



**sij** | ravne systems

FORGED ROLLS





The SIJ Group is the largest Slovenian vertically integrated Slovenian metallurgical Group and one of the largest producers of stainless and special steels in Europe.

The SIJ Group consists of five divisions:

- Steel (Acroni and Metal Ravne)
- Manufacturing (Ravne Systems, Elektrode and SUZ)
- Distribution and Processing (Slovenia, EU and USA markets)
- Scrap (Slovenia and former Yugoslav republics)
- Headquarter and Other services

SIJ Ravne Systems has considerable experience and a long tradition in producing forged products for cold rolling mills, and much more. We manufacture all kinds of through hardened and surface hardened rolls for cold rolling steel sheets.

400 years of production tradition is supported by ISO quality certificates.

**SIJ Ravne Systems is a member of  
SIJ – Slovenian Steel Group.**

[www.sij.ravnesystems.com](http://www.sij.ravnesystems.com)

[www.sij.si](http://www.sij.si)

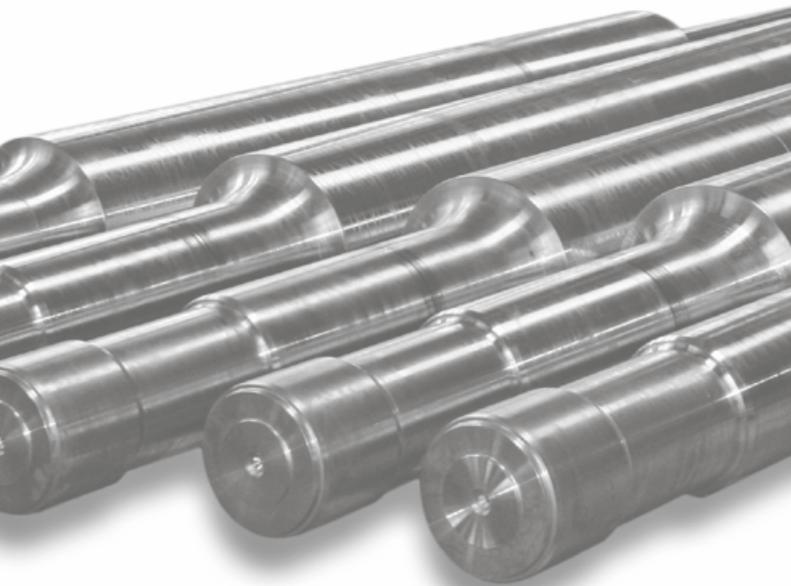




## WHY SIJ RAVNE SYSTEMS?

Perfect quality, excellent service and the desire to build a longterm partnership. This is who we are – SIJ Ravne Systems, your reliable partner.

- A unique combination of metallurgical and engineering know-how.
- The highest product quality as a result of tight integration in a vertical chain, from steelmaking to the final product.
- Rolls made from ultra-clean steel as a result of the ESR method.
- In-house accredited laboratories performing a wide range of tests, inspections and calibrations.
- The ability to offer a complete package of products and services for the steel mills; from complete assembled equipment, subassemblies, components, spare parts and industrial knives for metal, to maintenance, reconstruction and revamping.



## INCREASE YOUR PRODUCT'S LIFESPAN

The highest product quality based on world class production equipment and more than 400 years' experience in steelmaking and steel processing.



## ACHIEVE OPTIMAL FUNCTIONALITY

Narrow dimensional tolerances, lower than those prescribed by international standards.



## OPTIMIZE YOUR PRODUCTION PROCESSES

Extensive range of mechanical and heat treatment options to find the optimal product completion stage for your production process.



## EXCEED YOUR CUSTOMERS' EXPECTATIONS

A strong in-house R&D department and broad application knowledge to find the best solutions for your customers' requirements.

## FORGED ROLLS FOR COLD ROLLING MILLS

### Dimensional range of roll production:

- Up to 830 mm (33") in diameter
- Up to 5,500 mm (216") in length
- Up to 10,000 kg (22,000 lbs) in weight

### Key characteristics of rolls:

- Application of ultra-clean steels
- Application of steels developed specifically for cold rolling
- Computerized guidance and control of the volume and surface heat treatment processes
- Permanent and sustained efforts to improve the quality and application of rolls in the form of research and development
- Application of modern ND inspection methods
- Independent quality assurance system
- Partnership relations with customer-based experience

Rolls are produced from special alloyed tool steels, which are made using EAF + (VD + LF) vacuum technology processes or by an additional electroslag remelting process (ESR).

We guarantee uniform hardness in the range +/-0.5 HRC.



## SURFACE HARDENED ROLLS

For all types of rolling mills.

Guaranteed hardness throughout the hardened layer depending on the steel used and optimal mechanical properties.

