



PLASMA COMPONENTS

X-SERIES END BLOCKS | Y-SERIES END BLOCKS | MAGNET BARS
PLANAR MAGNETRON BODIES | MAGNETRON LIDS | LION
VA PROCOS 2 | VA PROCESSMASTER | VA TRIM & SHIM TOOL

PROVEN COMPONENTS.
EXCELLENT RESULTS.
FOR YOU.

OUT
NOW!

Our components are now free
to explore new horizons. **WITH YOU.**



What are you looking for in a supplier of components and process solutions? Experience? Reliability? A proven track record?

VON ARDENNE equipment is used in over 50 countries. We have established an installed base of hundreds of coating systems worldwide, ranging from small tools to equipment for large-area coating applications.

Every day, our customers are facing the challenge of staying in a leading position. Why do they choose VON ARDENNE Process Solutions as their partner? Consider our **keys to success:**

Field Experience – Our technical team is comprised of engineers who have been there, in the field, delivering results. Not only does this mean we know what it takes to get the job done, in many cases we have done it before.

Simulation & Modeling – For new applications, we can guide the process design with extensive simulation and modeling capabilities. From mechanical stress, to thermal modeling, to magnetic field modeling, to charged particle motion, our team can simulate your process before we begin to ensure the highest chance of success.

Sampling Capability – VON ARDENNE has over 20 machines that are suitable for sampling. From small cluster tools to large in-line systems, we can use demonstration runs to further assure you that your process will deliver the results you need once installed.

In-House Assembly & Quality Control – VON ARDENNE builds all of our products in our facility in Germany. We conduct the most demanding quality and functional tests in the industry before shipping our products to you. We meet or exceed most of our competitor's specifications for technical performance and reliability.

Process Knowhow – By combining our hardware and process control solutions, we can deliver the highest performing processes to the most demanding specifications. Whether you are looking for the best material properties, high rates, uniformity, utilization, or all of the above we can deliver a process that meets your requirements.

Technology Knowhow – Beyond the local coating processes, VON ARDENNE offers state-of-the-art machine control solutions. From optical inspection to automated process adjustment, we add the final pieces of technology to make not only your local process run, but to make your machine perform – to deliver a product as you need it, when you need it.

Worldwide Competence Centers – A truly global organization, VON ARDENNE's subsidiaries can provide integration and startup support, service, and training. When you need it, help is always close at hand.

VON ARDENNE is more than a component supplier, we are a solution provider. Let us put our experience to work for you.

Mission – Our mission is to create value by bringing our industry leading technology and process experience to our customers.

We want to achieve that by offering state-of-the-art hardware solutions with best-in-class performance specifications and reliability. Furthermore, we offer advanced process control hardware and software solutions to control processes of single sources or in complex layer stacks settings.

It is our aim to deliver an excellent process result according to your specifications and timeline. And we are confident that we can offer you what you are looking for in a supplier.

Simulation-Driven Product Development

Vacuum System Dynamics for Complex Deposition Machines

Matlab/SIMSCAPE

The conceptual design of complex and dynamic vacuum systems is extremely demanding. VON ARDENNE has accepted this challenge and has developed a MATLAB/Simscape library to model and simulate vacuum dynamics either for single compartments or overall simulations for complex vacuum deposition machines. VON ARDENNE has more than 40 years of experience in vacuum deposition and outstanding expertise

in multiscale simulation to feature highly optimized system performance and to ensure best process quality originated from component design. We accelerate product development and upgrades by reducing the engineering effort with cutting-edge modelling and simulation for product planning for your individual process solution and feasibility studies for upgrading running systems.

Low-Pressure Gas Flow for Best Gas Distributions

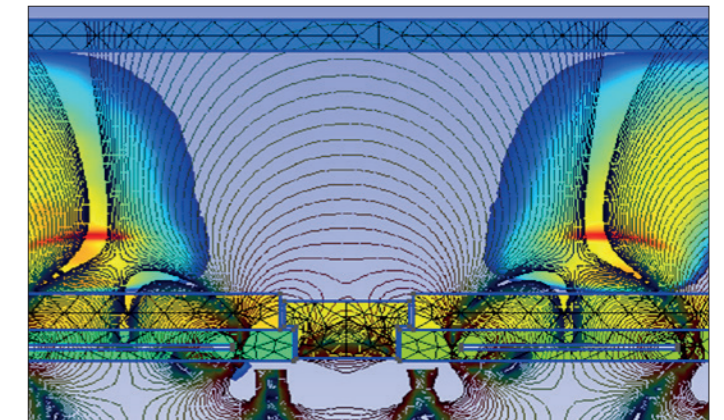
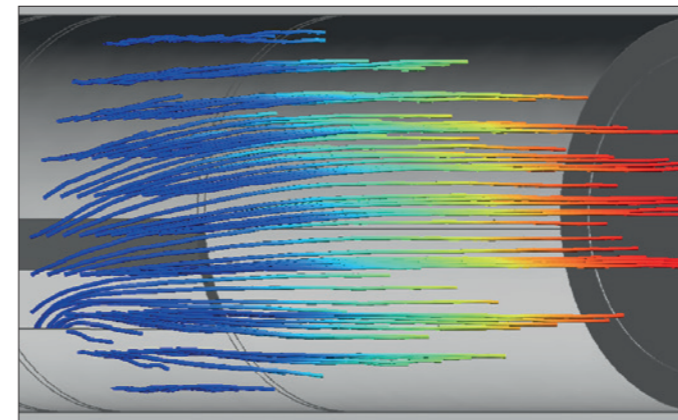
DSMC – Direct Simulation Monte Carlo

The simulation of low-pressure gas distributions in process chambers requires special numerical methods and a highly computational effort. The DSMC method is applied already in the construction and design phase at VON ARDENNE in order to achieve the best gas distributions.

Plasma Process and Magnetic Field for Excellent Film Growth

PICMC – Particle in Cell Method

Cutting-edge thin-film technology is characterized by film homogeneity, high target utilization, film-optimized process design and other technological requirements. At VON ARDENNE, plasma and magnetic field simulations are used to analyze and improve the decisive physical process responsible for the film growth.



Optical Simulation for Outstanding Film Properties

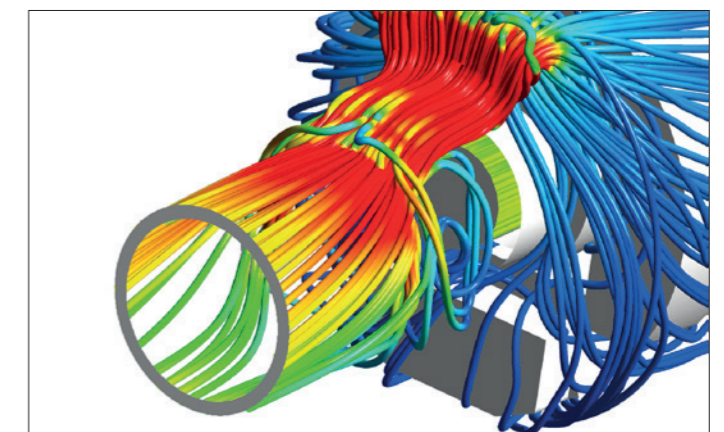
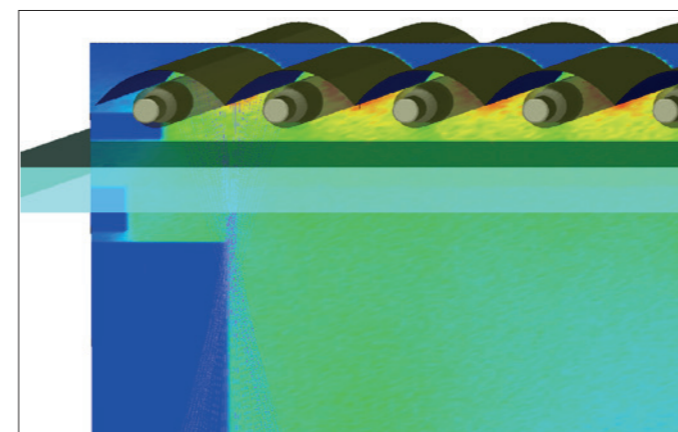
Ray Tracing and Thin-Film Properties

Optical simulations are widely used to achieve the most efficient design for VON ARDENNE equipment with flash-lamp based annealing and patterning technology. Furthermore, the parameters of thin films are optimized using simulation methods so that the overall optical properties meet the requirements.

Finite Element Simulations for Best Coating Results

Mechanical, Thermal, CFD, Multi-Physics

FE simulations for the analysis and optimization of different physical processes in combination with many years of experience are essential prerequisites for VON ARDENNE coating systems to meet the high quality requirements of our customers.



X-SERIES END BLOCKS - XC-S

Components for Rotatable Magnetrons

The **XC-S End Block** is a compact, internal drop-in end block for low- to medium-power sputter systems. Typical applications for this type of end block are architectural glass, photovoltaics, web and display coating and coatings for automotive applications.

Our **XC-S End Block** is available for upgrades and retrofits for all coating systems, regardless of the manufacturer. It also covers a wide range of specifications.

Furthermore, this end block is easy to maintain and always up to date in terms of seal systems and current transmission.

