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
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.
MOST FREQUENTLY USED STEEL GRADES

<table>
<thead>
<tr>
<th>Ravne brand name</th>
<th>W.Nr.</th>
<th>DIN</th>
<th>C</th>
<th>Cr</th>
<th>Mo</th>
<th>V</th>
<th>Ni</th>
<th>Hardnes HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIHARD 2327</td>
<td>1.2327</td>
<td>86CrMoV7</td>
<td>0.85</td>
<td>1.70</td>
<td>0.30</td>
<td>0.10</td>
<td>/</td>
<td>≤ 67.5</td>
</tr>
<tr>
<td>SIHARD 2375</td>
<td>1.2375</td>
<td>83CrMoV9</td>
<td>0.88</td>
<td>2.10</td>
<td>0.25</td>
<td>0.10</td>
<td>/</td>
<td>≤ 67.5</td>
</tr>
<tr>
<td>SIHARD R243</td>
<td>/</td>
<td>/</td>
<td>0.70</td>
<td>3.00</td>
<td>0.50</td>
<td>0.10</td>
<td>/</td>
<td>≤ 66</td>
</tr>
<tr>
<td>SIHARD R246</td>
<td>/</td>
<td>/</td>
<td>0.80</td>
<td>3.00</td>
<td>0.50</td>
<td>0.10</td>
<td>/</td>
<td>≤ 66</td>
</tr>
<tr>
<td>SIHARD R350</td>
<td>/</td>
<td>/</td>
<td>0.80</td>
<td>5.00</td>
<td>0.50</td>
<td>0.10</td>
<td>/</td>
<td>≤ 66</td>
</tr>
<tr>
<td>SIHARD R240</td>
<td>/</td>
<td>/</td>
<td>0.70</td>
<td>3.10</td>
<td>0.32</td>
<td>0.10</td>
<td>0.70</td>
<td>≤ 66</td>
</tr>
<tr>
<td>SIHARD 2304</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIQUAL 7225</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparison of the main properties:

<table>
<thead>
<tr>
<th>WEAR RESISTANCE</th>
<th>HARDENING LAYER</th>
<th>TOUGHNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIHARD R246</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIHARD R240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIHARD R350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Ravne brand name</th>
<th>W.Nr.</th>
<th>DIN</th>
<th>Directional Chemical Composition (%)</th>
<th>Hardness HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP2023</td>
<td>1.3395</td>
<td>PMHS6-5-3C</td>
<td>C Cr Mo V W Co Si Mn</td>
<td>1.26 4.1 5 3 6.3 0.5 0.3 ≤ 67</td>
</tr>
<tr>
<td>ASP2030</td>
<td>1.3294</td>
<td>PMHS 6-5-3-8</td>
<td></td>
<td>1.26 4.1 5 3.1 6.4 8.4 0.5 0.2 ≤ 67</td>
</tr>
<tr>
<td>ASP2060</td>
<td>1.3292</td>
<td>PMHS 7-7-7-11</td>
<td></td>
<td>2.3 4.1 7 6.5 6.5 10.5 0.5 0.3 ≤ 67</td>
</tr>
<tr>
<td>SIRAPID 3346</td>
<td>1.3346</td>
<td>HS2-9-1</td>
<td>M1</td>
<td>0.83 3.85 8.6 1.2 1.7</td>
</tr>
<tr>
<td>SIRAPID 3343</td>
<td>1.3343</td>
<td>HS6-5-2</td>
<td>M2</td>
<td>0.9 4.15 5 1.9 6.5</td>
</tr>
<tr>
<td>SIRAPID 3344</td>
<td>1.3344</td>
<td>HS6-5-3</td>
<td>M3</td>
<td>1.2 4.15 5 2.95 6.5</td>
</tr>
<tr>
<td>SIHARD 2379</td>
<td>1.2379</td>
<td>X15CrMoV12</td>
<td>D2</td>
<td>1.55 11.5 0.7 1</td>
</tr>
<tr>
<td>SITHERM 2362</td>
<td>1.2362</td>
<td>X63CrMoV5-1</td>
<td></td>
<td>0.62 5.2 1.15 0.3</td>
</tr>
<tr>
<td>SITHERM R460</td>
<td>1.2362</td>
<td></td>
<td></td>
<td>0.72 5.5 1.3 0.6</td>
</tr>
</tbody>
</table>
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
IN-HOUSE R&D DEPARTMENT

We are continuously working to find optimal solutions for our customers according to their requirements and applications. Our in-house 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.
The best things in the world contain Slovenian steel.
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