Our forged rolls withstand high pressure and are characterized by uniform hardness within +/- 0.5 HRC throughout the working barrel and a homogeneous steel microstructure.

Hardness drop throughout the hardened layer is max. 3%.

### Our rolls offer:

- Higher productivity
- High reliability
- Safety in operation
- Finer surface quality
- Higher rolling rate
- Positive influence on TCO

### Which is achieved by:

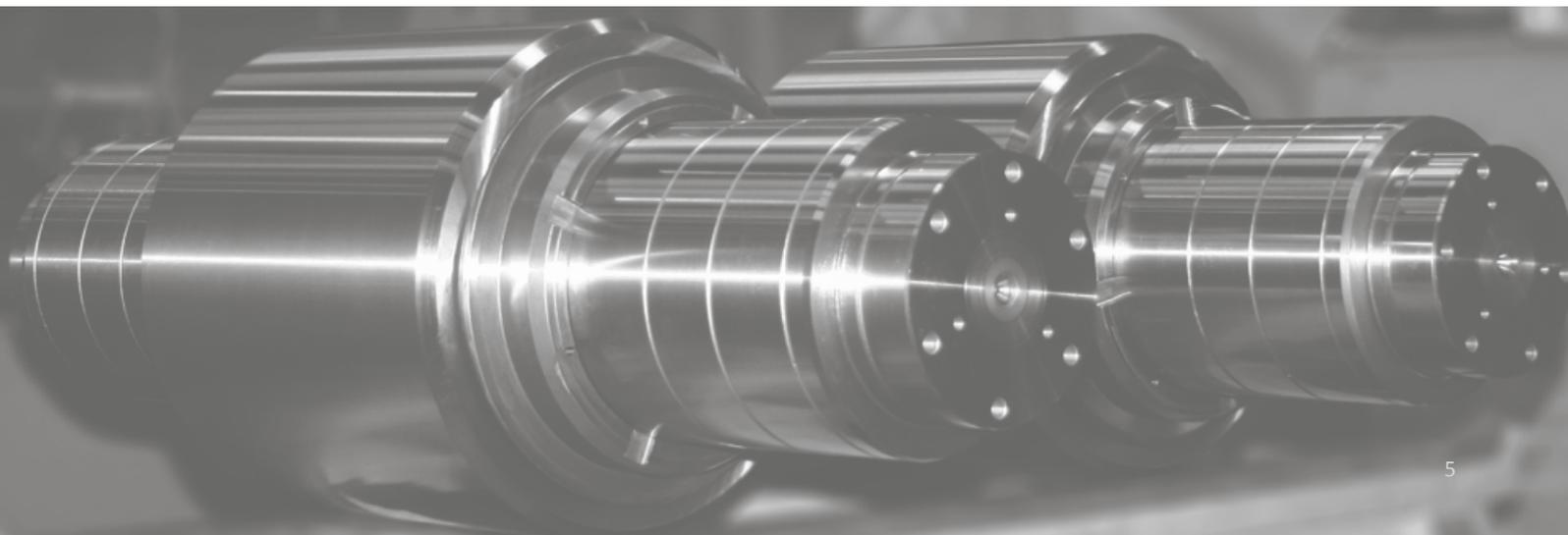
- A combination of the best steel grades
- State-of-the-art heat treatment equipment
- Precise machining
- Multi-step inspection of each roll
- Continuous investment into the development of new grades

Our own heat treatment facilities for optimal mechanical characteristics is available – optimal working hardness is guaranteed by a **bi-frequency** induction hardening machine, which was developed, designed, and produced in-house.