X-SERIES END BLOCKS - XC-L

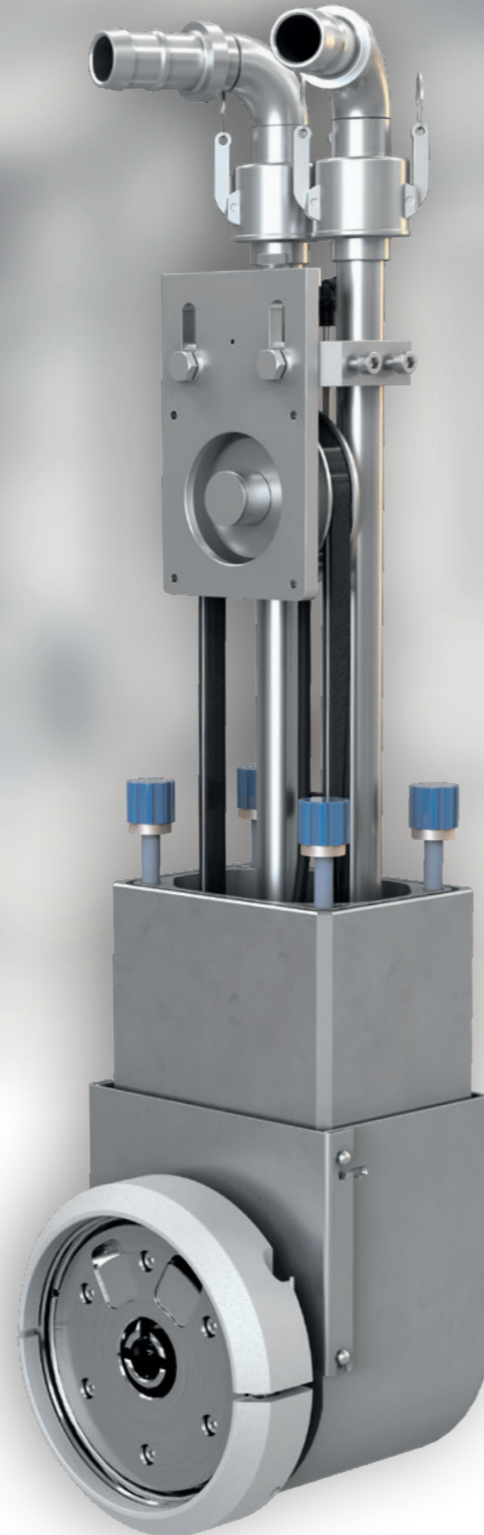
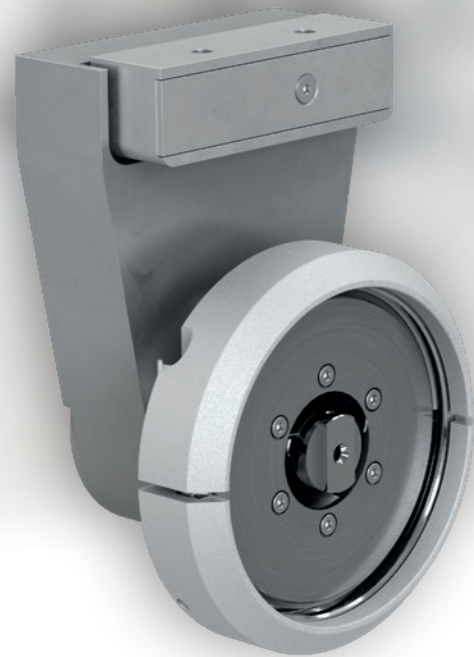
Components for Rotatable Magnetrons

The new **X-Series End Block XC-L** is a drop-in end block for mid- to high-power applications such as architectural glass, thin-film photovoltaics, anti-reflective or TCO coatings.

The X-Series is available for upgrades and retrofits for all coating systems, regardless of the manufacturer, and covers a wide range of specifications.

The new, state-of-of-the-art design of the **XC-L** enables easy maintenance and is always up to date in terms of seal systems and current transmission.

XC-S



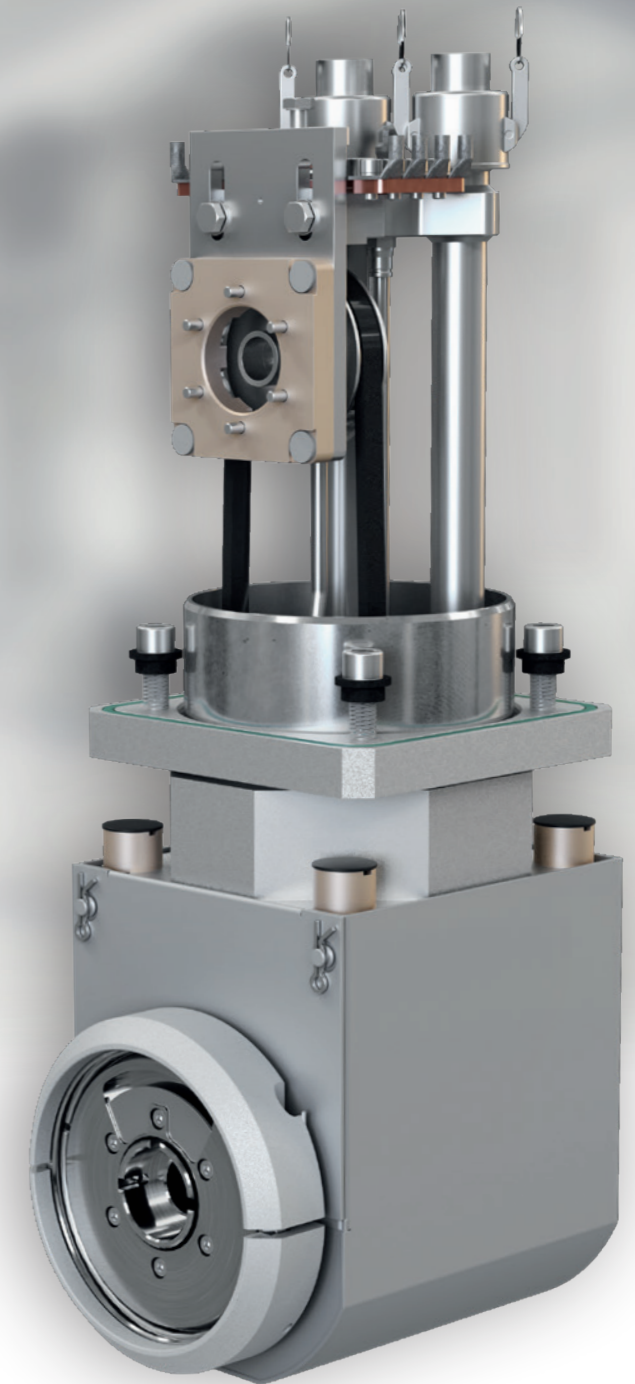
TECHNICAL DATA XC-S

Subject to change without notice due to technical improvement.

Mounting position	horizontal and vertical
Max. current AC/DC	up to 200 A (60 kHz) / 225 A
Max. power	up to 100 kW (DC/60 kHz AC)
Max. target length	2500 mm
Helium leak rate	< 1x10 ⁻⁶ mbar*l/s
Rotation speed	3 min ⁻¹ to 60 min ⁻¹
Safe operation weight load	≤ 370 kg horizontal mounting vertical mounting on request

The dimensions and interfaces of the **XC-S End Block** are compatible with all common process lids in the field and are therefore suited as components for new coating machines and for retrofits.

XC-L



TECHNICAL DATA XC-L

Subject to change without notice due to technical improvement.

Mounting position	horizontal and vertical
Max. current AC/DC	Up to 450 A (DC/80kHz AC)
Max. power	Up to 200 kW (DC/80 kHz AC)
Max. target length	4000 mm
Rotation speed	3 min ⁻¹ to 60 min ⁻¹
Safe operation weight load	≤ 500 kg horizontal mounting vertical mounting on request

The dimensions and interfaces of the **XC-L End Block** are compatible to all common magnetrons in the field and are therefore suited for retrofits.

X-SERIES END BLOCKS: XC-S & XC-L

Components for Rotatable Magnetrons

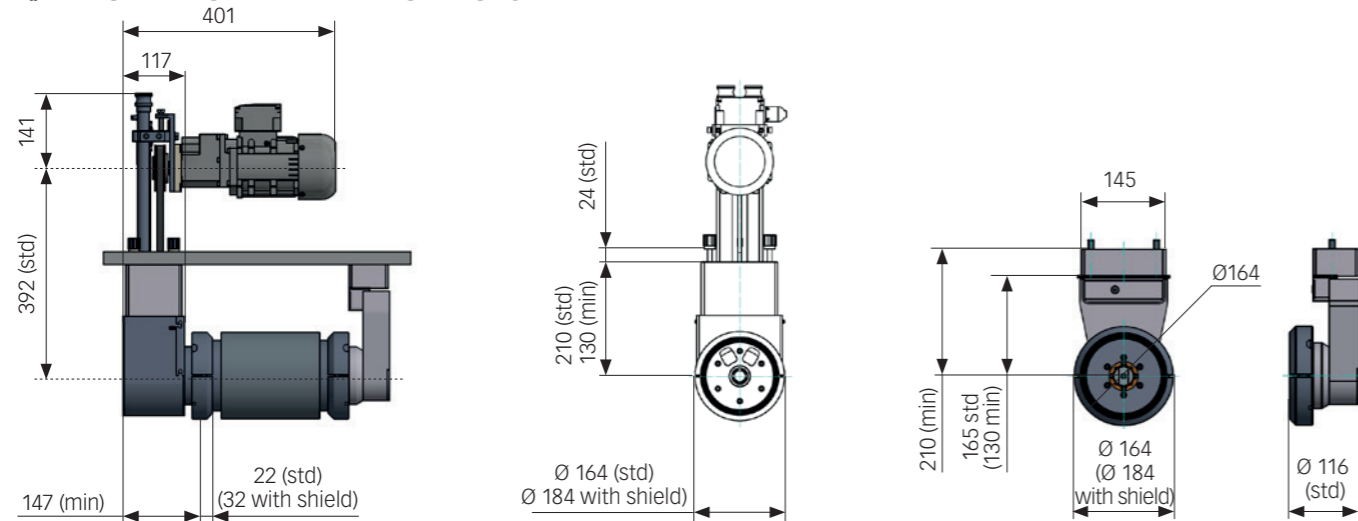
FEATURES

- ... Compact single-sided design
- ... Cartridge design for all wear parts
- ... Flexible target holder
- ... Interchangeable seal system
- ... Multiple shielding options
- ... Encapsulated areas and double redundant seal systems
- ... Smart ready
- ... Immediate vacuum check

