



ELECTRICAL STEEL – isovac[®]

Technical terms of delivery
1 September 2019

These general terms apply to all electrical steel supplied by companies in the voestalpine Steel Division. Please use the following link to find a list of the companies affiliated with the Steel Division:

www.voestalpine.com/stahl/en/Companies

The names of companies in the voestalpine Steel Division are referred to simply as **voestalpine** in this document.

Printed copies cannot be updated on a regular basis. Please refer to the most recent content in the online data sheets found on our home page. Technical changes are reserved. Errors and misprints are excepted. No part of this publication may be reprinted without explicit written permission by voestalpine Stahl GmbH.

CONTENT

- 4 Introduction
- 5 Quality management
 - 5 » Comprehensive quality management
 - 5 » State-of-the-art testing techniques
- 6 Steel grade overview
 - 6 » isovac® electrical steel by voestalpine
 - 7 » Fully processed electrical steel
 - 8 » Semi-processed electrical steel
 - 9 » Cold-rolled pole sheets
- 10 Surface
 - 10 » Surface
 - 10 » Surface finish
 - 10 » Preservation
- 11 Insulation systems/coatings
- 12 Order quantities and manufactured units
 - 12 » Electrical steel as wide strip (coil)
 - 12 » Electrical steel as slit strip or cut sheets
 - 12 » Weights
- 13 Available dimensions
 - 13 » Electrical steel as wide strip (coil)
 - 14 » Electrical steel in slit strips
 - 14 » Electrical steel cut to length in sheets and tailored blanks
- 15 Inspections
 - 15 » Magnetic properties
 - 15 » Test certificates
- 16 Labeling
- 17 Technical review of inquiries, homologation, initial samples and serial supply
- 18 Additional information
 - 18 » Weld seams
 - 18 » Processing information
 - 18 » Marking
 - 18 » Packaging
 - 19 » Transport and storage
 - 19 » General terms of sale
- 20 Order data

INTRODUCTION

voestalpine operates one of Europe's most modern steelmaking facilities in Linz. Each of the modern lines required for the production of high-quality steel strip is located next to related facilities and is highly integrated into the works.

Our goal is to innovate and go beyond standard steels, to continually offer high-quality products. The most modern manufacturing technologies, continuous quality control systems as well as intense research and development guarantee optimum product quality.

These technical terms of delivery provide information on the ordering and processing of **electrical steel**. Please direct any of your questions to your responsible sales personnel or technical specialist at voestalpine.

QUALITY MANAGEMENT

voestalpine is a quality leader in a challenging market environment, and it has become the company philosophy to meet the justified expectations and requirements of both the market and the customer with respect to every possible aspect of quality. Comprehensive quality management is a central component of the company strategy. In addition to this comprehensive quality management system, production monitoring using the most modern testing systems is also a necessity. These systems are inspected on a regular basis by external and independent agencies.

COMPREHENSIVE QUALITY MANAGEMENT

The voestalpine companies meet the highest standards of quality management and are certified pursuant to **Lloyd's Register QA Ltd.** in the United Kingdom as well as **ISO 9001** and **IATF 16949**.

This has been confirmed by numerous customer awards presented for best quality performance. Focus has been continually on this pursued path as well as on consistent implementation of all quality standards.

STATE-OF-THE-ART TESTING TECHNIQUES

voestalpine uses the most modern testing techniques and methods, laboratory information and management systems equipped with state-of-the-art technologies. The technical expertise of our testing and inspection laboratories is certified in accordance with international standards, e.g. **ISO/IEC 17025** and **ISO/IEC 17020**, and is accredited by Austrian national standards.

STEEL GRADE OVERVIEW

isovac® ELECTRICAL STEEL BY voestalpine

isovac® is the result of decades of experience at voestalpine in the production of electrical steel.

The innovative isovac® product family developed by voestalpine provides benefits to our customers in the field of electric steel strip with respect to higher energy efficiency and process optimization.

The isovac® product range includes conventional international standards as well as special grades with special properties.

