isovac®

ELECTRICAL INDUSTRY

Shape the future –
with isovac® by voestalpine

Domenico Marchese, Key Account Manager

voestalpine Steel Division
www.voestalpine.com/isovac

voestalpine
ONE STEP AHEAD.

isovac®

MORE THAN JUST ELECTRICAL STEEL

Electrify Tomorrow

The electrical industry is one of the most versatile and innovative sectors in the world. Whether for electric motors, generators or transformers—the requirements could not be more unique. Companies who don't take the path of continuous innovation risk being passed up in the long run.

With our comprehensive material know-how and expertise in the market, we engage in development partnerships with leading companies in the electrical industry worldwide. These partnerships make it possible for our customers to contribute substantially to the green electrification of our future.

To find out more about isovac®, visit us on our website at
www.voestalpine.com/isovac/en

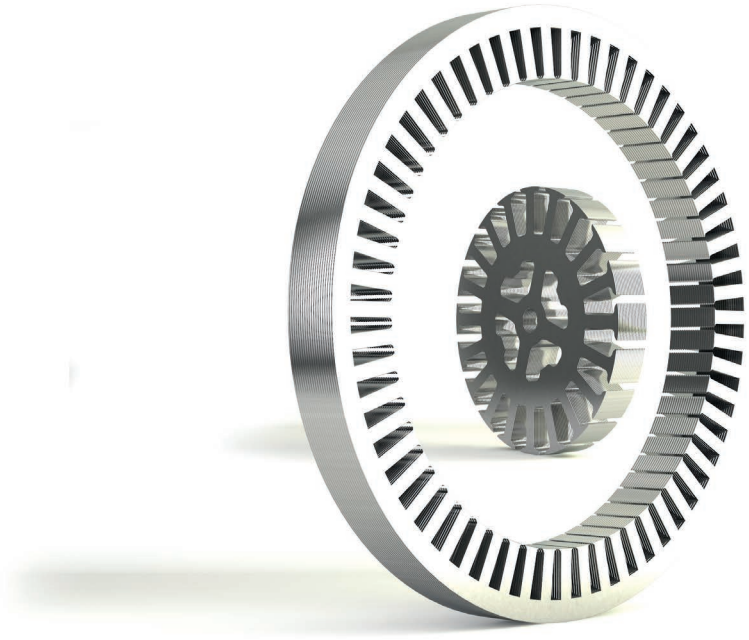
100% Performance

100% Green Power

0% Troubles

SEE FOR YOUR-SELF WHAT isovac® CAN DO!

Tailored solutions for individual demands



We set new standards with isovac®, an innovative electrical steel with excellent properties that lead to high performance as well as unsurpassed sustainability and meet much more than merely standard requirements. Our electrical steels find their applications in generators for hydraulic power stations, drive motors in the automotive industry, electric motors and compressors for household appliances, shielding systems used in medical technologies, motors for fully automated production lines, magnets for synchrotrons (particle accelerators), transformers for welding machines, power conversion reactance coils, and much more.

On the following pages you will find out more about isovac®, the electrical steel of voestalpine. Discover what added value it can bring to your business in the following fields of application:

- Generators
- Motors
- Static machines

100% Performance

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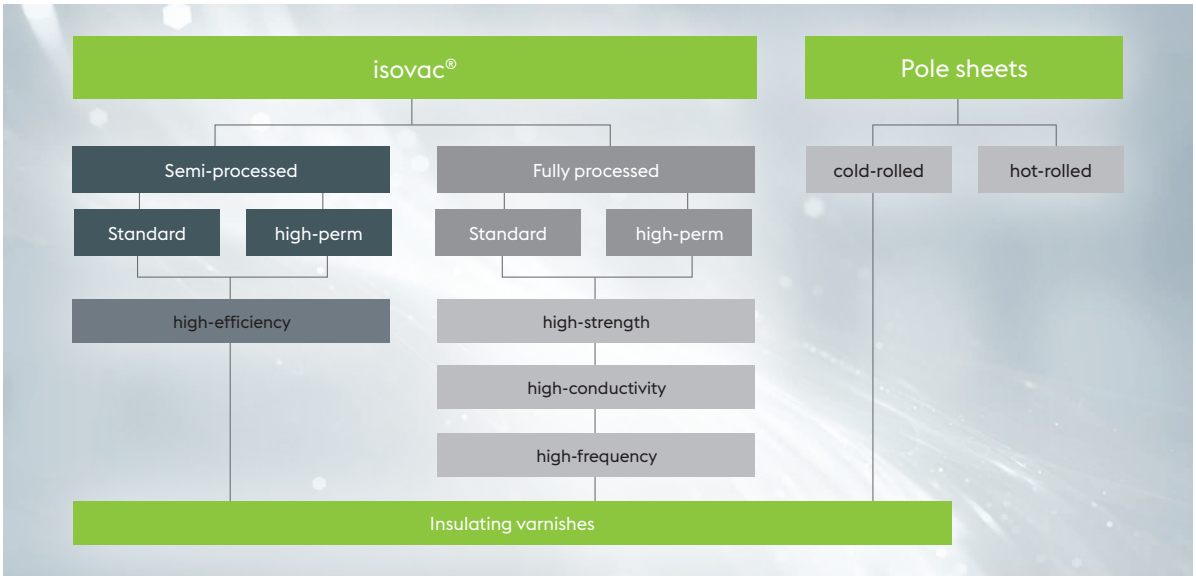
isovac®
PRODUCT RANGE