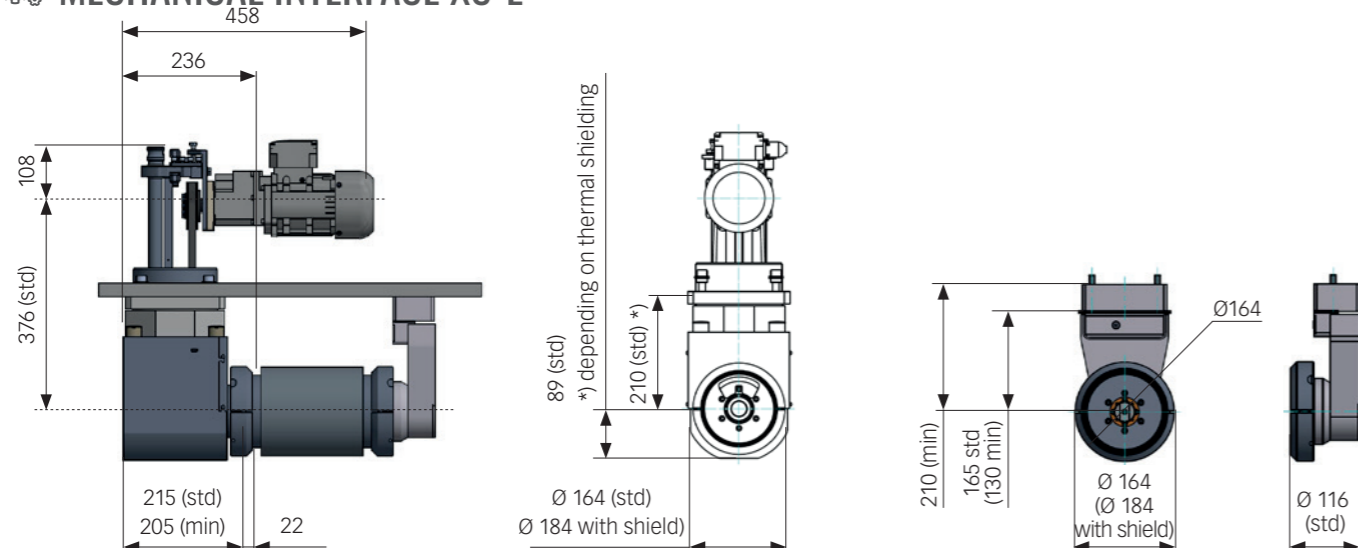
BENEFITS

- ... Less installation space and fewer seals necessary
- ... Basic maintenance in less than 15 minutes, advanced maintenance in less than 30 minutes
- ... No dismounting required
- ... Low chance of human error for seal systems
- ... Compensates unbalanced target
- ... Reduce forces on bearing
- ... Always up to date with best seal systems
- ... Perfect fit for each process setup
- ... Separation of functions to ensure durability
- ... Prepared to achieve maximum control
- ... Direct check of vacuum seal to support process fault isolation

MECHANICAL INTERFACE XC-S



MECHANICAL INTERFACE XC-L



Efficient Wear & Spare Part Concept

Due to the modular setup, easy accessibility and robust design, only a small number of wear and spare parts must be handled:

- ... Water and vacuum sealing cartridges for regular service
- ... Carbon brushes and sealings for advanced service
- ... Carbon brush exchange can be done individually
- ... For regular and advanced service, the end block remains installed, no need for additional end block maintenance areas near production tools
- ... Bearings and further critical parts designed as permanent or "never needs maintenance"
- ... Seal counter surface and sealing designed as plug and play: interchangeable parts to keep seal systems always up to date

Proven Tool Kit

A small but comprehensive tool kit is available for fast and convenient service actions:

- ... Contains every tool (incl. standard tools e.g. screwdriver) for a standardized service -> no need for an additional basic tool kit
- ... Each tool kit is tested while assembling end blocks for the customer.
- ... One toolkit equips one technician for one end block.
- ... Condition based maintenance
 - ... Regular service (< 15 min / end block)
 - ... Advanced service (< 30 min / end block)



End Block XC-S & XC-L - Wear parts

Condition-Based Maintenance

Regular service (< 15min / end block)

- ... includes water and vacuum rotary sealing
- ... 1 year+ interval (depending on process set up and rotation speed)

Advanced service (< 30min / end block)

- ... includes water and vacuum rotary sealing
- ... Additionally brushes and/or sealing counter surface can be replaced if needed
- ... 5 years+ , interval depending on the target weight

Quality Control

VON ARDENNE ensures the highest level of quality standards for all end blocks. Three special test stations are used for long-time tests and quality control while manufacturing in terms of vacuum integrity. Additional test stations guarantee safe operation for high-power applications and high-temperature conditions.

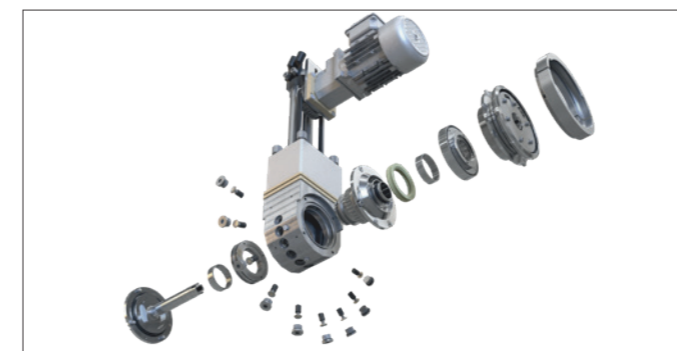
Test stations: static vacuum and water integrity, rotating vacuum and water integrity, complete functional tests at process power and target load



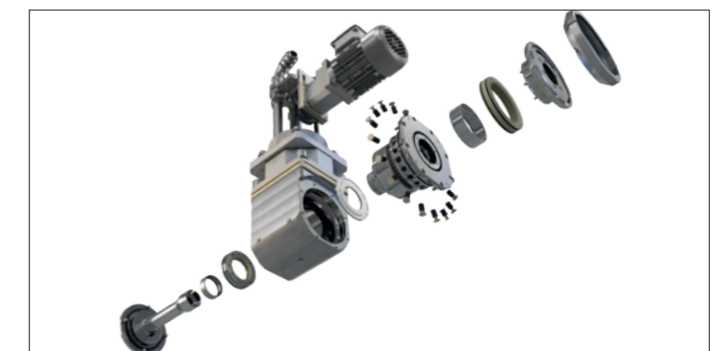
End block rotation test station
up to 6 end blocks simultaneously

Modular Setup XC-S & XC-L

- ... All spare parts available separately
- ... Exchange of single parts for easy adaption of other components (e.g. inline adjustable magnet bars,...)



