



sij

Quality steels
SIQUAL





SIJ is a vertically integrated holding company, the leading steel manufacturer in Slovenia, and one of the largest stainless and special steel manufacturers in Europe. SIJ Group consists of the two largest steel companies in Slovenia (SIJ Acroni and SIJ Metal Ravne), other manufacturing and processing companies (SIJ Ravne Systems, SIJ SUZ), specialized service and sales centers across Europe and the USA, and companies for scrap steel collection and sales.

www.sij.si



INCREASE YOUR PRODUCT'S LIFE SPAN

The highest steel quality, based on world class production equipment and more than 400 years of experience in steel making



DECREASE MACHINING COSTS

Narrow dimensional tolerances, exceeding international standards



OPTIMIZE YOUR MANUFACTURING PROCESSES

Extensive range of mechanical treatment possibilities to find the best fit for your production process



EXCEED YOUR CUSTOMERS' EXPECTATIONS

Strong in-house R&D department and broad applied knowledge helps you get the best solutions for your customers' needs

SIJ GROUP – YOUR PARTNER IN THE TOOLING INDUSTRY

Based on its vertical integration, SIJ Group has developed into a reliable partner for the steel using industry. From own steel scrap collection and steel production, to own steel centers and tool components production – all from one source in a timely manner, according to the most stringent industry requirements and standards.



STEEL PRODUCTION

SIJ ACRONI is the largest Slovenian steel manufacturer and one of the leading quarto plate producers in Europe, producing steel by recycling scrap in an electric arc furnace, casting it on a continuous caster and rolling it into high quality flat rolled steel products. With our state of the art plate mill, we produce plates up to 2500 mm in width.

SIJ METAL RAVNE, the second largest Slovenian steel manufacturer and one of the largest tool steel producers in Europe, produces steel by recycling scrap in an electric arc furnace, casting it into ingots and rolling or forging it into quality long steel products. Own forging shop, rolling mill, ESR remelting furnaces and a wide range of heat treatment and machining options allow us to produce a rich pallet of more than 200 steel grades in different dimensional shapes, from carbon and alloyed structural steels.

SIJ SUZ is a manufacturer of cold drawn, ground, peeled and hot rolled steel bars and wire. The product range comprises round, hexagonal and specially-shaped bars. SUZ also manufactures finished products, semi-products and spare parts on a classical turning machine and on universal CNC turning centers.