isovac®, our electrical steel for the highest energy efficiency, and our pole sheets provide you with a comprehensive package of benefits. Because of its excellent property profile, isovac® is a leading product worldwide.



isovac® – SEMI-PROCESSED AND FULLY PROCESSED

As a result of continuous rolling and annealing processes, all isovac® grades guarantee homogeneousness of the material with respect to its mechanical, geometric and magnetic properties. This leads to stable material processing at the customer and also guarantees consistent quality in each coil and steel grade.

HP

isovac® high-perm – The specialist with the highest permeability
The optimum adjustment of textures increases magnetizability and reduces core losses. This increase in efficiency makes it possible to maintain the same level of performance while reducing component size and saving material, weight and costs. This means that a higher level of performance can be achieved with the same component size.

- Increased performance achieved by increasing torque based on higher magnetizability
- Cost optimization through less material usage, less weight and less space requirement resulting from downsizing while maintaining the same level of performance.

SEMI-PROCESSED ELECTRICAL STEEL

HE

isovac® high-efficiency – The specialist for shorter final annealing times

isovac® HE (high-efficiency) is highly decarbonized in as-delivered condition, which means that the final annealing time at the customer can be significantly shortened. Subsequent annealing at the customer completely eliminates any mechanical damage introduced to the material during the punching process.

- Final annealing times significantly shortened by low carbon content
- Overall cost reductions based on low energy input, low emissions and higher productivity

FULLY PROCESSED ELECTRICAL STEEL

HS

isovac® high-strength – The specialist for high mechanical requirements

Both magnetic and mechanical properties play an important role in many modern high-speed motors or large electric machinery. The electrical steel in the rotor is especially subject to high mechanical stress, which requires the use of high-strength material. isovac® HS (high-strength) grades combine good magnetic properties with high strengths. We can supply the kind of material our customer requires. Our isovac® HS grades can be customized for higher strength, a higher degree of core compactness and highly innovative Backlack.

- Reduced air gap between rotor and stator as a result of higher strength or reduced rotor ridge widths in permanently excited machinery
- Larger freedom of design in electric machinery
- Possibility of partial subsequent annealing treatment at the customer in order to improve magnetic properties, e.g. in the stator

HC

isovac® high-conductivity – The specialist with high thermal conductivity

The high thermal conductivity of isovac® HC (high-conductivity) grades ensures rapid heat dissipation in combination with higher polarization while maintaining low specific total losses. Innovative design strategies made possible for electrical machinery

- Potential cost savings in electric machinery based on lower component sizes and lower material usage based on higher polarization
- Cooling power reduced by up to 20% as a result of higher thermal conductivity
- Alternative motor designs with reduced scrap volumes based on low strengths

HF

isovac® high-frequency – The specialist for high frequencies

The use of isovac® HF (high-frequency) grades guarantees optimum utilization of machinery at higher frequencies. High-precision adjustment of the microstructure and adaptation of the alloy content make it possible to keep losses low in the high-frequency range.

- Application in fast-turning machines with low core loss at high rotational speeds
- Greater freedom of design and motor size optimization based on higher strengths

POLE SHEETS

The right product for each application. Whether for low or high torques, frequencies or rotational speeds, our pole sheets are just the right product for a wide variety of different applications. Best electromagnetic and excellent mechanical properties in our pole sheets guarantee the highest level of security, even at high rotational speeds. The size and application determine whether cold-rolled or hot-rolled pole sheets are used.

