

INPREGNATION 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



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.





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.

4

Production line ZSB stator/stator Contact us!

assembly line stator assembly line Gantry loading: A gantry loads and unloads stators to and from the impregnation lines. Depending on the concept, SB ^{stator} « other loading options can also be implemented. i.HD-8000: With 3 units, the production capacity is over 1,000 units per day. Cooling section: After curing, the components are cooled down to below 40°C again. **Oven section:** Protective enclosure: Protects The components are heated up workers from contact with hot to 200°C for curing. components. Process steps i.HD 8000 or i.HD 4000

Loading

Impregnating

Final heating

Cooling

Weighing /

5



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.



6

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.

EVAFE

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).

40% energy savin



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



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

= VAF=



Flexibility: Flexible loading options due to modular system design.

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**



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





		1.11D-4000 Series	1.11D-0000 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 [m ²]	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 (u	p to)			
Length incl. winding head	50-450	50-280	50-280	
Width [mm]	100-400	100-280	100-280	
Max. Weight [kg]	60	50	50 Other	
Impregnation stations	1	2	4 sizes on request	
Max. current [A]	1000	1000	1000	
Flexibility				
Process control	***	***	***	
Ease of maintenance	**	***	***	
Lot size 1	***	*	**	
Accessibility	***	***	***	
Modularity	*	**	***	
Maintenance intensity	***	**	**	

9



Laboratory unit i.HD-100 I.HD-4000 series

I.HD-8000 series

Production line stator or rotor Contact us!

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.

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

EVAFE

EVIFE

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

Loading

4

assembly line

stator

-curing «

Weighing / electrical measurement

Preheating

Preheating oven:

the components.

For homogeneous preheating of

Trickling

Process steps i.TR 8000 or i.TR 4000

Gelling

Curing

Cooling (passive/active)

E VAF

11

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





Weighing / electrical measurement

Unloading

Trickling rethought: The VAF innovation i.TR-8000

System concept patent pending





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				
Dimensions					
Length [mm]	2800	3			
Width [mm]	1400	2			
Height max [mm]	2300				
Height min [mm]	2300				
Space requirement [m ²]	3.9				
Weight [kg]	2000	5			
Loading	manual	n			
Production capacity * [E/h]	1-2	8			
Production capacity * [3-shift, E/d]	25-40	1			
Component dimensions (up to)					
Length incl. winding head [mm]	50-450				
Plate pack diameter [mm]	100-400				
Max. Weight [kg]	50				
Impregnation stations	1				
Inclination	manual				
Gelling	Convection/induction				
Flexibility					
Process control	**				
Ease of maintenance	**	,			
Lot size 1	***	,			
Accessibility	***	,			
Modularity	*	,			
Maintenance intensity	***	,			



1. .

Trickling





Small series i.TR-4000



Series i.TR-8000

3000	3000	
2700	3000	
050	5200	
3050	3050	
3.1	9	
500	7500	
nanual / automatic	automatic	
3	16	
80	360	
i0-450	50-450	
00-400	100-250	Other sizes
50	50	component on request
2	4	
oneumatic/ electric	On request	
nduction	Induction	
***	***	
***	***	
**	**	
***	***	
**	***	
**	**	

* 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

Impregnation systems from VAF

Hot dipping

Trickling

About VAF

15

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! MAX RETTENMEIER

Sales Management Tel: +49 (0) 73 62 96 03-23 max.rettenmeier@vaf-bopfingen.de

VAF GmbH

Bergstrasse 13 73441 Bopfingen Germany www.vaf-bopfingen.de

VAF-E23101EN