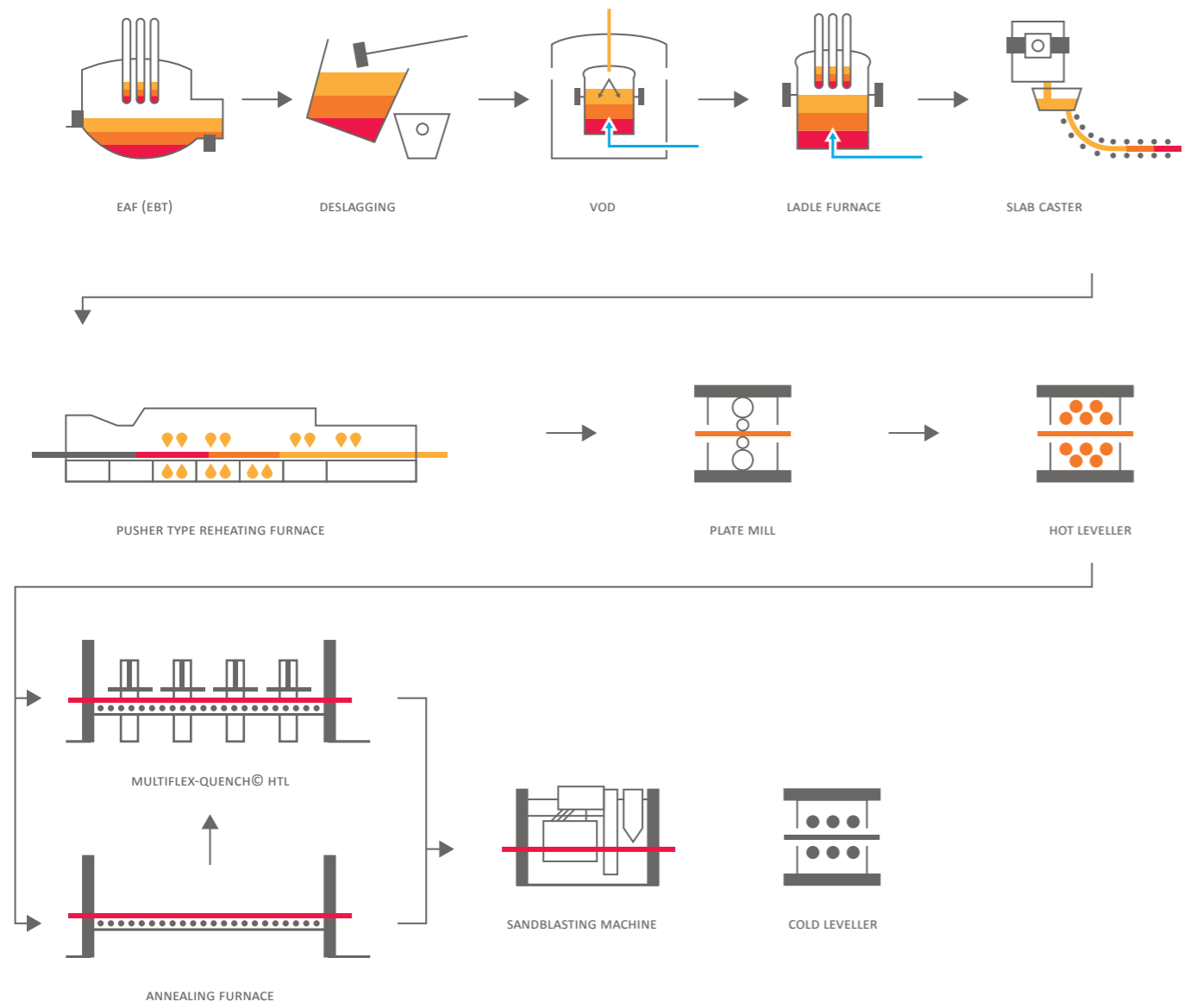
SIJ METAL RAVNE,
RAVNE NA KOROŠKEM, SI

SIJ ACRONI,
JESENICE, SI

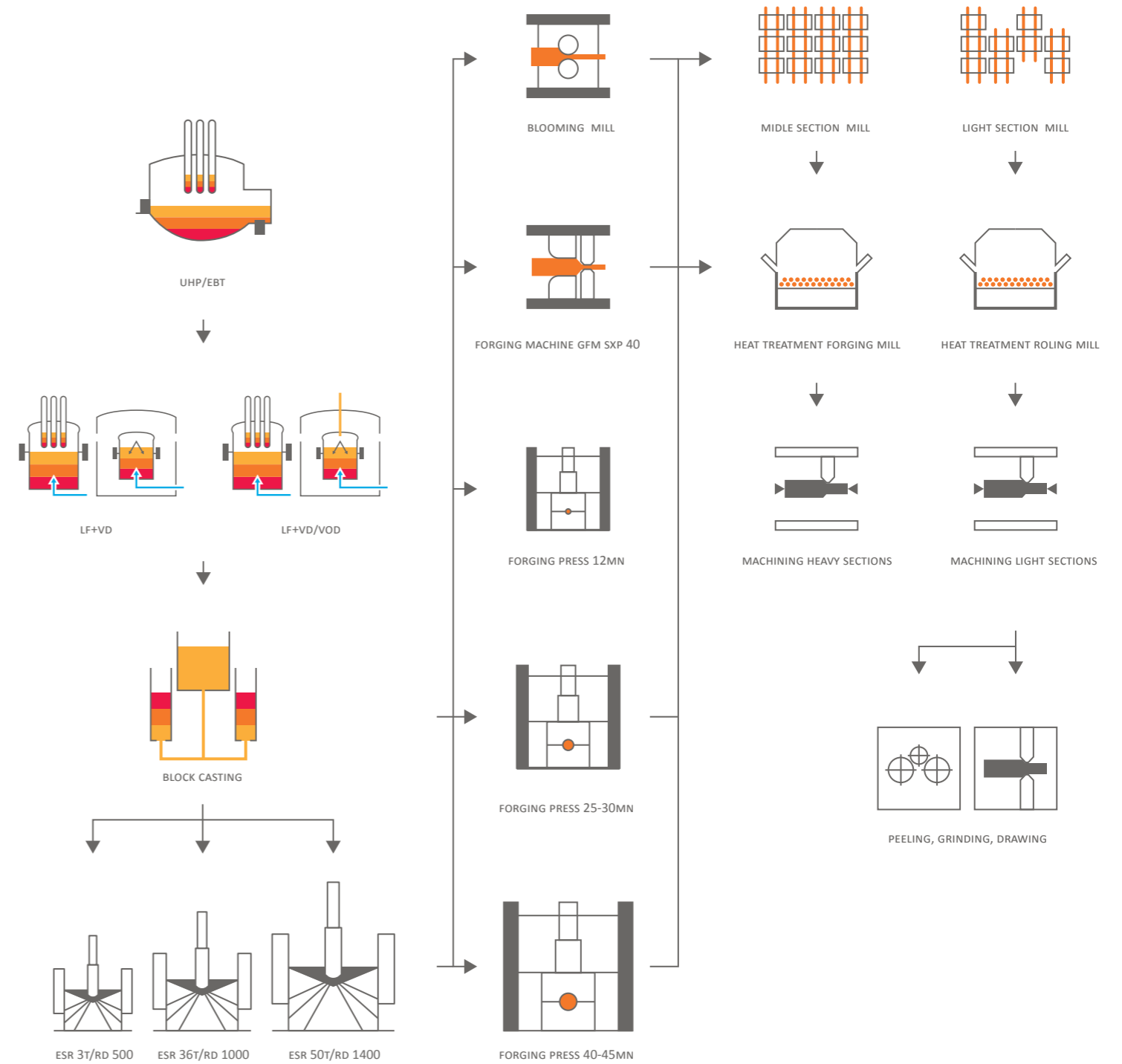
SIJ SUZ
JESENICE, SI