As a standard, the **isovac** name is added to the grade name in all company documents. Other names are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

PRODUCT RANGE

- » isovac®-grades
 - » Fully processed
 - » Semi-processed
 - » isovac® high-perm

- » Special isovac®-grades
 - » isovac® high-frequency
 - » isovac® high-conductivity
 - » isovac® high-strength
 - » isovac® NO
 - » isovac® high-efficiency
 - » isovac® CRML

- » Cold-rolled pole sheets

- » Hot-rolled pole sheets (included in the technical terms of delivery for hot-rolled steels found at www.voestalpine.com)

FULLY PROCESSED ELECTRICAL STEEL

After blanking, fully processed electrical steel strip is generally used for building core packets without previous heat treatment. The adjustment of the electromagnetic properties is carried out primarily by carefully adapting the alloying elements and the annealing parameters.

The international standards (**EN 10106, EN 10303, IEC 404-8-4, JIS C2552, GOST 21427.2, ASTM A677, AISI, IS 648, GB/T2521**) apply to all fully processed voestalpine products with respect to their geometric properties, tolerances and surface designs.

To the extent that no other standard is explicitly indicated, the currently applicable standard (**EN 10106 or 10303**) shall apply. All other parameters not defined in the standard are subject to separate agreement.

isovac® high-perm (HP)

isovac® high-perm grades feature a special microstructure and texture achieved in a special annealing process. This achieves higher magnetizability throughout the entire magnetic range and in higher flux density.

isovac® high-frequency (HF)

isovac® high-frequency grades are specially alloyed electrical steel with low losses resulting from a precisely defined microstructure in higher-frequency applications.

isovac® high-conductivity (HC)

isovac® high-conductivity grades are specially alloyed with higher thermal conductivity and lower strength than that of standard grades.

isovac® high-strength (HS)

isovac® high-strength grades achieve higher strengths through special annealing and a precisely defined microstructure. A special strength-increasing alloying strategy makes it possible through partial subsequent annealing to further optimize these grades with respect to their property profile.

isovac® NO

isovac® NO grades were developed specially for applications in high-frequency and high-speed machinery in the automotive industry. NO grades are fully processed and do not have to be final annealed at the customer. NO grades comply with **DIN EN 10303** or a similar standard.

SEMI-PROCESSED ELECTRICAL STEEL

Semi-processed electric steel strip is delivered in cold-rolled (skin-passed) condition. Skin-pass rolling creates optimum processing properties in as-delivered condition and an optimized microstructure during final annealing at the customer. Individual parts and finished core packets can be final-annealed.

The material is annealed at the customer in order to attain specific electromagnetic properties, to decarbonize the material and to apply a thin oxide layer that acts as an insulating surface between the punching parts.

The product range of semi-processed electrical steel includes grades governed by conventional international standards (**EN 10341, ASTM A726, ASTM A683, IEC 60404-8-2; 60404-8-3; IS 15391-2**) as well as special grades with special properties.

All semi-processed products made by voestalpine are subject to the provisions of **EN 10341** with respect to geometric properties, tolerances and surface types. All parameters contained in the standard are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

isovac® high-perm (HP)

isovac® high-perm grades feature a precisely defined microstructure and texture achieved through special annealing. This results in higher magnetizability throughout the entire magnetic range and in higher flux density.

isovac® high-efficiency (HE)

isovac® high-efficiency grades are highly decarbonized in as-delivered condition, a factor which shortens the final annealing time at the customer. The continuous annealing process and the relatively low alloy content lead to lower losses and high material magnetizability.

isovac® CRML

Cold-rolled magnetic laminations are semi-processed electrical steels that meet highly specialized requirements with regard to magnetic properties following a defined annealing process. This product is intended for 50 Hz or 60 Hz electrical applications. All cold-rolled motor lamination grades made by voestalpine are subject to **ASTM A726** with regard to magnetic, mechanical and geometric properties, tolerances and surface types. Special grades with special properties not defined in **ASTM A726** are delivered in compliance with similar standards. Magnetic and mechanical properties are agreed upon separately.