HOT-ROLLED POLE SHEETS

Thermomechanically rolled steels with guaranteed magnetic properties

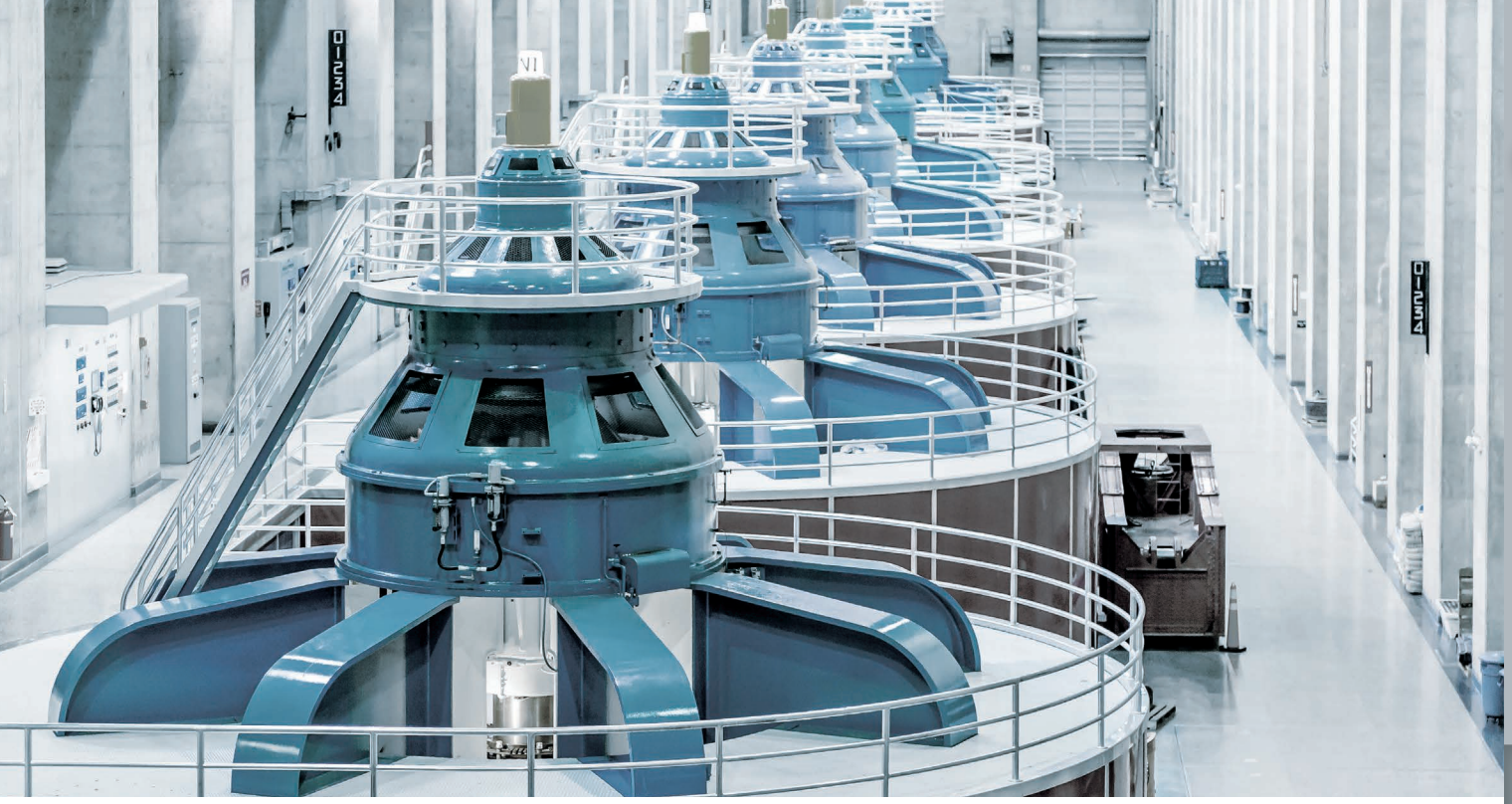
- Best laser-cutting properties
- Homogeneous mechanical properties
- Minimum inherent stress and residual stress
- Narrowest flatness, shape and dimensional tolerances
- Minimum deviations in thickness (across cross-section) of cut sheets
- Our special production route results in a distinct, homogeneous and strongly adhesive oxide layer that guarantees best insulation.