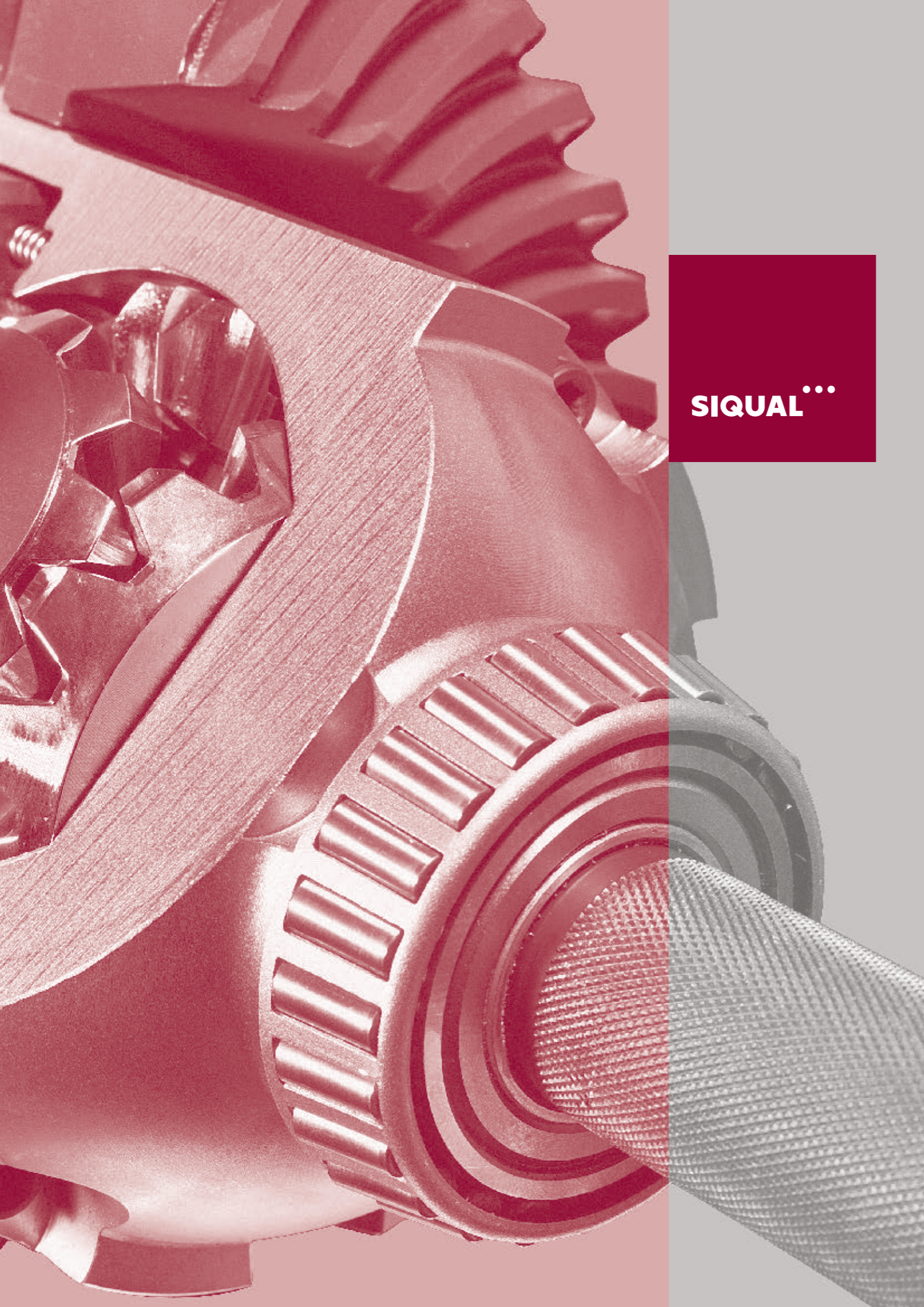


PRODUCTION PROCESS FLAT PRODUCTS



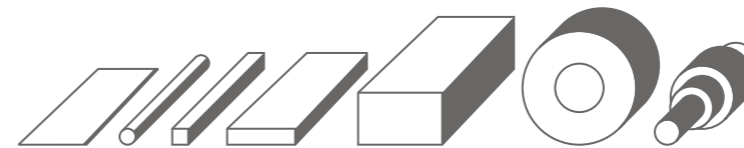
PRODUCTION PROCESS LONG PRODUCTS





SIQUAL...

SIQUAL...