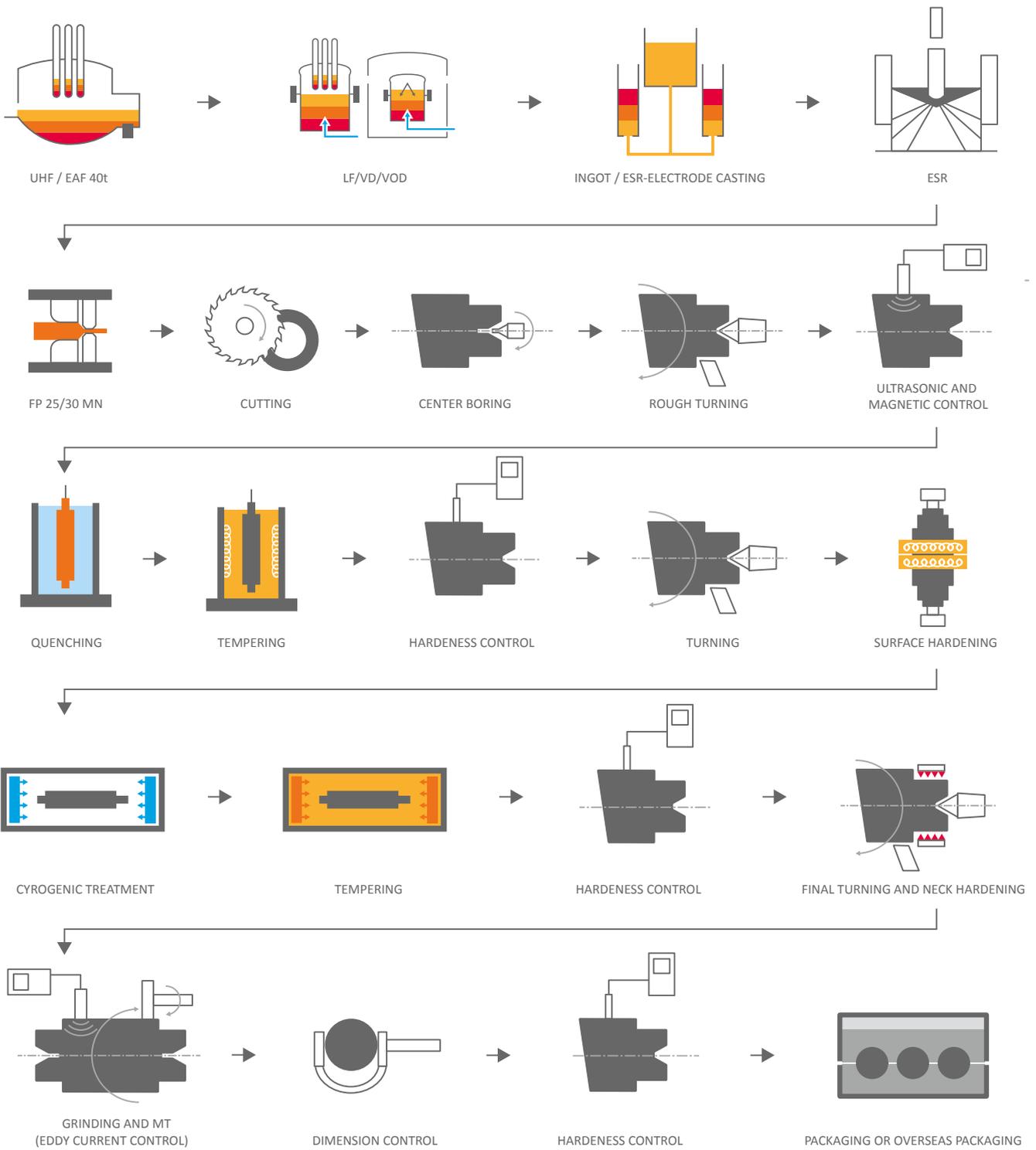
**A highly advanced 3-D induction hardening machine** (manually adjustable induction frequency) for the best mechanical characteristics of roll necks.

**Cryogenic treatment** – a step forward in the heat treatment hardening process, which completes the transformation of the steel microstructure from austenite to a stronger martensitic structure with greater hardness. Steel hardness increases by raising the percentage of martensite in the steel structure – hence, wear resistance increases as it correlates positively with hardness.

Surface hardened rolls are made from high-quality steels and in accordance with customer requirements.



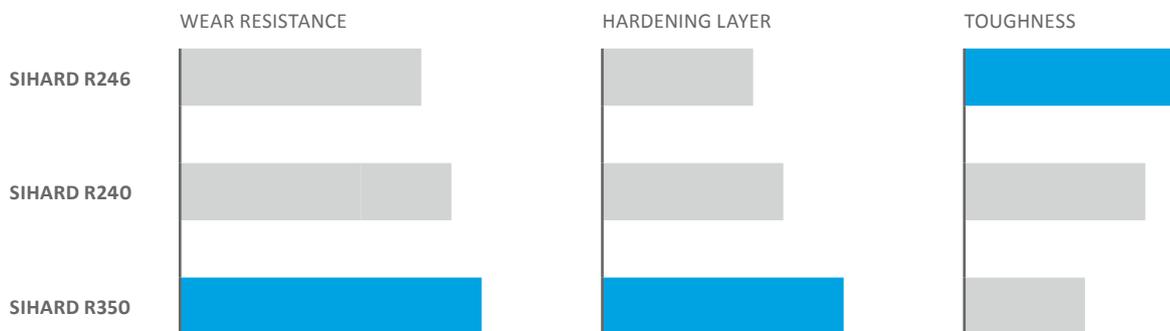
# ROLL PRODUCTION FLOWCHART – SURFACE HARDENED