COLD-ROLLED POLE SHEETS

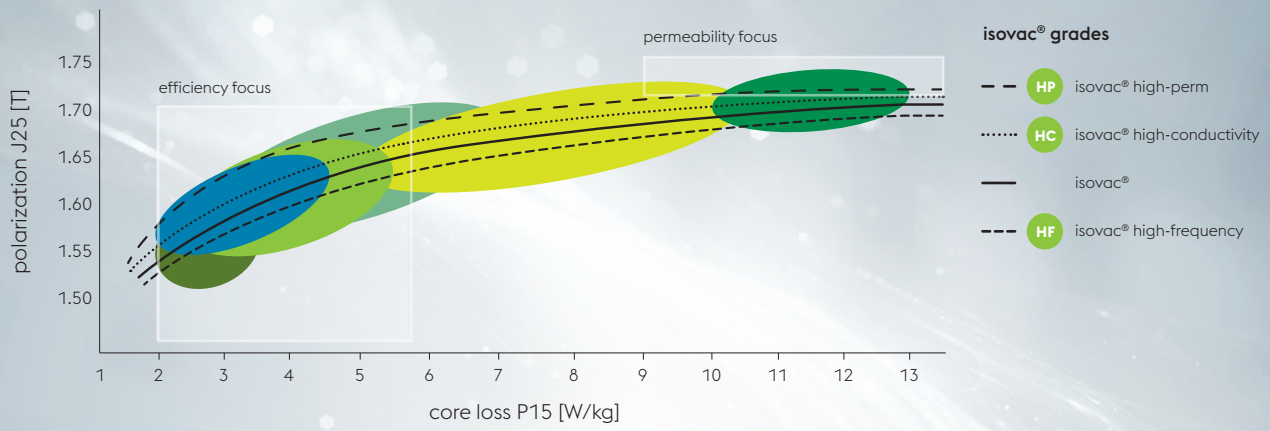
Cold-rolled steels with guaranteed magnetic properties

- Best cutting, punching and laser-cutting properties
- Low anisotropy
- Highest strength
- Narrowest flatness and dimensional tolerances

Please find the technical data sheets and more detailed information at the following link
www.voestalpine.com/isovac/en/Download/Datasheets



Overview of types of electrical steel



Applications	Machine type
E-mobility and high-end applications	High-end synchronous (PM) and asynchronous motors
Energy generation (hydro/turbo)	Synchronous and medium-pole asynchronous generators
High-end household appliances and robotics	AC/DC servo and brushless DC motors and Standard synchronous motors
Large-scale industrial applications	Alternators and asynchronous motors
Household appliances and standard applications	Universal motors and single-phase standard motors and standard asynchronous motors and DC motors
Gearless wind power systems	Multi-pole synchronous/asynchronous generators

MOTOR APPLICATIONS

With respect to compact engine design and high efficiency, we have just the right product for each customer. High individual demands on the efficiency and performance of motors steels are met by high permeability, low core loss and, where required, high strengths. Using the most modern technologies, high-quality electrical steel grades are also produced to meet your individual product requirements (from Vibracall to industrial motors).

Motors		isovac®		Core losses		
		fully processed	semi-processed	low	medium	high
Maximum width*	[mm]	1,600	1,600			
Thickness*	[mm]	0.3–1.0	0.5–1.5			
Cut shapes		● ● ●	● ● ●			
Single-phase standard motor		✓	✓			✓
Standard asynchronous motor		✓	✓		✓	✓
High-end asynchronous motor		✓		✓		
Standard synchronous motor		✓	✓	✓	✓	
High-end synchronous PM motor		✓		✓		
Universal motor		✓	✓		✓	✓
DC motor		✓	✓		✓	✓
Brushless DC motor		✓	✓	✓	✓	
AC servo motor		✓	✓	✓		
DC servo motor		✓	✓	✓	✓	

Coil Slit strip Cut shapes

*) further thicknesses and widths upon request

Insulation varnishes					grades					
uncoated	C-3	C-5	C-6	Backlack	standard	HP	HC	HF	HS	HE
✓	✓	✓			✓		✓			
✓	✓	✓			✓		✓			✓
		✓		✓		✓	✓			
	✓	✓		✓		✓		✓		✓
		✓		✓		✓		✓	✓	
✓	✓	✓			✓					✓
✓	✓	✓			✓					
		✓		✓		✓	✓			
		✓		✓		✓	✓			
		✓		✓		✓	✓			

GENERATOR APPLICATIONS

Future energy generation facilities will require the highest standards of quality. Particularly in the field of renewable energies, high-quality electrical steel and pole sheets contribute substantially to increased efficiency. Non-grain-oriented isovac® electrical steel and our hot- and cold-rolled pole sheets stand for best electromagnetic properties and highest energy efficiency.