SIQUAL grades cover a selection of various steel grades:

- Bearing steel
- Steel for pressure vessel
- Case hardening steel
- Nitriding
- Steel for quenching and tempering
- Spring steel

Highly adaptable to the wishes and needs of our clients, SIQUAL steel has a consistent level of quality. It is always delivered within the agreed period, ensuring uninterrupted production and increased productivity, while narrow tolerance ranges reduce the costs of mechanical treatment.

BEARING STEEL

Base for bearing steel properties is high cleanliness, low amount of gases. Our steels are guarantee for long life time due to high, uniform hardness and uniform microstructure after heat treatment.

Bearing steel material selection

SIJ grade	W.Nr.	Grade	
SIQUAL 3505	1.3505	100Cr6	•
SIQUAL 3520	1.3520	100CrMnSi6-4	•
SIQUAL 3539	1.3539	100CrMnMoSi8-4-6	•

STEELS FOR PRESSURE VESSELS

Steels for pressure vessels are intended for manufacturing of containers for storage or transportation of liquids or gases (ammonia, chlorine, propane, butane) which operates above or below atmospheric pressure. This steels are used in oil refineries, petrochemical plants, submarines, space vehicles, in general, in all hydraulic and pneumatic systems. They are also used as diving cylinders, steam boilers, boilers or pipes operating at high or low temperatures, turbine housings, for the use of fossil fuels.

Depending on the application, namely whether the steel used for the elevated or low temperature, these steels are alloyed with different elements. Thus, for example, addition of molybdenum increases the resistance at elevated temperatures, nickel is added to improve properties at low temperatures, chromium is added for corrosion resistance.

End products produced from forged and rolled long products for pressure equipment directive must exhibit high value of safety and reliability, due to their operation in high pressure, high temperature and corrosive atmosphere. During production of our products we take great care to assure absence of detrimental chemical elements, required cleanliness and final heat treatment. Products are delivered in annealed, normalized and tempered, quenched and tempered and stress relieved condition.



Steels for pressure vessel material selection

SIJ grade	W.Nr.	Grade	ASTM/ASME	
SIQUAL 5415	1.5415	16Mo3	A182F1/A/SA204	• • •
SIQUAL 5663	1.5663	X7Ni9	A553, Type I	•
SIQUAL 6981	1.6981	21CrMoNiV4-7		•
SIQUAL 7335	1.7335	13CrMo4-5	A182F11/A/SA387Gr12	• • •
SIQUAL 7336	1.7336	13CrMoSi5-5	A/SA387Gr11	• •
SIQUAL 7362	1.7362	X12CrMo5	A/SA182F5 / A/SA387Gr5	• •
SIQUAL 7380	1.7380	10CrMo9-10	A/SA182F22 / A/SA387Gr22	• • •
SIQUAL 7386	1.7386	X11CrMo9-10	A/SA182F9 / A/SA387Gr9	• •
SIQUAL 7709	1.7709	21CrMoNiV5-7		•
SIQUAL 7715	1.7715	14MoV6-3		•
SIQUAL 7779	1.7779	20CrMoV13-5-5		•
SIQUAL S350			A314 501	•
SINOXX 4903	1.4903	X10CrMoVNb9-1	A/SA182 F91 A/SA387 Gr.91	• •

CASE HARDENING STEEL

Steels for this application, with low carbon content are produced with selected scrap and high cleanliness. They are used for products where high surface hardness and tough center is essential. Our products are delivered in annealed condition. After mechanical process, surface of end product is enriched with carbon in carbon rich atmosphere and after quenching and tempering surface with hardness over 60 HRC is achieved.

Strips and sheets made of case hardening steels are used for parts with improved wear and fatigue resistance. Other benefits derived from surface hardening are resistance to plastic deformation of the part surface, good capacity for contact load, free of quench cracking, good dimensional control and greater ease in grinding and polishing to smooth surface.

SIJ grade	W.Nr.	Grade	
SIQUAL 5752	1.5752	15NiCr13	•
SIQUAL 5810	1.5810	18NiCr5-4	•
SIQUAL 5860	1.5860	14NiCr18	•
SIQUAL 5919	1.5919	15CrNi6	• •
SIQUAL 5920	1.5920	18CrNi8	• •
SIQUAL 6566	1.6566	17NiCrMo6-4	• • •
SIQUAL 6587	1.6587	18CrNiMo7-6	•
SIQUAL 7016	1.7016	17Cr3	• •
SIQUAL 7131	1.7131	16MnCr5	• • •
SIQUAL 7147	1.7147	20MnCr5	• • •
SIQUAL 7321	1.7321	20MoCr4	•
SIQUAL S140		AISI 3310	•

NITRIDING STEEL

One of the biggest advantages of nitriding steels is that the end product can achieve high hardness and wear resistance and almost no shape or dimension deformation is taking place during final heat treatment. Our products are delivered in annealed or QT condition.