## MOST FREQUENTLY USED STEEL GRADES

Ravne brand name	W.Nr.	DIN	Directional Chemical Composition (%)					Hardnes HRC
			C	Cr	Mo	V	Ni	
SIHARD 2327	1.2327	86CrMoV7	0.85	1.70	0.30	0.10	/	≤ 67.5
SIHARD 2375	1.2375	83CrMoV9	0.88	2.10	0.25	0.10	/	≤ 67.5
SIHARD R243	/	/	0.70	3.00	0.50	0.10	/	≤ 66
SIHARD R246	/	/	0.80	3.00	0.50	0.10	/	≤ 66
SIHARD R350	/	/	0.80	5.00	0.50	0.10	/	≤ 66
SIHARD R240	/	/	0.70	3.10	0.32	0.10	0.70	≤ 66
SIHARD 2304								
SIQUAL 7225								

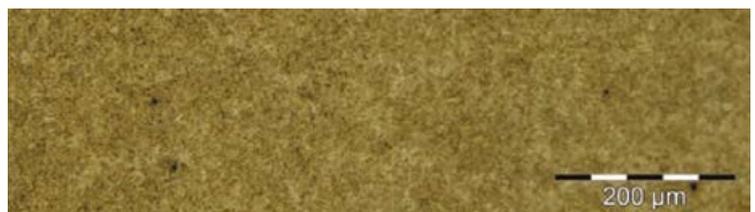
Comparison of the main properties:



The microstructure of the induction hardened layer is low tempered martensite and small carbides (magnification 500x).



The microstructure of the induction hardened layer is low tempered martensite and small carbides (magnification 500x) – 5 Cr steel.



## THROUGH HARDENED – SENDZIMIR ROLLS

We provide all kinds and size of work and intermediate rolls for cluster rolling mills.

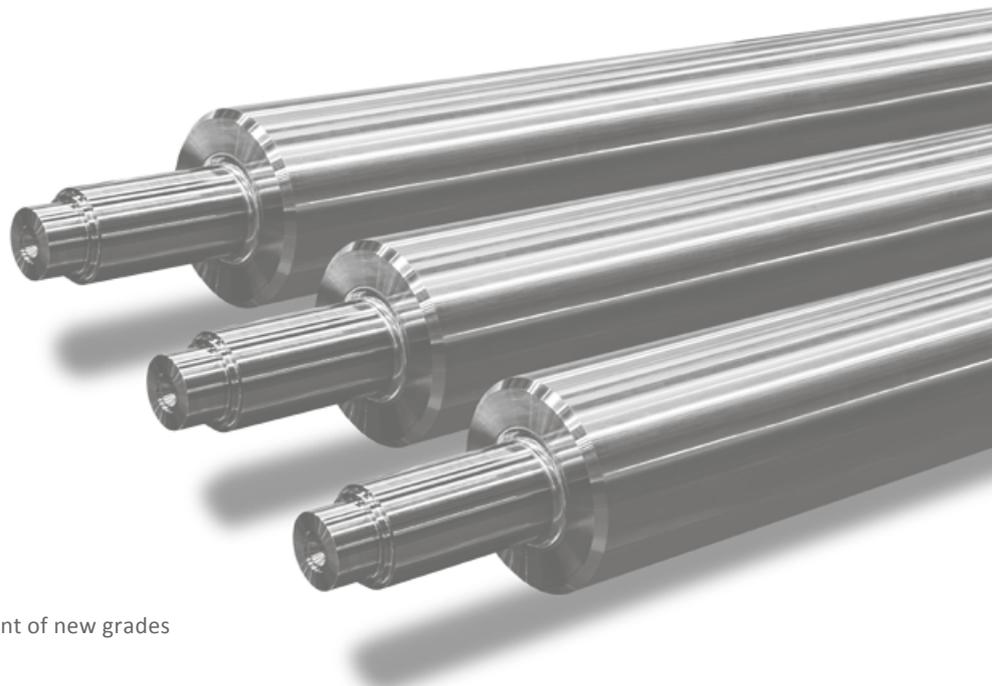
Guaranteed hardness throughout roll diameter and optimal mechanical properties.  
Our forged rolls withstand high pressure and are characterized by uniform hardness within +/- 0.5 HRC throughout the working barrel and a homogenous microstructure of the steel.

### Our rolls offer:

- Higher productivity
- High reliability
- Safety in operation
- Finer surface quality
- Higher rolling rate
- Positive influence on TCO

### Which is achieved by:

- A combination of the best steel grades
- State-of-the-art heat treatment equipment
- Precise machining
- Multi-step inspection of each roll
- Continuous investment into the development of new grades