The guaranteed mechanical and magnetic properties of grades not set forth in the standards are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

COLD-ROLLED POLE SHEETS

All cold-rolled pole sheets made by voestalpine are subject to the provisions of **EN 10265** with respect to geometric properties, tolerances and surface types. Special grades with increased strengths not defined in **EN 10265** are delivered in compliance with similar standards. Strengths and magnetic properties are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

Please use the following link to find more detailed information about this product in the data sheet for the respective grade: www.voestalpine.com/isovac/en/product-overview/data-sheets

SURFACE

SURFACE

The conventional international standards apply to all fully processed and semi-processed voestalpine products. The respective standard must be indicated at the time of the order. **EN 10106**, **EN 10303** or **EN 10341** shall apply to the extent that no other standard is explicitly indicated.

SURFACE FINISH

Fully processed electrical steel is delivered with a smooth surface (typically $R_a = 1.0 \mu\text{m}$ max.). Semi-processed electrical steel is delivered as a standard with a skin-pass-rolled surface (typically $R_a = 1.2$ min. through $3.2 \mu\text{m}$ max.). The mean roughness value R_a is determined in accordance with **DIN EN 10049**. Other surface finishes are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

PRESERVATION

Electric steel is generally delivered in unoiled condition.

INSULATION SYSTEMS/COATINGS

Depending on the customer requirements, voestalpine supplies several insulating varnish systems that do not contain any toxic, carcinogenic or mutagenic constituents and comply with all the provisions of the **RoHS Directive 2011/65/EU**. Insulation systems are free of chromium and chromate compounds. Upon request insulation systems free of formaldehyde compounds are available.

COATING GROUP APPLIES PURSUANT TO EN 10342.

C-3	C-3	C-5	C-6
Organic insulation system	Self-bonding insulation system	Inorganic/organic insulating varnish system	Inorganic/organic insulating varnish system

Precise varnish properties can be found in the technical data sheets published by the respective varnish manufacturers. These can be provided by voestalpine upon request.

Deviations from the magnetic and mechanical properties set forth in the data sheets may occur independently of the used electrical steel grade in combination with the applied coating (coating thickness). Other guaranteed properties are subject to special agreement between the customer and voestalpine and shall be included in written form in the order.

The layer thickness for C-3, C-5 and Backlack is measured by Betascope (beta-backscattering method). The Deltascope (magnetic-induction measuring method) is used for C-6. voestalpine guarantees a maximum standard deviation of $\pm 1.0 \mu\text{m}$, irrespective of layer thickness. According to the Betascope manufacturer, varnish layers with thicknesses less than $3 \mu\text{m}$ are not suitable. A Deltascope measuring error of at least $1.5 \mu\text{m}$ must be taken into account in accordance with **EN ISO 2178**.

Insulation resistance is measured by means of the Franklin test according to **ASTM A717-81** and **IEC 60404-11**. As a result of the chemical composition of the varnishes, insulation resistance cannot be guaranteed for C-3 insulating varnish systems, irrespective of layer thicknesses, and for C-5 and C-6 insulating varnish systems for each side with varnish layers below $2 \mu\text{m}$ in thickness.

Customers must ensure that products with self-bonding varnishes are not subjected to temperatures exceeding $40 \text{ }^\circ\text{C}$ and are processed within a period of six months following delivery. Temperatures exceeding the limit temperature of $40 \text{ }^\circ\text{C}$ will lead to unpredictable alterations in the product properties, processing parameters and adhesive characteristics.

Special coating property requirements are to be agreed upon separately between the customer and the supplier.

ORDER QUANTITIES AND MANUFACTURED UNITS

ELECTRICAL STEEL AS WIDE STRIP (COIL)

- » The minimum order quantity per line item is one coil production unit (depending on the steel grade, between approx. 16 kg/mm and approx. 19 kg/mm strip width) and/or its multiple.
- » It is possible to subdivide these coil units into smaller coils.
- » The target is fulfillment of customer orders with respect to the requested coil weight. It is permissible to fall below the ordered coil weight by up to a maximum of 30%.
- » The weight tolerance of line items whose ordered weight exceeds 100 tons is plus/minus a typical coil production unit typical for this item.