X-SERIES END BLOCK XC-S



X-SERIES END BLOCK XC-L

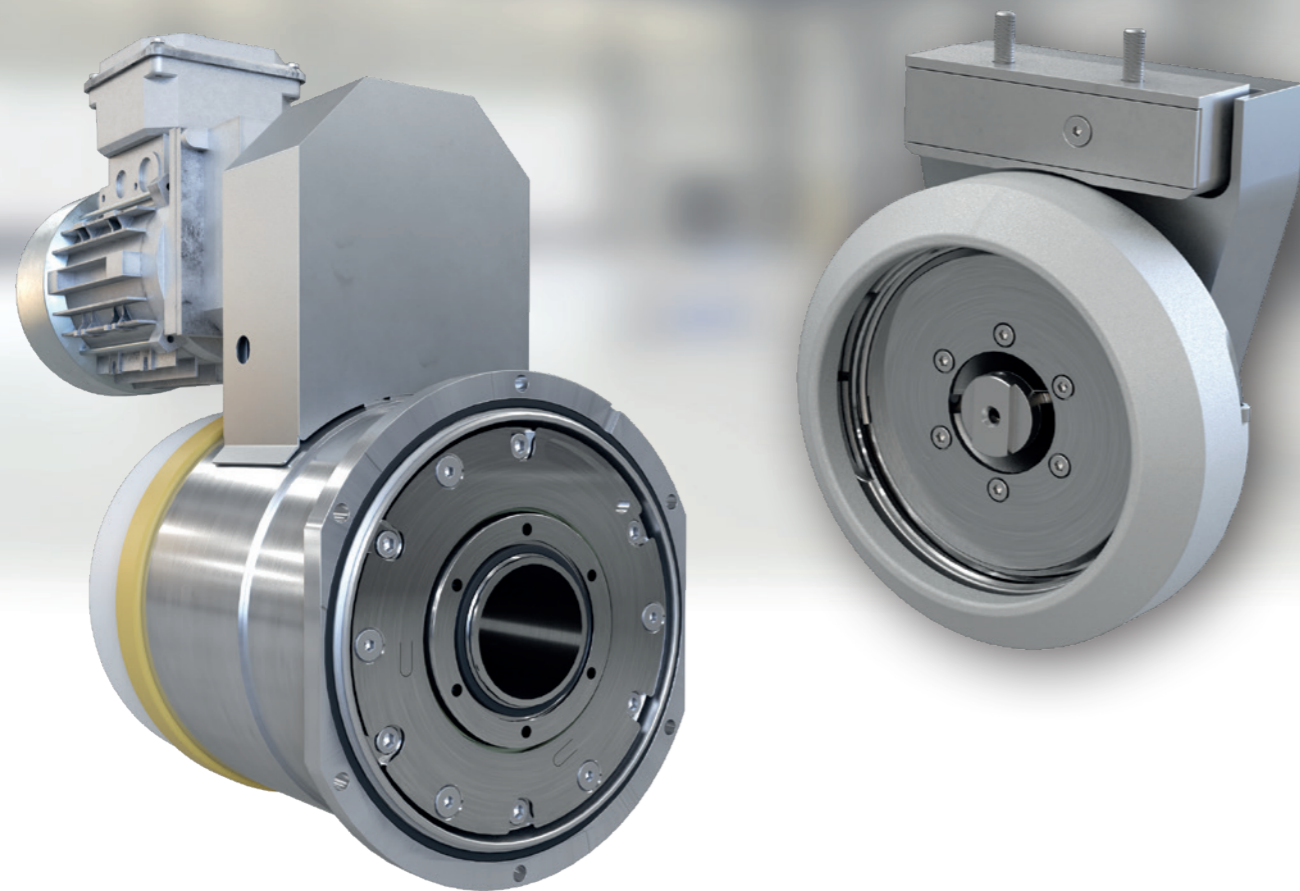
Y-SERIES END BLOCKS: YC-L

Components for Rotatable Magnetrons

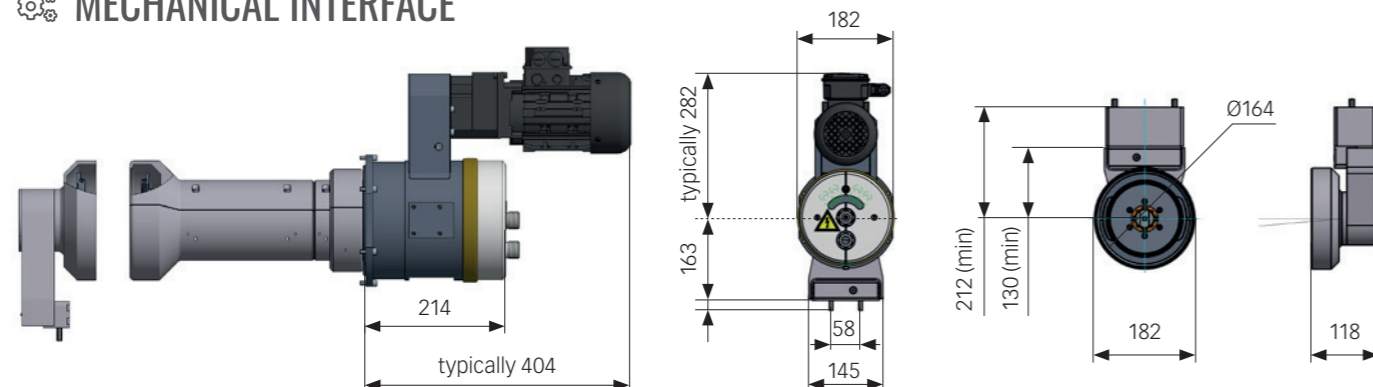
The **Y-SERIES END BLOCK YC-L** are used for applications where externally mounted end blocks are required. The basic concept is a single sided design where all media connections and drive assemblies are installed in one end block.

They are suited for roll-to-roll coating systems and carrier-based coating systems. Horizontal and vertical glass coating systems can be also be equipped with them.

The **YC-L** is available for upgrades and retrofits for all coating systems, regardless of the manufacturer, and covers a wide range of specifications.



MECHANICAL INTERFACE



FEATURES

- ... Compact single sided design
- ... Cartridge design for all wear parts
- ... Flexible target support
- ... Interchangeable and redundant seal systems

BENEFITS

- ... Less installation space, less seals necessary
- ... Basic maintenance in less than 15min, advanced maintenance in less than 30min
- ... No dismounting required
- ... Low chance of human error for seal system replacement
- ... Compensates unbalanced target
- ... Reduce forces on bearing
- ... Always up to date with best seal systems
- ... Separation of functions to ensure durability

Condition-Based Maintenance

Regular service (< 15min / end block)

- ... Includes water and vacuum rotary sealing
- ... 1 year+ interval (depending on process set up)

advanced service (< 30min / end block)

- ... Includes water and vacuum rotary sealing
- ... Additionally brushes and/or sealing counter surface can be replaced if needed
- ... 5 years+ , interval depending on the target weight

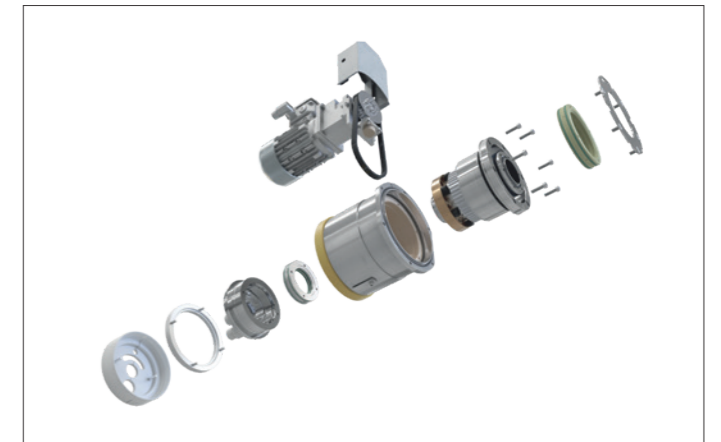
Efficient Wear & Part Concept

Due to the modular setup, easy accessibility and robust design, only a small number of wear and spare parts must be handled:

- ... Water and vacuum sealing cartridges for regular service
- ... Brushes and sealings for advanced service
- ... Carbon brush exchange can be done individually
- ... For regular and advanced service, the end block remains installed, no need for additional end block maintenance areas near production tools
- ... Bearings and further critical parts designed as permanent or "never needs maintenance"
- ... Seal counter surface and sealing designed as plug and play: interchangeable parts to keep seal systems always up to date

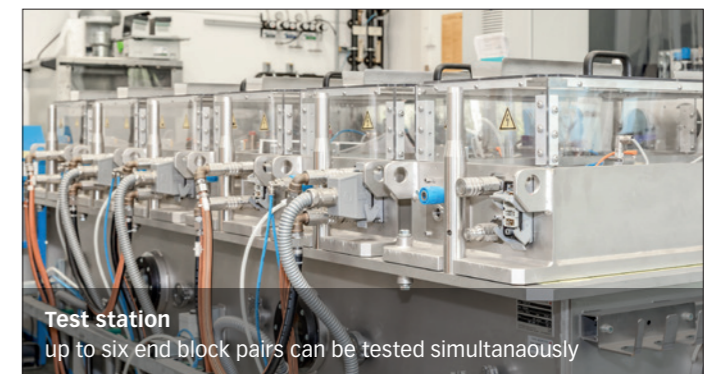
Modular Setup

- ... All spare parts available separately
- ... Exchange of single parts for easy adaption of other components (e.g. inline adjustable magnet bars,..)



Quality Control

VON ARDENNE ensures highest level of quality standards for all end blocks. A special test station with four vacuum chambers is used for long-time tests and quality control while manufacturing in terms of vacuum integrity. Additional test stations guarantee safe operation for high power applications and high temperature conditions.



Test station
up to six end block pairs can be tested simultaneously

TECHNICAL DATA

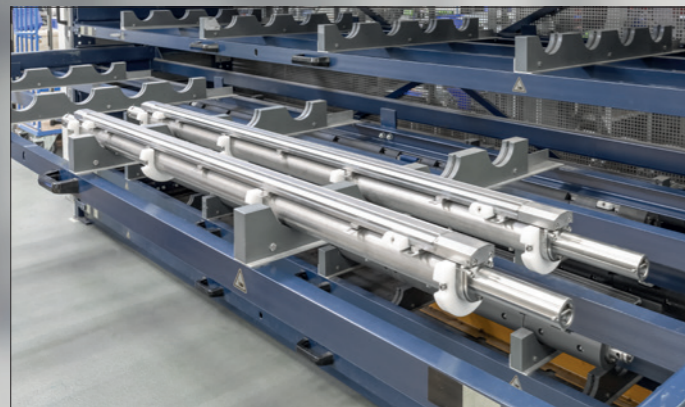
Subject to change without notice due to technical improvement.

Mounting position	horizontal and vertical
Max. current AC/DC	350 A (DC/80kHz AC)
Max. power	160 kW (DC/80 kHz AC)
Max. target length	4000 mm
Rotation speed	3 min ⁻¹ to 60 min ⁻¹
Safe operation weight load	≤ 500 kg horizontal mounting vertical mounting on request

The Y-Series end blocks are suited for retrofits on all common coating systems in the field using side-mounted end blocks as their dimensions and interfaces are compatible.

MAGNET BARS

Components for Rotatable Magnetrons



VON ARDENNE magnet bars are state of the art in technology. We have installed more than 2000 magnet bars in all fields of coating application.