SIJ grade	W.Nr.	Grade	
SIQUAL 8509	1.8509	41CrAlMo7-10	•
SIQUAL 8515	1.8515	31CrMo12	•
SIQUAL 8519	1.8519	31CrMoV9	•
SIQUAL 8550	1.8550	34CrAlNi7-10	•

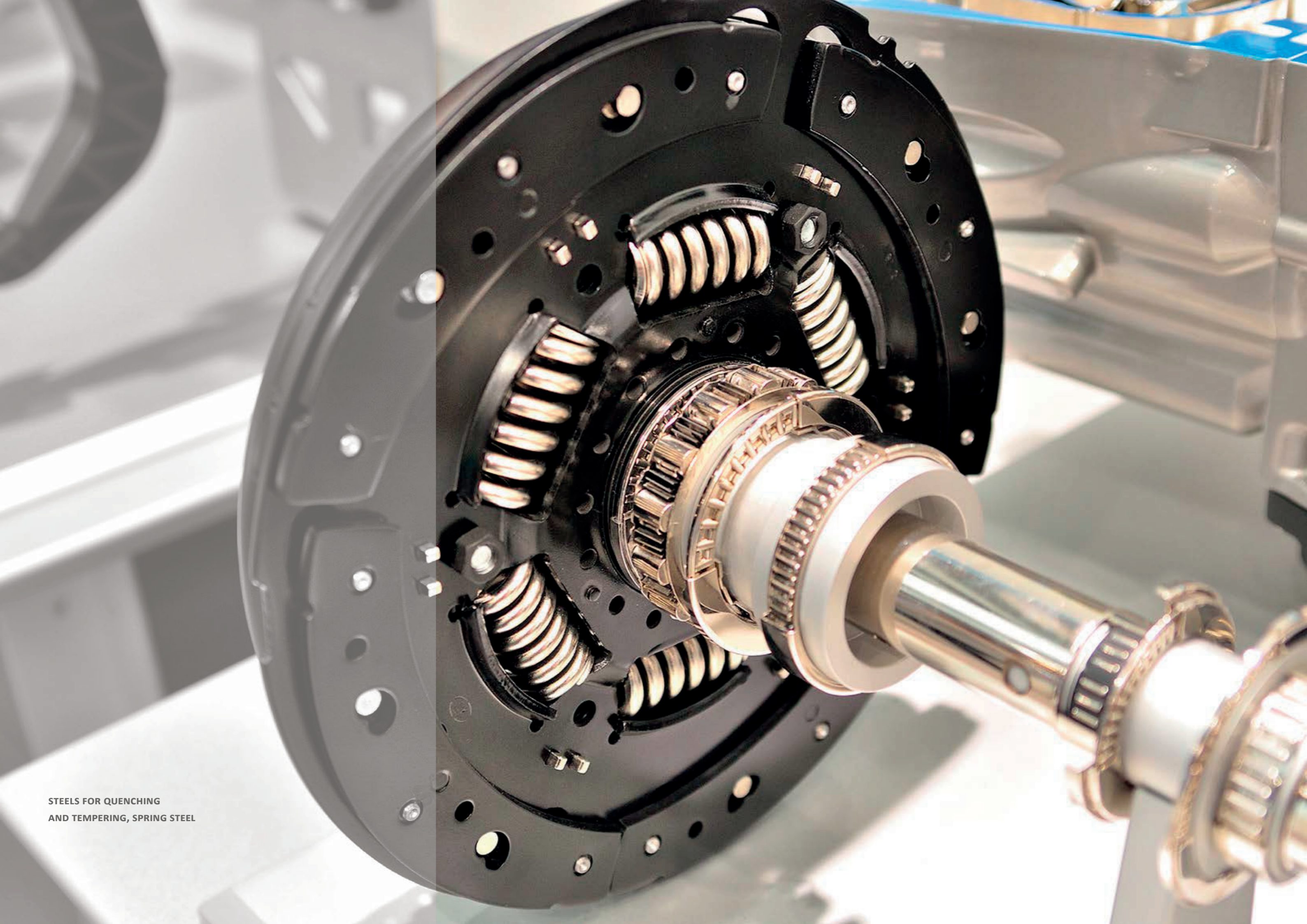
STEELS FOR QUENCHING AND TEMPERING

Steels in this group are intended for quenching and tempering in order to achieve final properties. They are used in the production of machines, machine parts, constructional engineering and in many other application where high strength and sufficient plasticity is required. Depending on cross-section and amount of alloying elements they need to be cooled in water, oil or air after austenitization. After tempering on suitable temperature, the needed strength and plasticity is achieved. Carefully sorted scrap is used for production, repeatable amount of alloying elements is enabling repeatable properties and heat treatment processes. They may be delivered in annealed or quenched and tempered condition.

Strips, sheets and plates made of steels for quenching and tempering are intended for products with high strength and hardness and good toughness at the same time. The products are formed in annealed condition, the desired mechanical properties are achieved by quenching and tempering made by customer.