ELECTRICAL STEEL AS SLIT STRIP OR CUT SHEETS

- » The minimum order quantity per line item is one coil production unit, which ranges roughly between approx. 16 kg/mm and approx. 19 kg/mm strip width and/or its multiple, depending on the steel grade.
- » This coil production unit can be subdivided.
 - » Possible in small coils for slit strip, e.g. 19, 9.5, 4.75 kg/mm.
 - » Subdivision to ≤ 6 t is possible for cut sheets and packages of tailored blanks.
- » Overdelivery and underdelivery is permitted up to $\pm 10\%$.

WEIGHTS

- » The maximum weight per coil of steel strip is 30 tons.
- » The maximum weight per package of cut sheets is 6 tons.

AVAILABLE DIMENSIONS

Fully processed electrical steel is supplied pursuant to conventional standards such as **EN 10106**, **EN 10303**, **IEC 404-8-4**, **JIS C2552**, **GOST 21427.2**, **ASTM A677**, **AISI, IS 648**, **GB/T2521**, semi-processed electrical steel pursuant to **EN 10341**. Limited tolerances and other parameters not contained in the standard are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

A symmetric tolerance zone position is generally a prerequisite for the ordered thickness. Products made of electrical steel are supplied in the following forms:

- » Wide strip (coil), with mill edge or cut edge
- » Longitudinally slit strips with cut edges
- » Sheets with cut edges
- » Tailored blanks

Please find more detailed information about available dimensions in the product data sheets of the respective steel grade group.

ELECTRICAL STEEL AS WIDE STRIP (COIL)

Product variant	Thickness [mm]	Width max. [mm]	Outer diameter max. [mm]	Inner diameter [mm]
isovac®	0.30-1.00	1600	2000	600 *
Cold-rolled pole sheets	0.70-1.50	1600	2000	600 *

Available combinations of widths and thicknesses vary depending on the steel grade.
* Indicated references are standard values.

ELECTRICAL STEEL IN SLIT STRIPS

Product variant	Thickness [mm]	Strip width max. [mm]	Outer diameter max. [mm]	Inner diameter [mm]
isovac®	0.30-1.00	19-1600	850-2000	500/600 *
Cold-rolled pole sheets	0.70-1.50	19-1600	850-2000	500/600 *

Available combinations of widths and thicknesses vary depending on the steel grade.
* Indicated references are standard values.

ELECTRICAL STEEL CUT TO LENGTH IN SHEETS AND TAILORED BLANKS

Product variant	Thickness [mm]	Width max. [mm]	Length max. [mm]	Package weight max. [t]
isovac®	0.30-1.00	300-1550	300-5000	6
Cold-rolled pole sheets	0.70-1.50	300-1550	300-5000	6

Available combinations of widths and thicknesses vary depending on the steel grade.

Please use the following link to find the maximum respective prematerial width in the respective product data sheet for each grade: www.voestalpine.com/isovac/en/product-overview/data-sheets

INSPECTIONS

Characterization of electrical steel with respect to test units, sampling and performance of inspection tests is pursuant to the stipulations contained in the respective order standards and/or specific agreements at the time of the order. Additional tests are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

MAGNETIC PROPERTIES

The magnetic properties of Fully processed electrical steel are measured and guaranteed in as-delivered condition based on the provisions set forth in **DIN EN 10280**. As an alternative and based on separate agreement, the magnetic properties are determined according to **EN 60404-2**. The actual density of the respective grade is used in both testing methods (Epstein test, single-sheet measurement). This value is provided by voestalpine upon request. The confirmed values remain valid for a period of six months following the completion date.

The magnetic properties of semi-processed electrical steel strip are the result of a test conducted subsequent to heat treatment in accordance with **EN 10341**.