Generators		isovac®		Pole sheets	
		fully processed	semi-processed	cold-rolled	hot-rolled
Maximum width*	[mm]	1,600	1,600	1,600	1,620 (1,750)
Thickness*	[mm]	0.3–1.0	0.5–1.5	0.7–1.5	2.0–12.0
Cut shapes					
Multi-pole synchronous/asynchronous generators		✓		✓	✓
Asynchronous generator		✓		✓	✓
Synchronous generator		✓		✓	✓
Alternators		✓	✓		

Coil Slit strip Cut shapes

*) Further thicknesses and widths upon request

100% Performance

100% Green Power

0% Troubles

Core losses			Insulation varnishes					Grades					
low	medium	high	uncoated	C-3	C-5	C-6	Backlack	standard	HP	HC	HF	HS	HE
		✓	✓*		✓		✓		✓	✓			
✓	✓		✓*		✓	✓	✓		✓		✓		
✓			✓*		✓	✓	✓		✓		✓	✓	
	✓				✓			✓		✓			✓

*) only pole sheets

STATIC MACHINES
APPLICATIONS

Customized, high-quality isovac® grades for static machines are used for special areas of application, e.g. reactance coils for power conversion, shielding systems used in medical technologies or highly complex particle accelerators (synchrotrons). We continually develop and optimize isovac® grades in close cooperation with our customers.

Static machines		isovac®		Core losses		
		fully processed	semi-processed	low	medium	high
Maximum width*	[mm]	1,600	1,600			
Thickness*	[mm]	0.3–1.0	0.5–1.5			
Cut shapes		✓	✓			
Ballasts (HID)		✓	✓		✓	
Wielding Transformers		✓	✓		✓	✓
Distribution Transformers (blended with GO)		✓		✓		
Magnets & Shielding		✓		✓	✓	✓
Magnetic Switches		✓		✓	✓	
Magnetiv Amplifiers & Reactors		✓		✓	✓	

Coil Slit strip Cut shapes

*) Further thicknesses and widths upon request

Insulation varnishes					Grades					
uncoated	C-3	C-5	C-6	Backlack	standard	HP	HC	HF	HS	HE
✓		✓			✓	✓	✓			✓
		✓			✓					✓
		✓				✓				
✓	✓	✓		✓	✓	✓				
✓		✓		✓		✓		✓		
		✓		✓		✓	✓	✓		

Technical consultation

Do you have special requirements? Our technical experts will be happy to assist you with all of your concerns and work with you in developing customized solutions.

PRECISION AS A FACTOR OF SUCCESS

For more efficiency in processing. We are fully committed to the state-of-the-art technical product properties demanded by the market. Our claim to narrow shape tolerances and processability goes much further.

Mechanical properties and insulation

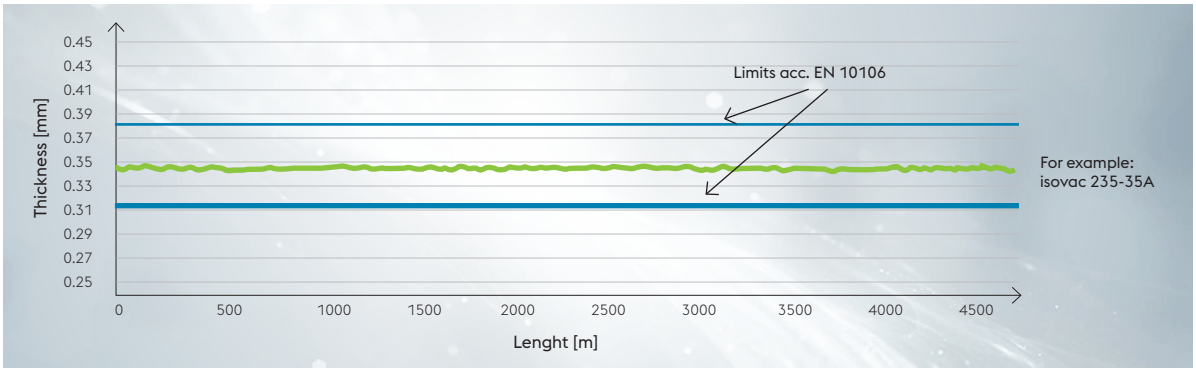
Mechanical properties guarantee both the functionality of rotating electrical machinery and, more importantly, the processability of the steel strip. Consistent mechanical properties as well as clean surfaces that cause minimal abrasion on the punching tool are prerequisites to optimized punching processes. One possibility of reducing tool wear and improving the punching process is the application of an insulating layer on the steel surface. The layer acts as an insulator and is especially effective in providing lubricating action for the punching tool.