SIJ grade	W.Nr.	Grade	
SIQUAL 0913	1.0913	50Mn7	• • •
SIQUAL 1170	1.1170	28Mn6	• • •
SIQUAL 1151	1.1151	C22E	• •
SIQUAL 1191	1.1191	C45E	• • •
SIQUAL 1203	1.1203	C55E	• • •
SIQUAL 1221	1.1221	C60E	• • •
SIQUAL 2703	1.2703	74NiCr2	• • •
SIQUAL 5662	1.5662	X8Ni9	•
SIQUAL 5710	1.5710 †	36 NiCr 6 †	•
SIQUAL 5736	1.5736 †	36NiCr10 †	•
SIQUAL 5737	1.5737 †	30NiCr11 †	•
SIQUAL 5755	1.5755 †	31 NiCr 14 †	•
SIQUAL 5864	1.5864 †	35NiCr18 †	•
SIQUAL 6510	1.6510	39NiCrMo3	• • •
SIQUAL 6511	1.6511	36CrNiMo4	•
SIQUAL 6545	1.6545	30NiCrMo2-2	•
SIQUAL 6580	1.6580	30CrNiMo8	•
SIQUAL 6582	1.6582	34CrNiMo6	• • •
SIQUAL 6747	1.6747	30NiCrMo16-6	•
SIQUAL 6753	1.6753	23MnNiMoCr6-4	•
SIQUAL 6758	1.6758	23MnNiMoCr5-4	•
SIQUAL 6773	1.6773	36NiCrMo16	•
SIQUAL 6949	1.6949	30 NiCrMoV 12	•
SIQUAL 6957	1.6957	27NiCrMoV15-6	•
SIQUAL 7218	1.7218	25CrMo4	• • •
SIQUAL 7220	1.7220	34CrMo4	• • •
SIQUAL 7225	1.7225	42CrMo4	• • •
SIQUAL 7227	1.7227	42CrMoS4	• • •
SIQUAL 7228	1.7228	50CrMo4	•
SIQUAL 7707	1.7707	30CrMoV9	•
SIQUAL 7711	1.7711	40CrMoV4-6	•
SIQUAL 7733	1.7733	24CrMoV5-5	•
SIQUAL 7734	1.7734	15 CDV 6 custom	•
SIQUAL 7765	1.7765	32CrMoV12-10	•
SIQUAL 8070	1.8070	21CrMoV5-11	•
SIQUAL 8161	1.8161	58CrV4	•
SIQUAL S120		AISI 1141	•
SIQUAL S130		SAE 4340	•






STEELS FOR QUENCHING
AND TEMPERING, SPRING STEEL

SPRING STEEL

Steels for springs are distinguished by high strength in connection with high yield strength after final heat treatment. High cleanliness enables long life time. Delivery in annealed or by special agreement in quenched and tempered condition is possible.

Sheets, strips and plates made of spring steels are intended for production of all kinds of springs. The products are formed in spheroidization annealed condition, but the desired properties are obtained by proper heat treatment - quenching and tempering made by customer.

SIJ grade	W.Nr.	Grade			
SIQUAL 1231	1.1231	C67S	•	•	•
SIQUAL 1248	1.1248	C75S	•	•	•
SIQUAL 1260	1.1260	66Mn4	•	•	
SIQUAL 5024	1.5024	46Si7	•	•	•
SIQUAL 5026	1.5026	56Si7	•	•	•
SIQUAL 5028	1.5028	65Si7	•	•	•
SIQUAL 5223	1.5223	42MnV7	•	•	
SIQUAL 7102	1.7102	54SiCr6	•	•	•
SIQUAL 7103	1.7103	67SiCr5	•	•	•
SIQUAL 7117	1.7117	52SiCrNi5	•	•	
SIQUAL 7701	1.7701	52CrMoV4	•	•	
SIQUAL 8159	1.8159	51CrV4	•	•	•

DIMENSIONAL RANGE AND DELIVERY CONDITIONS FOR FLAT ROLLED PRODUCTS

DIMENSIONAL RANGE

	HOT ROLLED STRIP	HOT ROLLED SHEET	COLD ROLLED STRIP
Thickness (mm)	3 – 6	3 – 6	0,3 – 3
Width (mm)	100-1000	800 – 1000	30 – 1000
Length (mm)		2000 – 6000	
Weight (kg/mm width)	7 – 9		6 – 8
ID (mm) 610 and 508			

	COLD ROLLED SHEET	HEAVY PLATES
Thickness (mm)	0,5 – 3	8 – 100
Width (mm)	1000	1000 – 2000/2500
Length (mm)	2000 – 6000	2000-6000
Weight (kg/mm width)	7-9	9,6
ID (mm) 610 and 508		

DELIVERY CONDITIONS

HEAVY PLATES

- As rolled
- normalized rolled
- normalized
- annealed
- normalized+tempered
- quenched and tempered

Edges can be trimmed or untrimmed.