TEST CERTIFICATES

A request for test certificates as set forth in **EN 10204** may be specified in the order. A 2.2 test certificate based on **EN 10204** is the standard. The minimum value for core loss is indicated as 1.5 T. Additional parameters and/or customer-specific documents are subject to special agreement between the customer and voestalpine and must be included in written form in the order.

LABELING

Standard labeling consists of a tag per package unit and indicates the following:

- » Supplier
- » Recipient
- » Order number
- » Strip number (identification number)
- » Heat number
- » Part or package number
- » Steel grade
- » Dimension
- » Number of units
- » Weights
- » Date of production
- » Test samples labeled as such

Additional data or marking directly on the material (coil, package or bundle marking) is subject to special agreement.

TECHNICAL REVIEW OF INQUIRIES, HOMOLOGATION, INITIAL SAMPLES AND SERIAL SUPPLY

ORDERS ACCORDING TO CONVENTIONAL INTERNATIONAL STANDARDS

The customer informs voestalpine of the standard applicable to the order. All materials of an individual order are supplied exclusively according to a single material standard. Any limitations to standard provisions are subject to special agreement between the customer and voestalpine and must be included in written form in the order. They are subject to confirmation and approval by voestalpine. Any further technical testing is performed exclusively based on the adopted standardization.

ORDERS BASED ON EXISTING CUSTOMER SPECIFICATIONS

Prior to each initial sampling process, customers are required to submit their final material specification for technical review. voestalpine then issues a technical opinion along with a signed copy of the customer specification. The customer reviews this technical opinion and returns the signed document to voestalpine.

Should any content of the technical opinion not be acceptable to the customer, renegotiation between the customer and voestalpine is required until an agreement is reached. In the event that the customer does not sign or return the technical opinion and a trial sample is produced, this shall be deemed to constitute acceptance of the technical opinion. In such cases, voestalpine shall not accept subsequent complaints pertaining to any deviations from the customer specification.

TRIAL SAMPLES, TRIAL DELIVERIES, APPROVALS OF TRIAL SAMPLES AND SERIAL PRODUCTION

For each initial order prior to serial production, material samples and separate varnish samples are provided by voestalpine to the customer. Trial material serves as an opportunity to compare measuring systems between voestalpine and the customer and as a basis for subsequent processing. Following this testing at the customer, the customer orders initial samples for processing on an industrial scale and indicates **trial sample** in the order. After processing the material, the customer submits a written approval of the trial sample to voestalpine. In the event that the customer fails to submit this written approval and a new order is triggered at voestalpine, the trial sample is automatically deemed to be homologated material for serial supply. This is independent of pertinent customer specifications.

ADDITIONAL INFORMATION

WELD SEAMS

If not otherwise agreed at the time of the order, electrical steel may feature weld seams after cold rolling. Should the customer specification designate that weld seams resulting from cold rolling are not acceptable, voestalpine shall reserve the right to laser-join strip ends after eliminating errors. Laser-joined strip ends are also admissible for underweight coils. As a result of the highly localized heat input in electrical steel, laser joints are characterized by only slight increases in hardness and geometric thickness. Non-acceptance of laser joints is subject to special agreement between the customer and voestalpine and must be indicated in written form in the order.

PROCESSING INFORMATION

SPECIAL PROCESSING INSTRUCTIONS FOR SEMI-PROCESSED ELECTRICAL STEEL

Resulting from the manufacturing method and supply in the form of coils or slit strips, semi-processed electrical steel in accordance with **EN 10341** and semi-processed isovac®-grades in as-delivered condition may feature residual curvature in the direction of rolling and inner tension. Preventive measures must be taken by the consumer to minimize or eliminate the effects of these properties during processing or application of the product.

In the event that recurrent defects become apparent during the unwinding of a coil or a slit coil, suggesting that the entire coil or slit coil will result in greatly increased scrap during processing, the processor shall discontinue use of the coil and notify the supplier immediately.