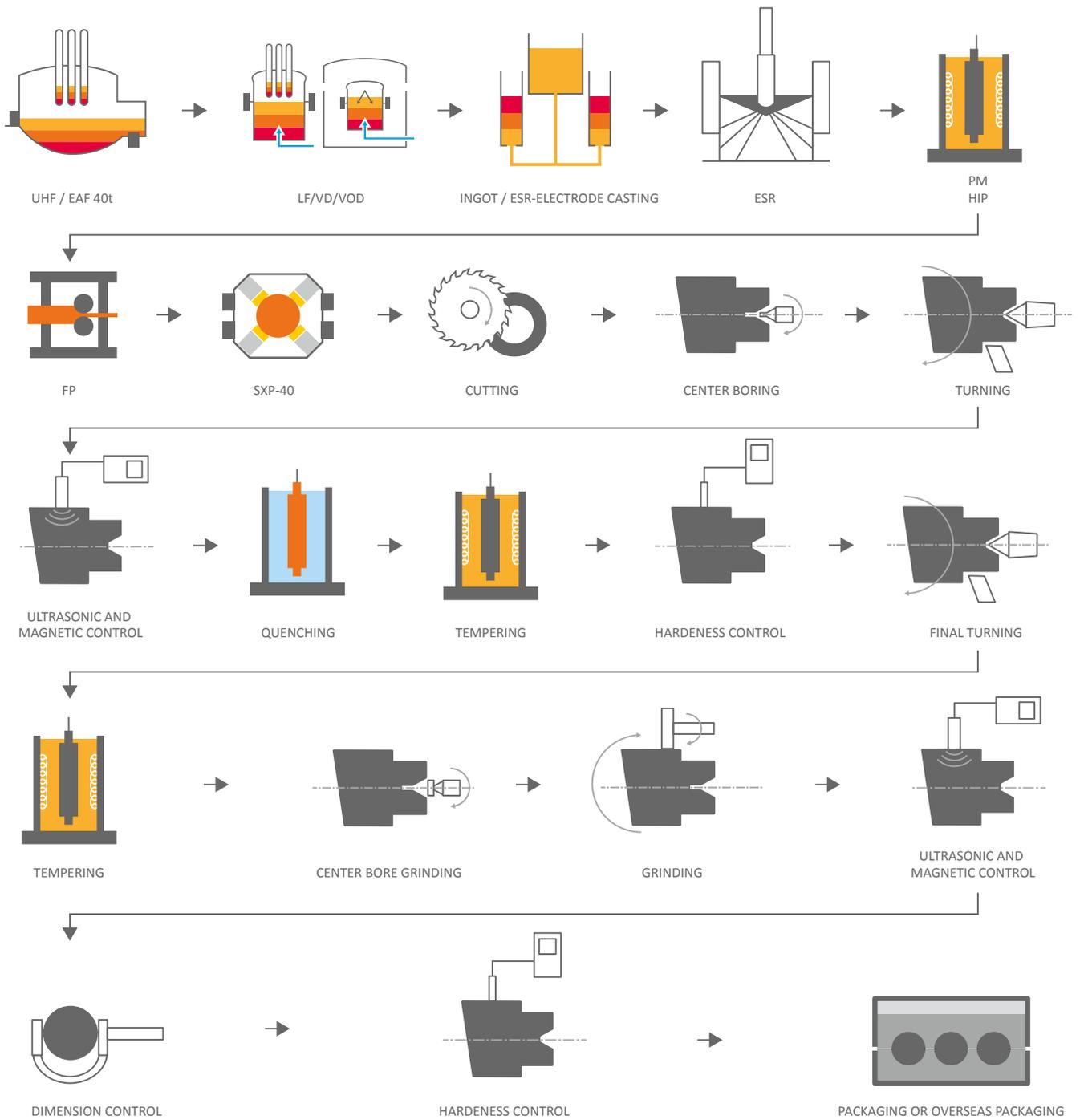


We are not limited by size length and weight of Sendzimir rolls.  
We produce rolls for all cluster rolling mill types.

