view of the trickling process
- Flexible loading options
- Energy-efficient through induction
- Integrated extraction technology

	Laboratory unit i.TR-100	Small series i.TR-4000	Series i.TR-8000
Dimensions			
Length [mm]	2800	3000	3000
Width [mm]	1400	2700	3000
Height max [mm]	2300	3050	5200
Height min [mm]	2300	3050	3050
Space requirement [m²]	3.9	8.1	9
Weight [kg]	2000	5500	7500
Loading	**manual**	**manual / automatic**	**automatic**
Production capacity * [E/h]	1-2	8	16
Production capacity * [3-shift, E/d]	25-40	180	360
Component dimensions (up to)			
Length incl. winding head [mm]	50-450	50-450	50-450
Plate pack diameter [mm]	100-400	100-400	100-250
Max. Weight [kg]	50	50	50
Impregnation stations	1	2	4
Inclination	manual	pneumatic/ electric	On request
Gelling	Convection/induction	Induction	Induction
Flexibility			
Process control	★★	★★★	★★★
Ease of maintenance	★★	★★★	★★★
Lot size 1	★★★	★★	★★
Accessibility	★★★	★★★	★★★
Modularity	★	★★	★★★
Maintenance intensity	★★★	★★	★★

Other component sizes on request

* Cycle time measured on the basis of a reference component

Our technical center has more than 700 m² at its disposal

100 m² area for impregnation

Our **Technical Center**

At our technical center, we support our customers in the qualification of the impregnation process with fully comprehensive documentation reports as well as electrical measurement results. This enables us to optimize processes in terms of quality and cost-effectiveness.

Possibilities and service

- Process development and optimization
- Commission impregnation
- Resin testing
- Prototype testing

Laboratory equipment

- i.HD-100
- i.TR-100
- Electrical measuring facility
- Quality inspection tools

Who is **VAF**?

As a strong partner of internationally active automobile manufacturers, we specialize in the construction of complete assembly lines for the automatic production of classic components such as transmissions, chassis, and axles.

We are playing a pioneering role in automated component production for the car of the future. In a very short time, our team develops equipment, not only for the highly efficient production of stators but also for batteries, fuel cells, and electrolyzers. For example, the world's fastest stacking line for fuel cell stacking comes from Bopfingen. Several funding projects in new vehicle drives underscore the company's innovative strength.

With more than 450 employees, a production and assembly area of 21,000 m² and supported by powerful in-house manufacturing, we are your innovative partner for automation solutions “Made in Baden-Württemberg”.

Interested? Contact us!

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OUR PORTFOLIO FOR E-MOBILITY

BATTERY

Cylindrical cell
Pouch cell
Prismatic cell

HYDROGEN

Fuel cell
Electrolyzer

ELECTRIC MOTOR

Stator and rotor assembly
Dip impregnation
Trickle impregnation

VAF-E24101 EN