In the development of our magnet bars, we focus on target erosion, layer uniformity, process stability and application-dependent field strengths.

They are available in a wide range of strengths and lengths and are inspected in our in-house facilities for quality control.

FEATURES

- ... Optimum layer uniformity
- ... High target utilization
- ... Uniform layer properties over the full substrate width
- ... Optimal setting for your technology regarding
 - ... uniformity
 - ... sputter rate
 - ... process voltage
 - ... energy impact on substrate
- ... Reduced process voltage
- ... Maximum process power (only limited by target material or bonding)
- ... Optimum solutions and support of process requirements

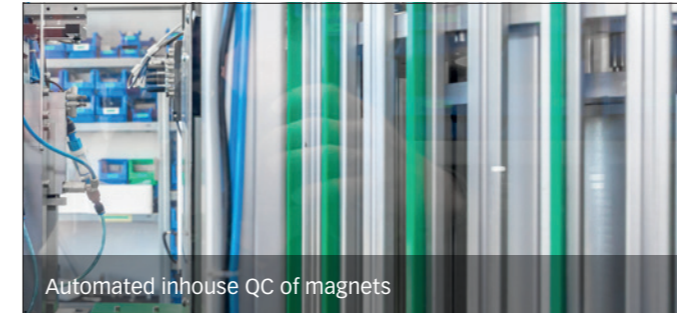
BENEFITS

- ... Excellent magnetic field uniformity
- ... Optimized race track return design and different end caps
- ... Variation of sputter angle between $\pm 15^\circ$ and $\pm 60^\circ$
- ... Available with inverted magnet arrangement
- ... Optimized cooling concept
- ... Technological experience
- ... Use with any end blocks

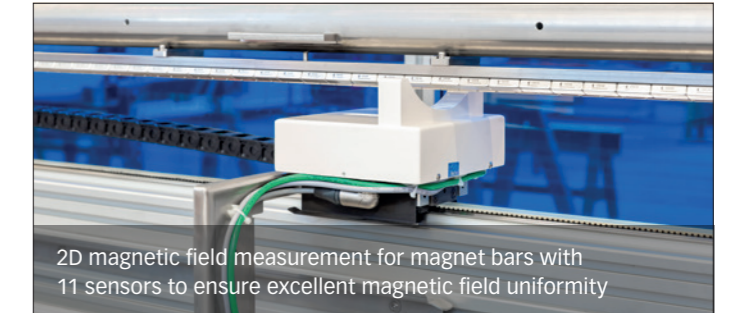
Best Quality Control on the Market

- ... In-house quality control of magnets - only magnets meeting very demanding specifications are used for assembly of magnetic systems
- ... Our magnetic systems are assembled by skilled workers.

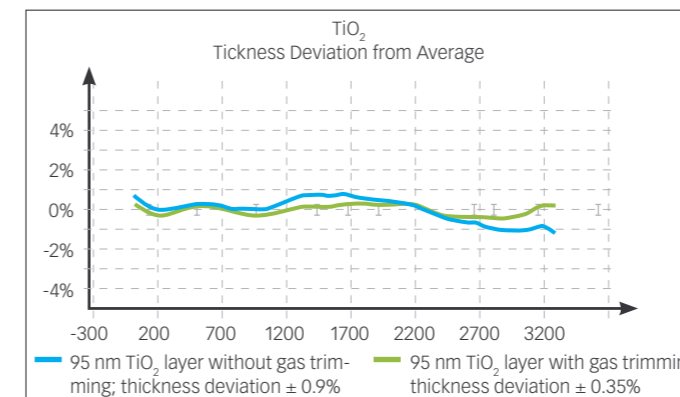
- ... High sensitivity magnetic measurement during assembly [11 sensor simultaneous measurement for fast and complete 2D magnetic field scan]
- ... Re-assembly of magnetic systems if needed, until uniformity spec is fulfilled



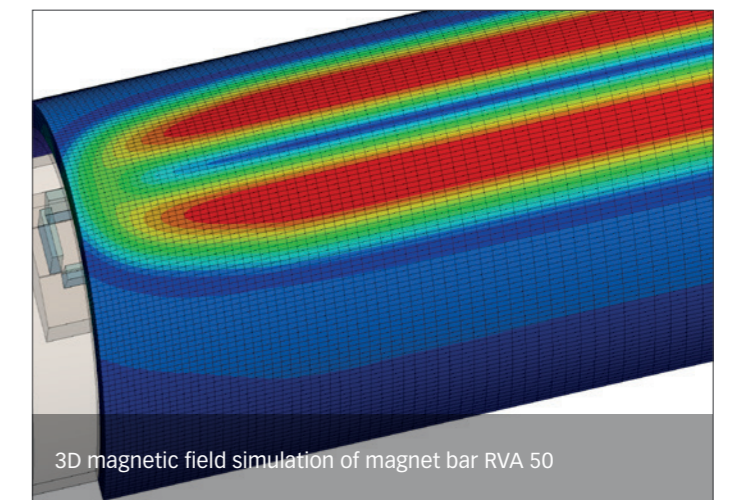
Automated inhouse QC of magnets



2D magnetic field measurement for magnet bars with 11 sensors to ensure excellent magnetic field uniformity



Application example RVA 30: resulting layer uniformities large-area coating



3D magnetic field simulation of magnet bar RVA 50

TECHNICAL DATA

Subject to change without notice due to technical improvement.

	RVA 30	RVA 50	RVA 70	RVA 100
Max. magnetic-field flux density at target surface ($\varnothing 152$ mm) typ./max.	27 / 29 mT 270 / 290 Gauss	52 / 55 mT 520 / 550 Gauss	68 / 72 mT 680 / 720 Gauss	112 / 118 mT 1120 / 1180 Gauss
Target utilization	> 80 % with dog bone targets	> 85 % with straight targets	> 85 % with straight targets	> 85 % with straight targets
Application	Architectural glass, web coating/display, AR	Architectural glass, photovoltaics, web coating/display, AR, special applications	Architectural glass, photovoltaics, web coating/display, AR, special applications	ITO, photovoltaics, web coating/display, special applications
Length	Up to 4000 mm	Up to 4000 mm	Up to 4000 mm	Up to 4000 mm
Typical target materials	Sn, Zn, ZnSn, Si, TxO,...	Sn, Zn, ZnSn, Si, TxO, Cu, Al, Ag, In,...	CuGa, AZO, Si, metals,...	ITO
Magnetic field uniformity	$\leq \pm 1.25\%$	$\leq \pm 1.25\%$	$\leq \pm 1.25\%$	$\leq \pm 1.25\%$
Resulting layer uniformity, down to	$\leq \pm 0.5\%$	$\leq \pm 0.5\%$	$\leq \pm 0.5\%$	$\leq \pm 0.5\%$

PLANAR MAGNETRON BODIES

Components for Planar Magnetrons

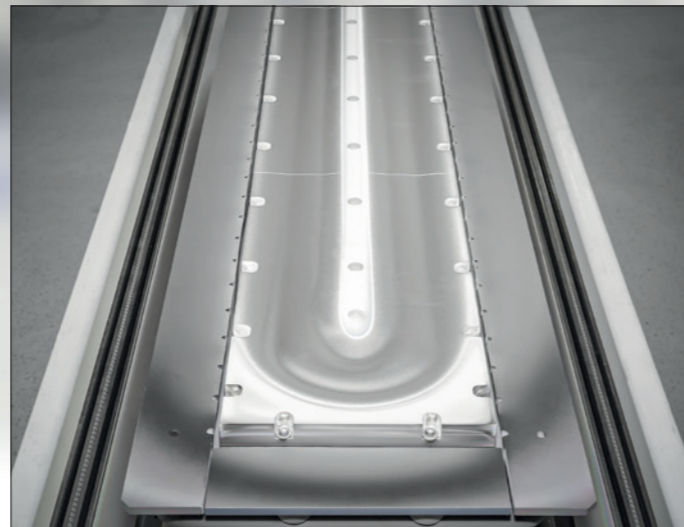
We offer state-of-the-art planar magnetrons for high-end technology applications. Our components are developed and manufactured 100 percent by VON ARDENNE.

Their performance has been industry-proven in depositing blocker and absorber layers for high-end triple Low-E coatings on glass coating systems but also in PV coating systems, in roll-to-roll web coaters and coating systems for display and other special applications.

We have sold more than 350 planar magnetrons for a wide range of different applications. They are available for retrofits and as adaption for new coating lines. Furthermore, we can provide them as complete process lids with and without direct pumping.

Hot target clamping is available (e.g. for ITO) for process evaluations for NiCr, Cr, Ag and others.

The product family consists of three different types of magnetrons: the wide single magnetron WSM, the High-Utilization Planar Magnetron HU-WSM and the Planar XT for planar applications on wide areas and SSM and HU-SSM for smaller areas.