## MOST FREQUENTLY USED STEEL GRADES

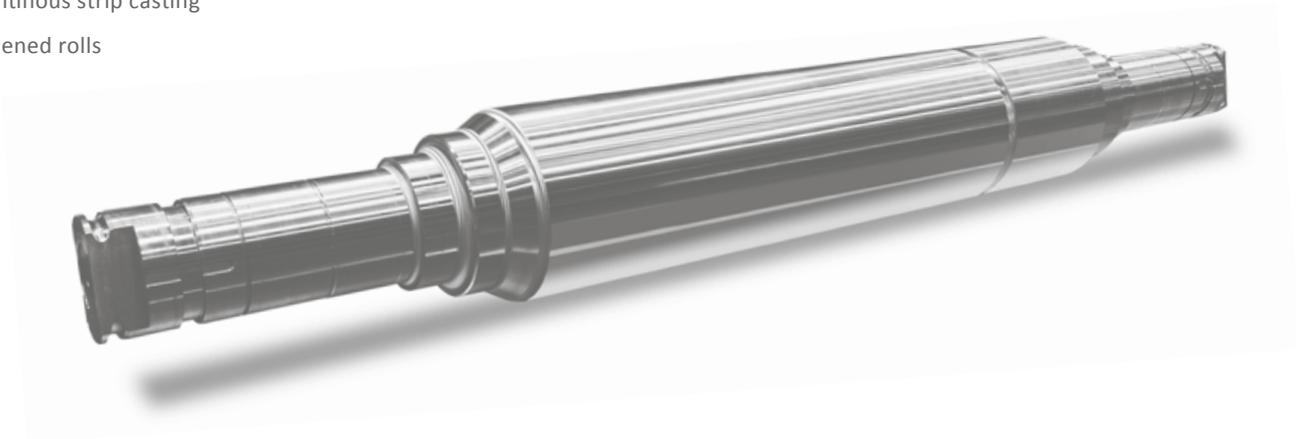
Ravne brand name	W.Nr.	DIN	AISI/SAE	Directional Chemical Composition (%)								Hardnes HRC
				C	Cr	Mo	V	W	Co	Si	Mn	
ASP2023	1.3395	PMHS6-5-3C	M3:2	1.26	4.1	5	3	6.3		0.5	0.30	≤ 67
ASP2030	1.3294	PMHS 6-5-3-8		1.26	4.1	5	3.1	6.4	8.4	0.5	0.2	≤ 67
ASP2060	1.3292	PMHS 7-7-7-11		2.3	4.1	7	6.5	6.5	10.5	0.5	0.3	≤ 67
SIRAPID 3346	1.3346	HS2-9-1	M1	0.83	3.85	8.6	1.2	1.7		0.2	0.2	≤ 65
SIRAPID 3343	1.3343	HS6-5-2	M2	0.9	4.15	5	1.9	6.5		0.2	0.2	≤ 65
SIRAPID 3344	1.3344	HS6-5-3	M3	1.2	4.15	5	2.95	6.5		0.2	0.2	≤ 65
SIHARD 2379	1.2379	X153CrMoV12	D2	1.55	11.5	0.7	1			0.3	0.4	≤ 62
SITHERM 2362	1.2362	X63CrMoV5-1		0.62	5.2	1.15	0.3			1.1	0.4	≤ 62
SITHERM R460			A8	0.72	5.5	1.3	0.6	1.2		0.9	0.5	≤ 62

# ROLL PRODUCTION FLOWCHART – THROUGH HARDENED



**TYPES OF PRODUCTS PRODUCED BY SIJ RAVNE SYSTEMS FOR ALUMINIUM INDUSTRY:**

- Forged rolls for foil production
- Roll cores for continuous strip casting
- Shells for continuous strip casting
- Surface hardened rolls