- Uniform mechanical properties
- High chemical material purity
- Very good adhesion between the material and insulation
- Continuous insulation thickness
- No defects in insulation

Geometric properties

The result of our stable and continuous rolling process is a reduction in the steel strip thickness tolerance value. The subsequent continuous annealing makes it possible for us to reduce material stress to a minimum and manufacture components with the highest precision.

- Narrowest tolerances in the strip in both longitudinal and cross direction for consistent package parallelism
- No damage to slit edges and strip surfaces
- Low stress in hot-rolled and slit strip (no strip waviness, high shape consistency)



Cleanliness

Consistent mechanical properties, narrowest tolerances and clean strip surfaces must be continuously guaranteed in order to allow efficient and problem-free processing. We minimize production residues as far as possible. Additionally, extremely abrasion-proof insulation coatings with good adhesion properties can be applied to the steel surface.

- Good insulation adhesion
- Minimum abrasion during splitting and punching

Adhesive bondability

A successful adhesive bonding process is dependent on the bondability of the insulation on the steel surface. For example, Backlack is a special insulating varnish for electrical steel. The main purpose of this varnish is to bond the individual lamellas with each other and create a compact laminated core without any short circuits. The use of Backlack allows us to achieve very complex geometries.

- Surface free from dust, oil, grease and silicon residues
- High level of insulation adhesion
- Optimized for full-surface adhesive bonding
- Homogeneous adhesive bonding
- Innovative coatings with Backlack and backlack-v®

Technical consultation

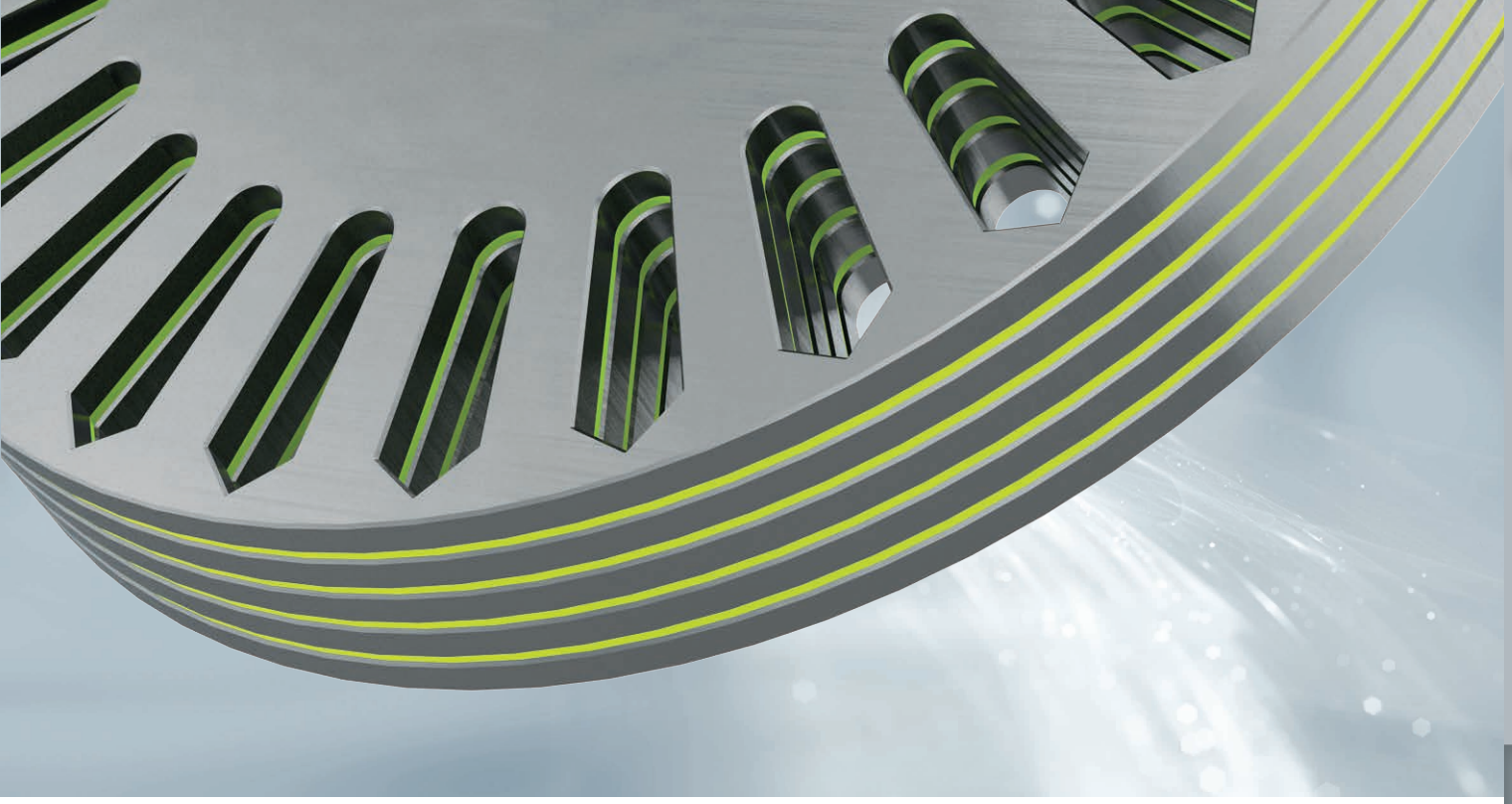
Our technical experts will be happy to assist you with any of your concerns. We will also be happy to provide consultation services for the optimization of prematerial widths and will gladly assist you in the creation of nesting diagrams for segment sheets.