FEATURES

BENEFITS

STANDARD WSM & SSM BODY

- ... Common planar type in last years
- ... Simple target design
- ... Target utilization 30 % for WSM (e.g. 4500 kWh for 30 mm Ag)
- ... Coating uniformity of $< \pm 1.0 \%$

- ... Stable operation
- ... Good layer uniformity

erosion profile



HIGH-UTILIZATION PLANAR HU-WSM & HU-SSM BODY

- ... Target life time 6000 kWh for 30 mm Ag
- ... Target utilization $\approx 35 \%$ to 40% for HU-WSM
- ... Coating uniformity of $< \pm 1.0 \%$; with targets close to end of lifetime $< \pm 1.5 \%$

- ... Longer target lifetime
- ... Higher target utilization
- ... Stable performance over whole target life time

erosion profile



PLANAR XT BODY

- ... Target lifetime potentially > 7000 kWh for Ag
- ... Target utilization $> 40 \%$
- ... Coating uniformity for planar cathodes (down to $\approx \pm 0.5 \%$)
- ... Simple target design

- ... High-performance in layer uniformity over whole target life time
- ... Long target life time
- ... Highest target utilization
- ... Simple and easy to manufacture target designs

erosion profile



ALL

- ... Sealed cooling channel
- ... Magnets are not exposed to water, no water seals are broken during target exchange.

Best Quality Control on the Market

- ... In-house quality control of magnets - only magnets meeting our demanding specifications are used for assembly of magnetic systems
- ... Our magnetic systems are assembled by skilled workers.

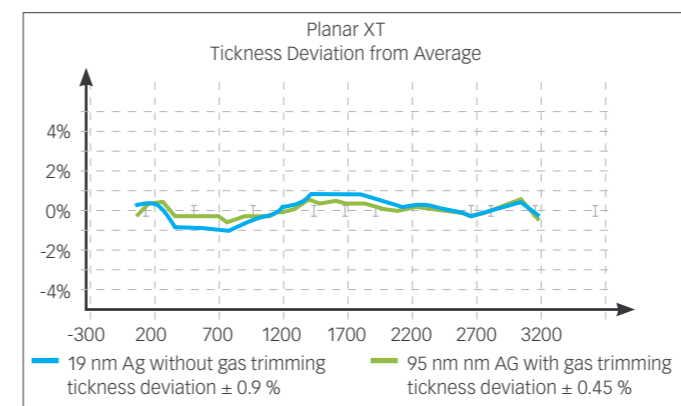


Automated inhouse QC of magnets

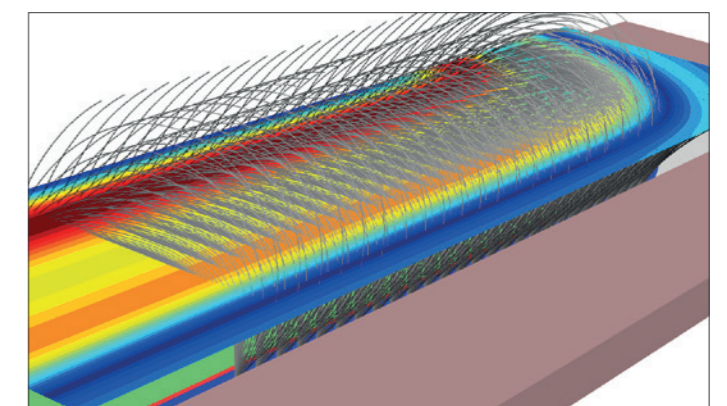
- ... High sensitivity magnetic measurement during assembly [3 sensor simultaneous measurement for fast and complete 2D magnetic field scan]
- ... Re-assembly of magnetic systems if needed, until uniformity spec is fulfilled



2D magnetic field measurement for planar bodies with 3 sensors to ensure excellent magnetic field uniformity



Application ex. Planar XT: resulting layer uniformities large-area coating



3D magnetic field simulation HU-WSM body

TECHNICAL DATA

Subject to change without notice due to technical improvement.

	WSM & SSM	HU-WSM & HU-SSM	PLANAR XT
Target materials	Ag, NiCr, Cr, Ti, all common DC target materials	Ag (limited by cooling and target design)	Ag, NiCr, Cr, Ti, all common DC target materials
Target life [kWh/m] for 30 mm Ag target	1096 kWh/m for WSM	> 1550 kWh/m for HU-WSM	> 1680 kWh/m
Target utilization for 30 mm clamped Ag target	up to 30 % for WSM	$> 35 \%$ for HU-WSM	$> 40 \%$
Magnetic field strength at given target thickness	14 mT at 22 mm	15 mT at 30 mm 13 mT at 35 mm	20 mT at 30 mm
Max. process power	> 16 kW/m	8 kW/m	> 16 kW/m
Proven magnetic field uniformity	$\leq \pm 1.25 \%$	$\leq \pm 1.25 \%$	$\leq \pm 1.25 \%$
Resulting layer uniformity, down to	$\leq \pm 0.8 \%$	$\leq \pm 0.6 \%$	$\leq \pm 0.5 \%$

MAGNETRON LIDS

VON ARDENNE components are also available as a package: as drop-in magnetron lids or side-mounted process units for a wide range of applications. Thanks to many years of experience gained from designing and installing advanced sputtering equipment, we can offer a complete portfolio of solutions from AC to DC processes, planar to rotatable applications and even magnetrons with integrated turbopumps.

VON ARDENNE offers complete technology solutions based on our deep knowledge in engineering advanced sputtering equipment and our hands-on experience from application development. We provide high-quality customized components to meet the application requirements of our customers. These components are suitable for the wide scope of DC or AC processes ranging from 10 to 180 kW with a variety of magnet designs and offers a fully integrated gas inlet system for your magnetron equipment.

VON ARDENNE sputtering equipment is available for all coating systems in the field, be it VON ARDENNE coating systems or third-party equipment, as a proven solution for a wide range of specific applications.



We also offer customized solutions for retrofits on coating systems already in the field. This enables customers to continue their process development and to acquire state-of-the-art equipment.

Magnet Bar and Magnet Systems

All magnet bars and magnet systems are similar in mechanical design and thereby interchangeable. Furthermore, our magnet bars and systems are very flexible in order to fit the specified application.

A stronger field provides lower process voltage, which makes it preferable for metallic processes. A weaker field, on the other hand, increases the coating uniformity and reduces drop-off at the substrate edges.

VON ARDENNE offers superior uniformities with all available magnetrons.



FEATURES

- ... Field-proven technology know-how in all fields of application
- ... Directly pumped process lid design available
- ... Wide range of planar & rotary cathode design for different applications
- ... Single or multi segmented gas inlet designs as nozzle or binary channel
- ... Multiple anode solutions and magnetron designs for hot process conditions in horizontal, vertical and R2R coating applications
- ... Tool box with different magnetic field designs and end block types

BENEFITS

- ... State-of-the-art design concepts to fit your requirements
- ... Saves installation floor space or decouples different processes
- ... Process set-ups from DC via pulsed DC, AC to bipolar and RF
- ... Gas inlet design as good as your process needs
- ... No limitations in application-dependent setups
- ... Optimal combination of proven techniques & technologies for your process

TECHNICAL DATA

Subject to change without notice due to technical improvement.

	MAGNET SYSTEM FOR PLANAR MAGNETRONS			MAGNET BAR FOR ROTATABLE MAGNETRONS			
	WSM & SSM	HU WSM & HU SSM	Planar XT	RVA30	RVA50	RVA70	RVA100
Magnetic field strength at standard target thickness	14 mT 140 Gauss	13 mT 130 Gauss	20 mT 200 Gauss	30 mT 300 Gauss	50 mT 500 Gauss	70 mT 700 Gauss	100 mT 1000 Gauss
Standard target thickness	22 mm	35 mm	30 mm	specifications for 152 mm OD targets			

LION®

Linear Ion Source

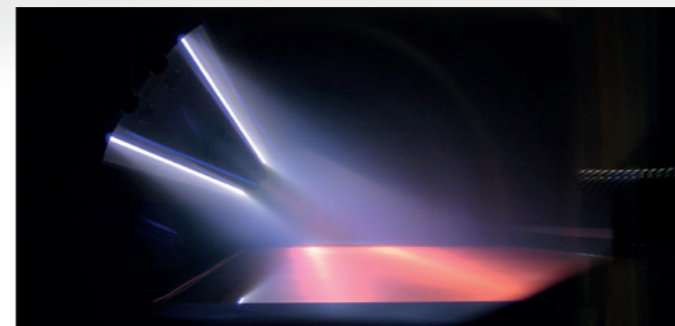
The VON ARDENNE Linear Ion Source **LION®** is a component that is suitable for pre-treatment and surface modification. It helps remove hydrocarbons and works with argon and, if necessary, with additional oxygen.

The ion beam of the **LION®** is strongly focused and highly energetic. Therefore, it is an ideal device for inline coating systems that require physical etching. Due to its simple and robust design, the ion source is easily scalable.

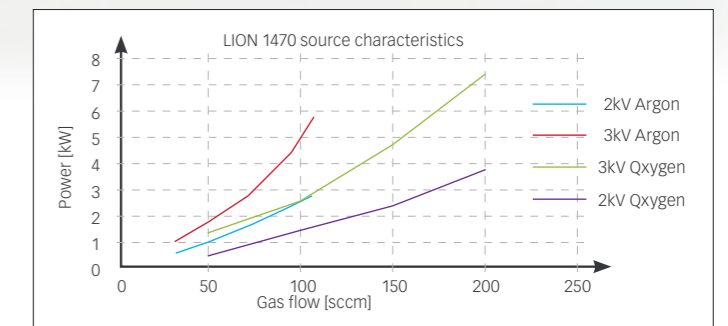
The main applications for the **LION®** are large-area glass coating and metal strip coating. It is available as a remote mounted version with an adjustable incidence angle or as a flange mount version.



LION® and glass substrate - etch rate SiO₂: 5 nm*m/min



LION® 1470 etch power as function of gas type and flow



FEATURES

- ... Simple - robust and scalable design
- ... Highly energetic and strongly focussed beam
- ... Pre-treatment of different substrate materials

BENEFITS

- ... Campaign time up to four weeks
- ... Excellent etching uniformity
- ... Easy customization

TECHNICAL DATA

Subject to change without notice due to technical improvement.