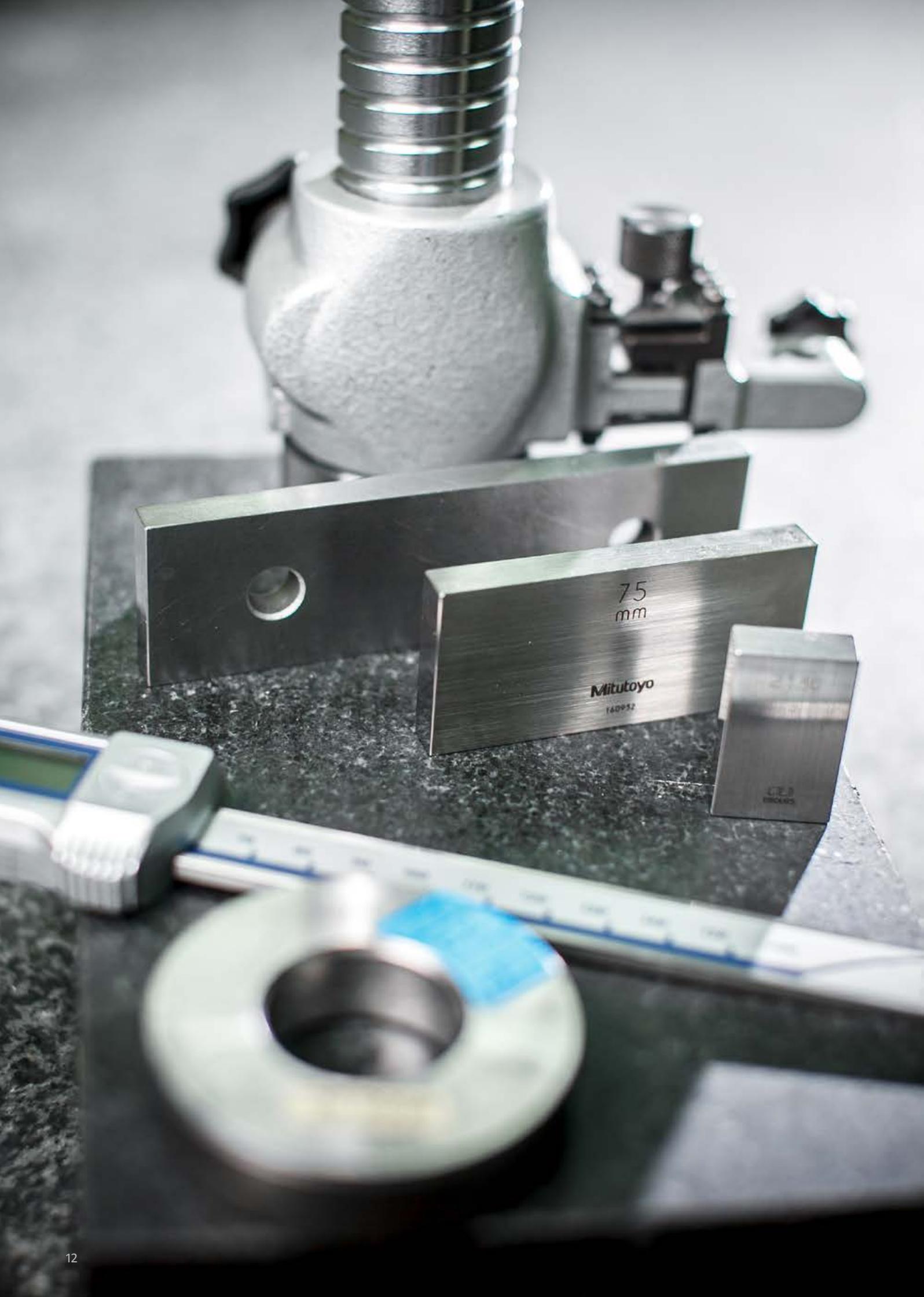


**SIJ RAVNE SYSTEMS PRODUCTS AND SERVICES OVERVIEW:**

- Complete assembled equipment
- Subassemblies
- Components
- Spare parts
- Industrial knives for hot and cold rolling mills
- Wear plates and liners
- Complete package of services, including maintenance, reconstruction, and revamping







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mm

Mitutoyo  
140932

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CE  
880405

## **IN-HOUSE R&D DEPARTMENT**

We are continuously working to find optimal solutions for our customers according to their requirements and applications. Our inhouse R&D department has over 30 employees, and our modern testing equipment allows us to develop and implement turn-key capex projects to meet even the most complex and technically demanding tasks and requirements of our customers.

- Problem solving - unique products and solutions
- Innovative products outperforming the average supplier on the market
- Development and testing of new steel grades as a result of the SIJ Group's vertical integration

## **IN-HOUSE ACCREDITED LABORATORIES**

SIJ Ravne Systems also has many well-respected accredited laboratories with highly qualified staff, who perform a wide range of calibrations, tests and inspections according to ISO/IEC 17025 and ISO/IEC 17020. The services provided by our laboratories are all carried out in line with accredited internal procedures, which conform to international standards.

### **Our main services include:**

- Calibration of length gauges and instruments, including shape and roughness testing
- Calibration of mechanical quantities: hardness, torque, force, etc.
- Non-destructive testing using RT, MT, PT, UT and VT methods
- Ultrasonic measuring instrument inspection
- Residual stress measurement

## **QUALITY ASSURANCE**

### **WITH EACH SHIPMENT THE CUSTOMER RECEIVES INSPECTION CERTIFICATES AND A QUALITY GUARANTEE**

We measure levels of retained austenite and residual stresses to guarantee the highest reliability and safety of operation. For this we use an accurate and safe X-ray diffractometer for measurement of residual stresses and retained austenite content. The Xstress unit measures stresses on crystalline material by X-rays, based on the phenomenon known as Bragg's law.

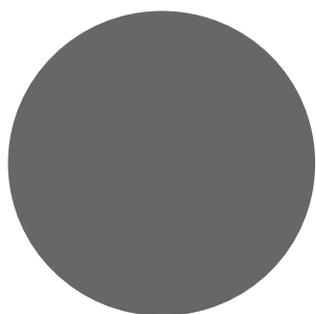
### **For quality assurance, our process inspection consists of:**

- Ultrasonic testing
- Magnetic particle testing
- Hardness testing
- Eddy-Current testing
- Dimension control
- X-ray measurements

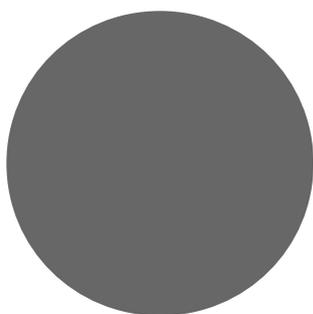
### **Certificates:**

- ISO 9001:2015
- EN ISO 3834
- LK – 004
- LP – 107
- K – 091

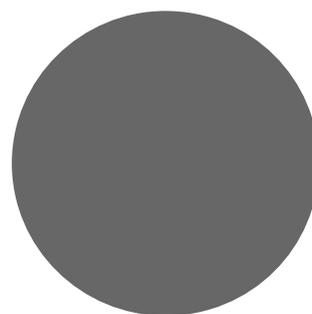
**Our work is never truly done; we are a part of an endless process.** This is symbolized by the three dots in our corporate logo, and in the logos of each SIJ Group product and service brand. Three dots equals three values. Each one stands firmly on its own, and they all stand together, forever. As a sign of trust and quality, they symbolize our three main values, which define who and what we are.