INSULATING VARNISH SYSTEMS

Additional treatment to extend electrical steel functionality. We offer the highest quality in our insulating varnish systems. In close cooperation with leading European varnish producers, we supply insulating varnishes that meet specific customer requirements. The varnishes do not contain any toxic, carcinogenic or mutagenic substances.

C-3 organic insulation system	C-5 inorganic/organic insulation system	C-6 inorganic/organic insulation system	Backlack for efficiency in electrical steel packages
Highly improved punchability.	Best weldability and resistance to annealing (under protective gas up to 850 °C) Excellent suitability to pressure die casting.	Pressure-resistant and improved punchability Thermal rating up to 420 °C and suitable for burn-off repair. Additionally high level of insulation resistance.	Backlack technology is an innovative joining technique used in the production of electrical steel packages. A controlled chemical process is used to cleanly and compactly join coated laminations. The technology is characterized by a number of efficiency and processing advantages when compared to conventional joining techniques.
especially well suited	especially well suited	especially well suited	especially well suited

100% green power
We offer insulating varnish systems free from chromium and formaldehyde. We guarantee freedom from chromium using our new high-resolution and quantitative verification method for electrical steel insulation systems. We comply with all pertinent EU directives (RoHS Directive 2011/65/EC).



backlack-v® – The coating innovation made by voestalpine

backlack-v®

Our development of the innovative backlack-v® coating provides the following benefits to customers for the first time in efficiently bonded electrical steel packages for applications in generators and industrial engines for improved product quality.
Improved coil stability guarantees optimized handling and increased safety.

The excellent processing properties of the full-surface adhesive-bonded electrical steel packages lead to a substantial increase in production process efficiency. Optimum matching of the base material with the coating makes it possible to significantly reduce processing temperatures and times across the entire range of isovac® grades.

» **Improved material quality**
Consistent quality of supply
Prolonged service life based on decelerated ageing

» **Improved adhesive behavior and higher typical adhesive strength, especially in the long term**
Improved sustained temperature and hydrothermal resistance of the adhesive-bonded package

» **Processing advantages in package manufacturing**
Reduced enameling time and diminished pressure
Shortened cooling time

» **Improved performance characteristics**
Improved thermal conductivity through optimized adjustment of lacquer fillers
Improved magnetic properties based on nearly complete protection against short circuits between laminations

Our recommendation for the highest demands.

Note
As a water-based varnish system, backlack-v® is also extremely environmentally compatible.

GLOBAL SUPPLY CHAIN STRATEGIES

When corporate boundaries become points of contact

We deliver our products throughout the world. The information and processes underlying these material flows are customized to meet specific customer specifications and are continually improved, from crude steel production to processing to final delivery.

The resulting global networks make it possible to reduce costs, minimize time frames and achieve quality advantages. Global networks allow a rapid response to ever changing conditions.

Our global supply-chain strategies strengthen the competitive position of customers and allow them to remain a step ahead of their competitors.

A TOTAL OF 25 voestalpine SALES AND DISTRIBUTION OFFICES ARE AT YOUR DISPOSAL.

www.voestalpine.com/eurostahl

100% Performance

100% Green Power

0% Troubles

The headquarters of the voestalpine Steel & Service Center Group is located adjacent to one of the most modern steel mills of Europe, voestalpine Stahl GmbH in Linz Austria. Further production locations strengthen our position and proximity to our customers: Tychy, Poland; Giurgiu Romania; our offices in Cittadella, Italy and additional partner SSC´s.