LION450		LION3450
Length body (scales in 150 mm steps)	420 mm	3420 mm
Effective etch width	300 mm	3300 mm
Power (max./typ.) in focussed Ar-operation	1.2 / 0.8 kW	10 / 6.3 kW
Power (max./typ.) in focussed O ₂ -operation	1.8 / 1.2 kW	14 / 9.8 kW
Operating voltage (max./typ.)	5 kV / < 3 kV	5 kV / < 3 kV
Operating pressure (max./typ.)	2E ⁻³ mbar / < 1E ⁻³ mbar	2E ⁻³ mbar / < 1E ⁻³ mbar
Gas type	Ar / O ₂	Ar / O ₂
Gas flow Ar (max.)	30 sccm	240 sccm

VA PROCOS 2

Process Control System for Reactive Sputtering

VA PROCOS 2 is a modular process control system that is specially designed for the stabilization of reactive sputter processes in the critical transition mode.

It is suitable for process characterization by optical emission lines, cathode voltage, oxygen partial pressure, combinations thereof and/or further PLC signals. Furthermore, it can be used for the stabilization of the plasma discharge and thus of the product properties by adjusting the supply of one or more reactive gases.

Since 1980, VON ARDENNE has been in a leading position in reactive sputtering processes. Furthermore, we have provided and optimized our process control system **VA PROCOS** for many years.

Our current **VA PROCOS 2** controls the reactive sputtering of compound layers and reliably stabilizes the working points in the crucial transition region. The system controls one or more reactive gas inlets (e.g. oxynitrides).

VA PROCOS 2 BASE UNIT

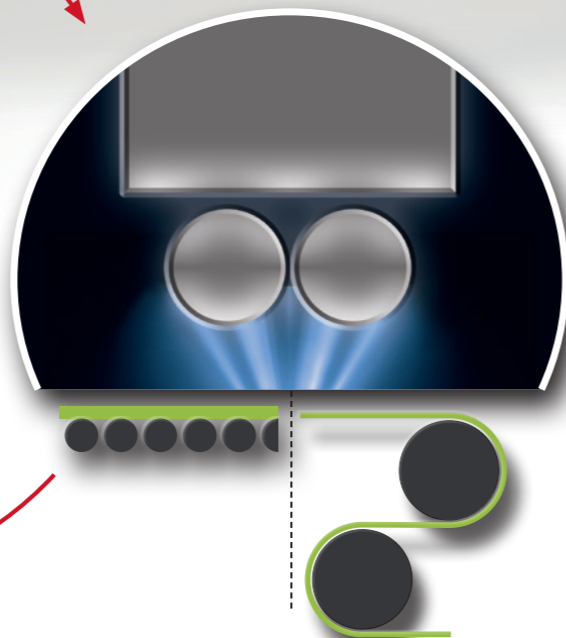
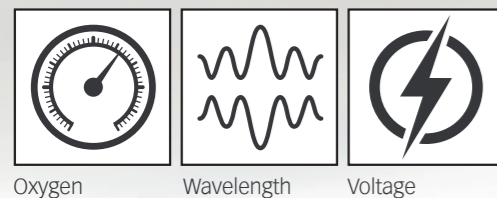
- ... Main controller for monitoring or process control application with 4 or 8 general purpose I/O channels;
- ... Profinet interface, optional Profibus and I/O link for digital MFC

VA PROCOS 2 EXTENDER

- ... Unit to extend BASE with 4 or 8 general purpose I/Os
- ... Multiple units can be interconnected via profinet

VA PROCOS 2 SOFTWARE

- ... Monitor (trending) and process control
- ... Can be easily configured



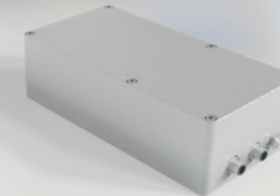
APPLICATION EXAMPLE

Higher sputtering rate → More productivity	SiO ₂ deposition rate [nm*m/min]	WITHOUT 30	WITH > 95
New film properties → New applications	Layer properties ZAO	transparent or conductive	transparent & conductive
Reduced arcing/nodules → Longer campaign times	Target SiO ₂		

OPTICAL INTENSITY MEASURING SYSTEM MS601



MF/DC VOLTAGE MEASURING UNIT SE04



O₂-LAMBDA PROBE



TECHNICAL DATA

Subject to change without notice due to technical improvement.

Wavelength range	185 nm to 900 nm
Vacuum connection	DN 40 ISO KF
Casing	temperature stabilized with water cooling
Power supply	24 V DC / 150 mA
Collimators	approx. (1 x 1.7) m ² , e.g. (6 x 9) 6" wafers
Max. ambient temperature of fiber optic	300 °C

Measurement range	2000 V
Peak input voltage	6000 V
Attenuation	1:1000
Output voltage	0 V to 10 V
Casing	IP67

ZrO ₂ sensor length	250 mm (other lengths on request)
Vacuum connection	DN 25 ISO KF
Analog gain	10x
Output voltage	0 V to 10 V
Casing	IP67

FEATURES

- ... PEM control, impedance control, Lambda control, balance/IMBAL
- ... Higher sputtering rate
- ... Specialized processing for ARC event detection and handling
- ... Choice of working point
- ... Automatic on-line balancing
- ... Thermal stabilized photomultiplier for PEM
- ... Unified analog I/O port for all sensors and actors
- ... IP67, robust cases, EMI shielded

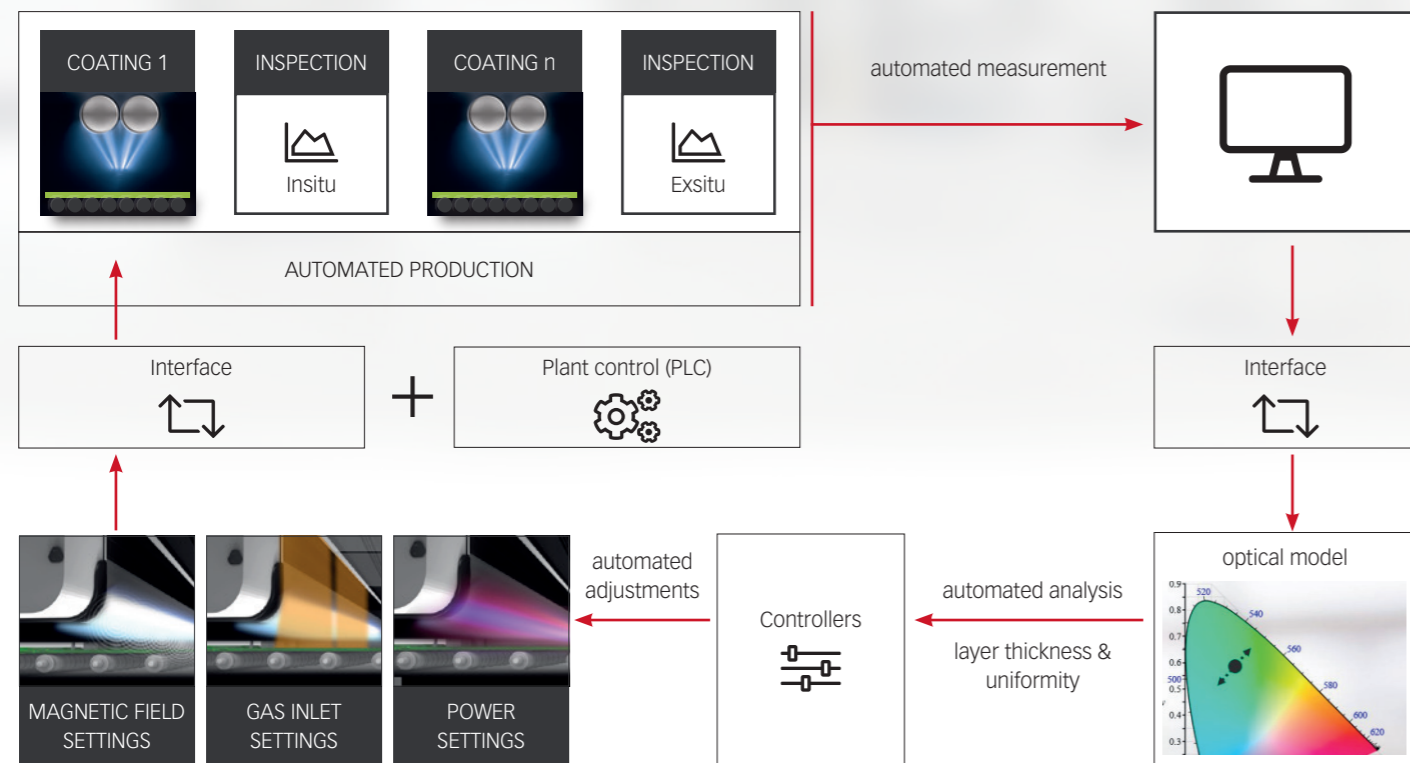
BENEFITS

- ... Stabilization of process, reduction of loss and longer campaign times
- ... Optimized layer and stoichiometry uniformity
- ... Stable measurements and control for low intensity plasma
- ... Increased productivity
- ... Less energy consumption (less power for same deposition rate)
- ... Process adapted and ready to use configuration
- ... Flexible configuration of hardware
- ... Designed for operation in an industrial environment

VA PROCESSMASTER

Process control in large-area coating is usually a non-automated task. It requires permanent monitoring of online measurements by human operators to detect deviations from a given reference spectrum. Such deviations result from different sources. Typically, the operator must decide which process parameters need to be adjusted. The operator's experience is crucial to achieve fast and reproducible results.