**CUSTOMIZATION.**

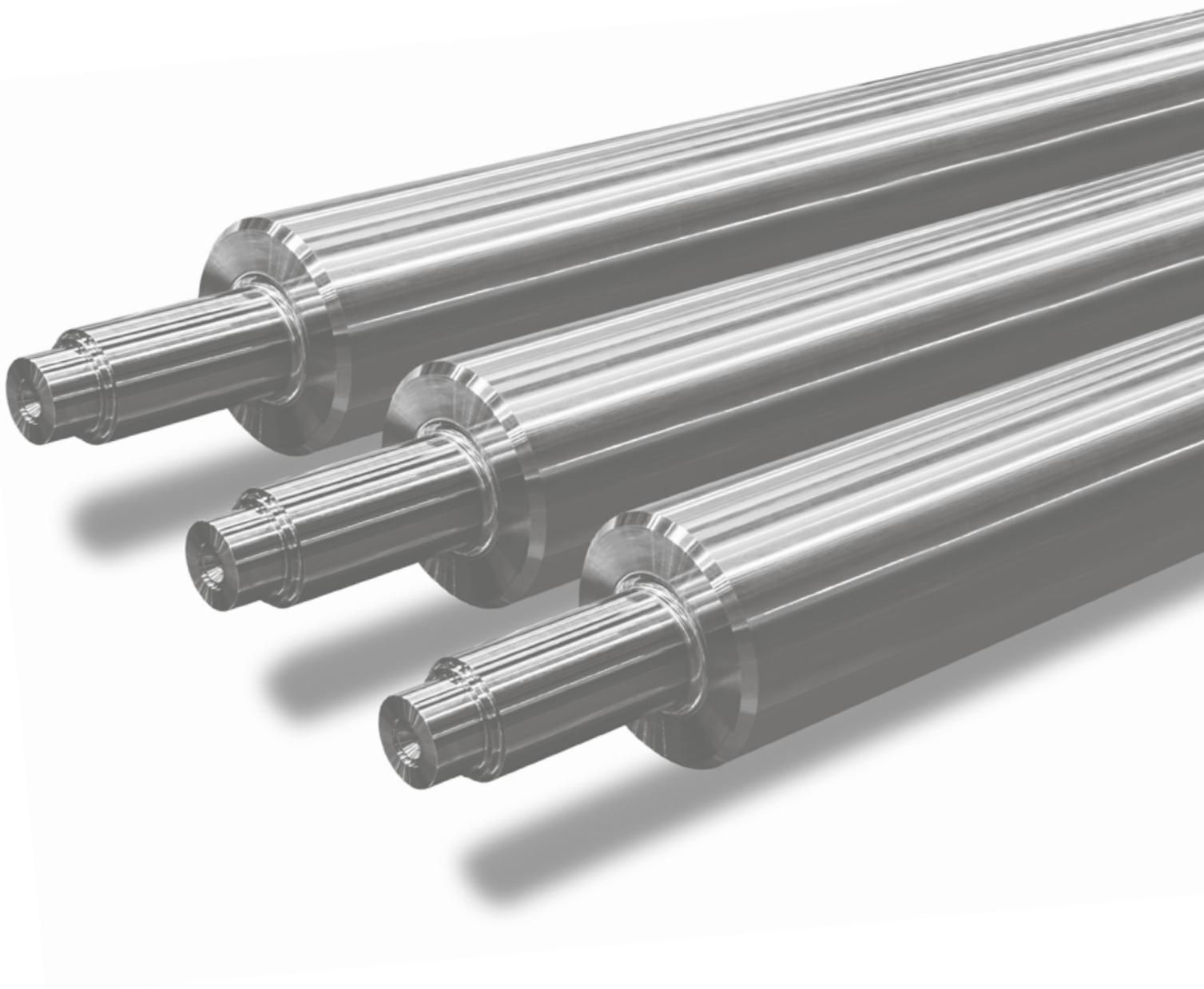


**STRIVING.**



**PROVEN.**

**sij** | group



The best  
THINGS IN THE  
WORLD CONTAIN  
SLOVENIAN  
steel

## **Sales network:**

### **Headquarters**

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