HOT ROLLED PLATES AND STRIPS

- As rolled
- normalized rolled
- annealed

COLD ROLLED STRIP

- annealed, skin passed
- cold rolled – hardened

** Surface finish of cold rolled strips and sheets: MA RL (Ra. 0,6µm)

SURFACE CONDITION

- Unscaled (hot rolled strips or plates, heavy plates)
- Shot blasted (heavy plates, hot rolled strips and plates)

TOLERANCES ON DIMENSIONS AND SHAPE

EN 10029	Hot rolled steel plates 3mm thick or above - Tolerances on dimensions, shape and mass
EN 10051	Continuously hot-rolled uncoated plate, sheet and strip of non-alloy and alloy steels - Tolerances on dimensions and shape
EN 10140	Cold rolled narrow steel strip - Tolerances on dimensions and shape
EN 10131	Cold rolled uncoated low carbon and high yield strength steel flat products for cold forming - Tolerances on dimension and shape
A20/SA20	Standard specification for general requirements for steel plates for pressure vessels

DIMENSIONAL RANGE AND DELIVERY CONDITIONS FOR LONG PRODUCTS

ROUND

Rolled	Ø 15-105 (0.59"-4.13") L = 3000 – 6000 mm (9.84 ft – 19.67 ft), according to EN 10060
Peeled/peeled&polished	Ø 15 – 80 mm (0.59" – 3.15"), L = 2500 – 6000 mm (8.20 ft – 19.67 ft), according to EN 10278
Ground/ground&polished	Ø 6 – 80 mm (0.25" - 3.15"), L = 2000 – 4000 mm (6.56 ft – 13.11 ft), according to EN 10278
Forged&peeled	Ø 105 – 205 mm (4.14" - 8.07"), L = 2000 – 6000 mm (6.56 ft – 19.67 ft), tol. +1 /-0 mm (+0.04"/-0")
Forged&turned	Ø 206 – 300 mm (8.11" - 11.81"), L = 2000 – 6000 mm (6.56 ft – 19.67 ft), tol. +2 /-0 mm (+0.08"/-0") Ø 301 – 1050 mm (11.85" – 41.33"), L = 2000 – 6000 mm (6.56 ft – 19.67 ft), tol. +3 /-0 mm (+0.12"/-0")
Cold Drawn	Ø 2 mm - Ø 120 mm

FLAT

Rolled EN 10058	width 40 – 150 mm (1.57" – 5.91") × thickness 7 – 65 mm (0.27" – 2.56"), L = 3000 – 6000 mm (9.84 ft – 19.67 ft)
Rolled DIN59200	width 155 – 255 mm (6.10" – 10.04") × thickness 15 – 65 mm (0.59" – 2.56"), L = 3000 – 6000 mm (9.84 ft – 19.67 ft) surface: sandblasted
Rolled EN10059	square 25 – 80 mm (0.98" – 3.15"), L = 3000 – 6000 mm (9.84 ft – 19.67 ft)
Forged DIN 7527/6	square 100 – max 850 mm (3.94" – max 33.46"), L = 2000 – 7000 mm (6.56 ft – 22.96 ft), flat: width 100 – 1600 mm (3.94" – 62.99") × thickness 450 mm (17.71") or max. 720.000 mm ² (max. 1116 sq inch)
Forged&milled (tol. + 2 / - 0 mm)	square 100 – max 850 mm (3.94" - max 33.46"), L = 2000 – 7000 mm (6.56 ft – 19.67 ft), flat: width 100 – 1600 mm (3.94" – 62.99") × thickness 450 mm (17.71") or max. 720.000 mm ² (max. 1116 sq inch)

BILLETS WITH ROUNDED EDGES:

square 85 – 254 mm

length: 2000 – 5500 mm

WIDE FLATS:

width 250 – 505 mm, width milled in tolerance +2/-0 mm

thickness 26 - 90 mm, tolerance +4/-0 mm

For any information about dimensions outside specified ranges, please contact us directly.

OPEN-DIE MACHINE FORGINGS

Machined forgings produced by SIJ include rolls, shafts, mandrels, sleeves and bushes, rings and plates.

All open-die forgings can be subjected to heat treatment (normalizing, soft annealing, hardening&tempering, quenching, etc.) and machining by

- turning
- milling
- drilling

DIMENSIONAL RANGE OF FORGINGS

Rolls, axles, shafts	
max. dia.	1000 mm (39.37")
max. length	10000 mm (32.8 ft)
max. weight	20000 kg (44.093 lbs)
Rings, discs	
max. external dia.	2300 mm (90.55")
max. weight	10000 mm (32.8 ft)
Bushes	
max. dia.	1400 mm (55.12")
max. length	2400 mm (7.87 ft)
max. weight	15000 kg (33.060 lbs)