The **VA PROCESSMASTER** is the tool for automated process setting and control for all layer systems. It follows a novel approach in process control and leads to best results without operator interaction. It also allows for a fully-automated drift compensation of the sputtering process and improves product quality. In a further step, this tool enables our customers to create complex recipes for attractive products. The tool also helps increase the productivity of a coating system, as it enables a faster adjustment to a new recipe.



FEATURES

Defined and predictable

- ... Process correction follows best-practice algorithm, not individual operator experience

Permanent action and 24/7 operation

- ... Process deviations minimized instead of waiting for threshold violation
- ... No „sawtooth“ curves upon startup

Full overview

- ... Simultaneous control of all magnetrons
- ... Simultaneous mean value control of layer thickness and uniformity

BENEFITS

- ... Increased yield & reduced cost of quality & claim management by
 - ✓ **Improved quality** by stabilized sputter process, reduced product variation and out-of-spec losses
 - ✓ **Larger product portfolio** with more profitable products
 - ✓ **More output** by accelerated product recipe changes in order to gain production up-time
 - ✓ **Stable operating points** over long periods
 - ✓ **Very high homogeneity** of individual layers and layer stacks (color)
- ... **Simplified operation**
- ... **Larger product portfolio** with more profitable products

VA TRIM & SHIM TOOL

The VON ARDENNE Online Trimming and Shimming Module is a web-based application that enables the quick optimization of the thickness uniformity („% range“) of a single thin layer.

After entering a measured thickness profile and the current trim gas settings, it proposes new trim gas settings that lead to improved uniformity.

In the same manner, the magnet bar adjustment („shimming“) for optimal settings can be calculated.

Trimming and Shimming

Trimming means the adjustment of gas flows at each individual gas inlet segment of the magnetron in order to achieve the most uniform layer thickness at any position of the glass pane.

This adjustment can be carried out while the coater is operating using the VON ARDENNE Ex-Situ Measuring System and visualization together with the Trimming & Shimming Module. Trimming adjustment is usually the first choice to improve the thickness uniformity.

Shimming is the adjustment of the magnetic system of rotatable magnetrons in order to improve the thickness uniformity locally on the glass substrate.



FEATURES

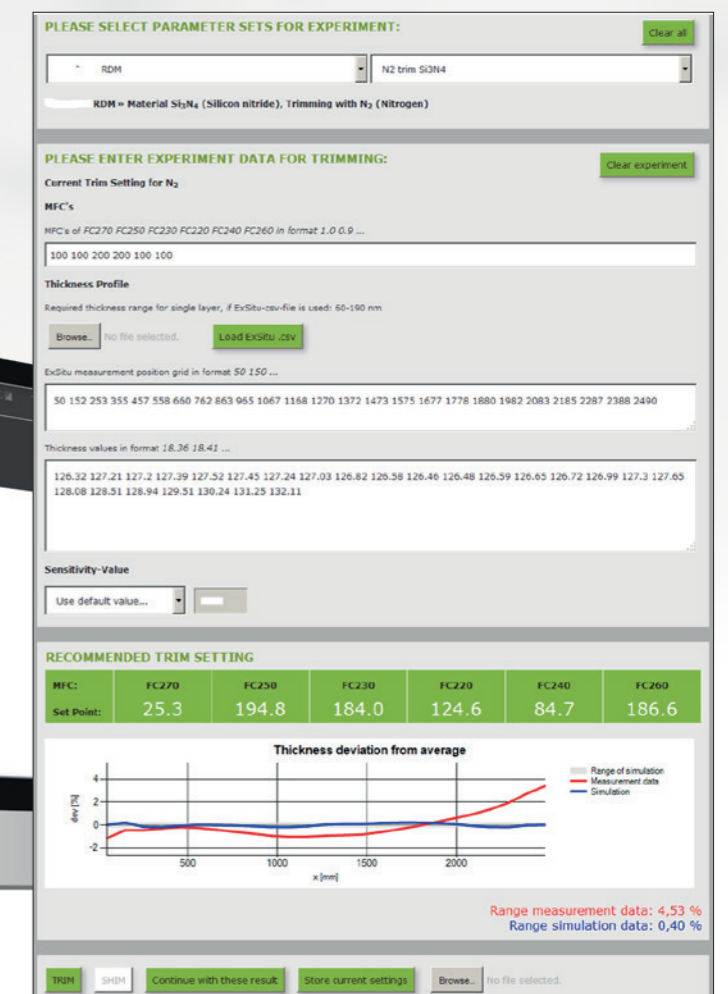
- ... Tuning of each layer to reach best uniformity
- ... Startup tuning of homogeneity after target change
- ... Pit-stop correction of long-term deviation of thickness profile

Procedure

Initially, a sample coating of a single layer is made under the current conditions. The measured color data is imported from the ex-situ measuring system into the trimming and shimming software. In the next step, the current trimming gas settings/shimming values are typed in.

First, the application calculates the layer thickness profile based on the measured spectra. Then, new trimming gas settings/shimming values for improved thickness uniformity are calculated. This data is entered into the visualization. Subsequently, a new sample coating is made and the thickness is measured again to confirm the improvement.

This procedure only needs to be repeated if the result is not satisfactory. Generally, it takes two to three iterations to obtain the best result.



BENEFITS

- ... Enables applications with strict uniformity requirements, like double or triple Low-E
- ... Increases product quality
- ... Reduces time needed

OUR STRENGTHS



IN-HOUSE TECHNOLOGY & APPLICATION CENTER

- ... Sample coatings of customer applications
- ... Development of customized layer stacks
- ... Product & process verification and optimization
- ... Testing of new technologies and components



GLOBAL PROJECT EXPERIENCE

VON ARDENNE equipment is used in over 50 countries.

We have established an installed base of hundreds of coating systems worldwide, ranging from small tools to equipment for large-area coating applications for several markets.



CLOSE PARTNERSHIP

VON ARDENNE has a network of partners for even more profound R&D work and to identify future technologies. It consists of:

- ... Fraunhofer Institutes such as IPMS, FEP, IST and ISE
- ... Institutes of the Helmholtz Association (Jülich, Berlin)
- ... Universities (Kiel, Dresden, Sheffield)
- ... Companies such as FAP GmbH, scia Systems GmbH



PROFESSIONAL SIMULATION SUPPORT

We offer professional simulation technology to ensure best process quality with regards to plasma, heat and cooling. Furthermore, our simulation tools help demonstrate, develop and improve layer properties and define or optimize processes, details and the performance of our systems.



COMPREHENSIVE SERVICE PORTFOLIO

- ... VON ARDENNE service hubs around the world
- ... On-site service
- ... Remote access by our technology department
- ... Regular technical and technological trainings
- ... Spare & wear part warehouse close to customers
- ... Lifecycle extension of wear parts



UPGRADES & RETROFITS

As soon as your business is growing, your VON ARDENNE equipment will grow accordingly - thanks to its modular design and the upgrades we provide. We will also supply you with the necessary technology upgrades if you decide to change your applications.

Furthermore, when your equipment is ageing, we will retrofit your systems with new components, no matter if they are VON ARDENNE or third-party machines.



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vonardenne.com

WHO WE ARE & WHAT WE DO

VON ARDENNE develops and manufactures industrial equipment for vacuum coatings on materials such as glass, wafers, metal strip and polymer films. These coatings give the surfaces new functional properties and can be between one nanometer and a few micrometers thin, depending on the application.

Our customers use these materials to make high-quality products such as architectural glass, displays for smartphones and touchscreens, solar modules and heat protection window film for automotive glass.

We supply our customers with technologically sophisticated vacuum coating systems, extensive expertise and global service. The key components are developed and manufactured by VON ARDENNE itself.

Systems and components made by VON ARDENNE make a valuable contribution to protecting the environment. They are vital for manufacturing products which help to use less energy or to generate energy from renewable resources.



SALES
CONTACTS



SERVICE
CONTACTS

WORLDWIDE SALES AND SERVICE

VON ARDENNE GmbH (headquarters) | Am Hahnweg 8 | 01328 DRESDEN | GERMANY

Sales: ☎ +49 (0) 351 2637 189 | sales@vonardenne.com

Service: ☎ +49 (0) 351 2637 9400 | support@vonardenne.com

VON ARDENNE Vacuum Equipment (Shanghai) Co., Ltd. | ☎ +86 21 3769 0555 | 📠 +86 21 6173 0200 | sales-vave@vonardenne.com; support-vave@vonardenne.com

VON ARDENNE Malaysia Sdn. Bhd. | ☎ +60 4408 0080 | 📠 +60 4403 7363 | sales-vama@vonardenne.com; support-vama@vonardenne.com

VON ARDENNE Japan Co., Ltd. | Tokyo office | ☎ +81 3 6435 1700 | 📠 +81 3 6435 1699 | sales-vajp@vonardenne.com; support-vajp@vonardenne.com

VON ARDENNE North America, Inc. | Ohio office | ☎ +1 419 386 2789 | 📠 +1 419 873 6661 | sales-vana@vonardenne.com; support-vana@vonardenne.com

VON ARDENNE Vietnam Co., Ltd. | ☎ +84 966 29 29 50 | sales-vavn@vonardenne.com; support-vavn@vonardenne.com

VON ARDENNE India Pvt. Ltd. | sales-VAID@vonardenne.com; support-void@vonardenne.com