Specific instructions are available for the processing of Backlack-coated material. These instructions can be obtained from your responsible technical specialist.

MARKING

voestalpine reserves the right to deliver marked or unmarked material in the event that the customer when placing the order does not provide any explicit information with respect to marking.

PACKAGING

Products can be supplied with inner diameters of approximately 500 or 600 mm. Packaging guidelines are to be agreed upon between the customer and voestalpine. Selected products may require single-row coil storage as a result of their weight, strip thickness and insulation or a combination of these properties. The customer must ensure that coils designated as such are stored accordingly. Any damage resulting from non-compliance with these regulations shall not be compensated by voestalpine.

The initial inner and final outer windings of coils and slit strips are considered to be packaging and are not representative of the properties in the remaining windings of the coil or slit strip.

TRANSPORT AND STORAGE

- » Transport in dry condition
- » Manipulate only with suitable hoisting devices
- » The material must be stored in a dry place and protected from the weather
- » Protect against condensation (avoid excessive temperature differences)
- » Use proper supports
- » Avoid local pressure loads
- » Keep storage times short

The material must be protected against any corrosion from salts, acids, alkaline fluids or other substances containing such.

In the event that the customer discovers that packaging has become wet, the coil shall be immediately unpacked and wiped dry. Quick action is required in such a case. Before it is processed, the material shall be stored in a dry and well ventilated environment. In every such case, the responsible technical specialist at voestalpine shall be contacted immediately in order to be able to initiate appropriate measures.

The supplied material, including packaging, shall be checked for product quality (identification, packaging and product condition) by the recipient of the material upon arrival. In the event that material damage or any inadmissible characteristic is discovered in the material at the time it is inspected upon arrival, this shall be documented as accurately as possible in the corresponding freight documentation:

- » Trucks: CMR
- » Railway CIM: Assessment of current condition by responsible railway company
- » Waterborne vessels: Bill of lading/deletion log

Anomalies encountered on the means of transport or in the course of unloading the material shall be documented using photographs sent to the responsible contact person at voestalpine. Such documentation excludes the possibility of the material being damaged by the consignee in the warehouse and provides evidence that the delivered material was damaged before it arrived.

GENERAL TERMS OF SALE

To the extent that individual technical properties and specifications are not specifically defined by the customer, e.g. by means of meaningful measurements and limit values, such properties and specifications shall merely serve as technical guidelines and non-binding target values unless otherwise agreed. voestalpine shall not grant any warranty nor be held liable for properties and/or specifications other than those explicitly agreed upon. This also applies to the suitability and applicability of pre-materials for certain applications as well as to the further processing of materials. All application risks and suitability risks are borne by the customer.

Please use the following link to find the applicable **general terms of sale for goods and services of the voestalpine Steel Division**: www.voestalpine.com/stahl/en/The-Steel-Division/General-Terms-of-Sale

ORDER DATA

The following information is required in each order:

- » Steel grades as defined by standards or explicit specifications
- » Dimensions, tolerances
- » Edge condition
- » Material test certificates, if desired; acceptance conditions upon request
- » Order quantity
- » Type of insulation, including thickness in μm
- » Preservation
- » For coils and slit strip
 - » Inner diameter
 - » Min./max. outer diameter
 - » With or without weld seam
 - » Min./max. coil/ring weight or min/max. kg/mm strip width
 - » Max. package weight (packing unit)
 - » Max. package width
- » For cut sheets
 - » Max. package weight
 - » Max. package height (with or without pallets)
- » Packaging
- » Labeling, marking, stamping
- » Type of transport, forwarder, customs forwarder
- » Type of truck or railcar
- » Mode of unloading, means of unloading and possible restrictions
- » Desired delivery date
- » Destination
- » Terms of delivery (Incoterms)
- » Material application

09/2019

voestalpine Steel Division
voestalpine-Straße 3
4020 Linz, Austria
productmanagement@voestalpine.com
www.voestalpine.com/steel

voestalpine
ONE STEP AHEAD.