APPLICABLE STANDARDS

ASME/ASTM 387	Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum
EN 10163-1	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections. General requirements
EN 10163-2	Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections. Plate and wide flats
EN 10164	Steel products with improved deformation properties perpendicular to the surface of the product. Technical delivery conditions
EN 10160	Ultrasonic Testing of Steel Flat Product of Thickness Equal or Greater Than 6 mm (Reflection Method)
EN 10028-1	Flat Products made of steels for pressure purposes
EN 10028-2	Flat Products made of steels for pressure purposes-non-alloy and alloy steels with specified elevated temperature properties
EN 10028-4	Flat products made of steels for pressure purposes — Nickel alloy steels with specified low temperature properties
EN 10132-1	Cold rolled narrow strip for heat treatment - Technical delivery conditions - Part1: General
EN 10132-2	Cold rolled narrow strip for heat treatment - Technical delivery conditions - Part 2: Case hardening steels
EN 10132-3	Cold rolled narrow strip for heat treatment - Technical delivery conditions - Part 3: Steels for quenching and tempering
EN 10132-4	Cold rolled narrow strip for heat treatment - Technical delivery conditions - Part 4: Spring steels and other applications
EN 10083-1	Steels for quenching and tempering - Part 1: General technical delivery conditions
EN 10083-2	Steels for quenching and tempering - Part 2: Technical delivery conditions for non-alloy steels
EN 10083-3	Steels for quenching and tempering - Part 3: Technical delivery conditions for alloy steels
EN 10084	Case hardening steels - Technical delivery conditions
EN 10089	Hot rolled steels for quenched and tempered springs
ASME/ASTM 553	Type I Ni-alloy steel plates for pressure vessels
ASME/ASTM 204	Carbon-Molybdenum Alloy Steel Pressure Vessel Plates
A20/SA20	Standard specification for general requirements for steel plates for pressure vessels

RESEARCH AND DEVELOPMENT

SIJ in-house development departments employ a team of highly competent experts, and is constantly being upgraded since our desire to bring the added value to our customers is set on a long-term basis.

IN-HOUSE R&D DEPARTMENTS

At SIJ we are constantly striving to find optimal solutions for our clients, according to their needs and application of their products. Therefore we have 3 in-house R&D departments, with more than 90 employees and modern testing equipment including scanning electron microscope with an EDS analyzer, an X-ray diffractometer and a dilatometer along with a mechanical and a chemical laboratory as well as laboratory heat-treatment furnaces.

On yearly basis we carry out more than 100 R&D projects with our clients and win multiple national innovation awards. Newly developed products represent more than 7% of our yearly turnover.

COMPETENCE CENTER

Incorporation into a partner development network represents a vital part of our research and development. On one hand, this means a closer cooperation with the top-level knowledge and development institutions, while on the other hand, it brings close cooperation with development departments held by our partners and customers as well as competent consulting.

SIJ is an incorporator and active member of KC IKM competence centre, an organisation where more than 250 engineers and researchers fully equipped with designing, laboratory, prototyping and measurement equipment are actively working in the sphere of new product and solutions development in close cooperation with our customers and end-users of the product.



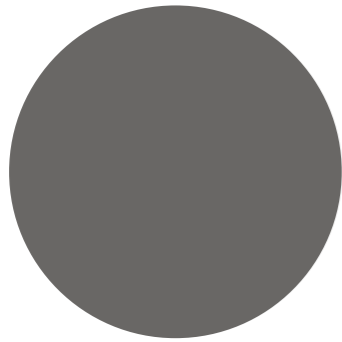
QUALITY ASSURANCE

Both of our steel mills are EN ISO 14001:2004, EN ISO 9001:2000 and OHSAS 18001:2007 certified.

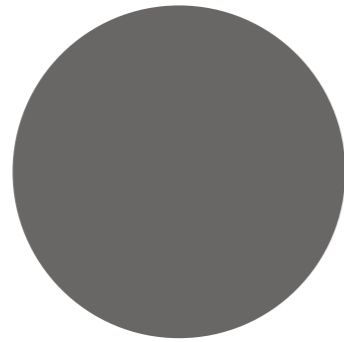
SIJ among other departments consists of many well respected accredited and in house laboratories with highly qualified staff, which perform a wide range of calibrations, testing and inspections according to ISO/IEC 17025 and ISO/IEC 17020. Services that laboratories provide are all performed following internal procedures which conform to international standards ISO, EN and ASTM. Main services include:

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

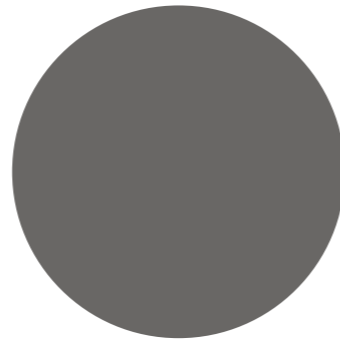
Our work is never truly done; we are a part of an endless process. This is symbolised by the three dots in our corporate logo, and the logos of each SIJ Group product and service brand. Three dots equals three values. Each one stands firmly on its own, and they all stand together, forever. As a sign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



CUSTOMISATION.



STRIVING.



PROVEN.

sij | group



**BEST THINGS IN THE WORLD
CONTAIN SLOVENIAN STEEL**



SIJ Group

Gerbičeva 98
1000 Ljubljana
www.sij.si