Please find more detailed information here
www.voestalpine.com/isovac/en/Info/International-sales

ELECTRIFY TOMORROW 100% PERFORMANCE

Are you ready for the package deal?

isovac® electrical steel for highest energy efficiency. We combine isovac® with our unique services, innovative materials, logistics, commercial advise and technical consultation in order to provide you with a comprehensive package of benefits.

BEST PRODUCT PROPERTIES FOR MAXIMUM PERFORMANCE

HIGHEST ENERGY EFFICIENCY THANKS TO INTENSE RESEARCH AND DEVELOPMENT

Maximum performance
Low eddy-current and hysteresis losses in electrical steel is of decisive importance in order to be able to efficiently utilize the energy used in the operation of electrical machinery. The most modern production facilities guarantee the production of electrical steel for the highest performance of electrical machinery.

Customized product properties
The exclusive manufacturing of prematerial in our integrated metallurgical facilities makes it possible for us to unceasingly monitor and ensure the high quality of all processing parameters. This results in a tailor-made product that meets the highest quality standards.

High magnetic polarization and permeability
Magnetic polarization and permeability are essential values in the engineering of electric machinery. Only high induction allows efficient utilization of available energies.

Material homogeneity
High process reliability and low tolerances through continuous rolling and annealing processes guarantee homogeneous material in the interest of mechanical, magnetic and geometric properties. This leads to stable material processing, low tool wear, less scrap accumulation and rejects as well as high dimensional accuracy of the stamped part.

High thermal conductivity
High thermal conductivity permits further optimization of performance. The innovative alloy design and the high chemical degree of purity of isovac® grades significantly increases thermal conductivity.

ELECTRIFY TOMORROW 100% GREEN POWER

Are you ready for a green future?

The question of sustainable conservation of resources can only be whether our world will be a livable place tomorrow. Set a new standard with our innovative isovac® electrical steel and contribute to a more sustainable and environmentally compatible future.

OUR WORLD WILL BE A LIVABLE PLACE TOMORROW

SUSTAINABILITY AS A STRATEGIC PRINCIPLE

100% recyclability
Our isovac® electrical steel is 100% recyclable. When calculating costs across the entire product lifecycle, steel shows substantial advantages in eco-balance when compared to other materials.

Lowest emissions
Our optimized production processes guarantee the lowest emissions. This reduces the environmental impact and sustainably increases the quality of life for future generations.

Recycled materials
67% of all incurred recycling materials and wastes are returned to the production process. This recycling process requires few natural resources and minimizes waste.

Free from chromium and formaldehyde
In collaboration with leading European varnish manufacturers, we supply insulating varnishes that contain no toxins, carcinogens, mutagens, formaldehyde or chromium compounds. The coatings meet all applicable EU directives.

Low energy consumption
Intelligent utilization of released energy and optimized selection of process parameters in the production of isovac® leads to substantially lower overall energy consumption than in conventional manufacturing processes.

Most ecological steelmaking plant in the world
We assume holistic responsibility for our products, continually optimize our production processes and develop our environmental management systems. We see environmental protection as the responsibility of each employee.

ELECTRIFY TOMORROW 0% TROUBLES

Are you ready for a careless package deal?

We will never be satisfied with excellent product quality alone. Comprehensive services and unlimited dedication to your challenges are at the core of our philosophy.

WE THINK IN TERMS OF SOLUTIONS

THE FOUNDATION OF OUR PARTNERSHIP IS BASED ON SOLUTIONS.

Development advantages
Our experience and continued research activities make it possible for us to develop innovative steel grades that help you more effectively meet your challenges in the future and provide you with a decisive competitive advantage.

Technical consultation and support
Our experts will support you with their excellent knowledge of the industry and materials and will be pleased to answer your questions. They guarantee comprehensive technical consultation pertaining to materials and applications.

Always close to you
Our international sales organization creates a direct connection between the customer and the production companies. Our sales organizations and representatives guarantee worldwide best consultation and expert solutions from a single source.

Precisely tailored to your needs
Each of the plants required for the production of high-quality steel strip is located in our modern steel works next to related facilities and is highly integrated into the production process. This makes it possible for us to react quickly and personally to your specific product requirements and to provide you with customized solutions.

Supply-chain management and logistics
We work together with you to devise the most optimized route, the best means of transport and, where necessary, comprehensive logistics strategies in order to guarantee availability and on-time delivery at the desired destination.

Process support
We support you throughout the entire process from placement of the order to delivery of the material. Whether it be in annealing trials, the adjustment of a stamping tool or assistance in making the transition to a new grade, our highly professional employees offer their expertise to you each step of the way.

0% Troubles

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ONE STEP AHEAD.