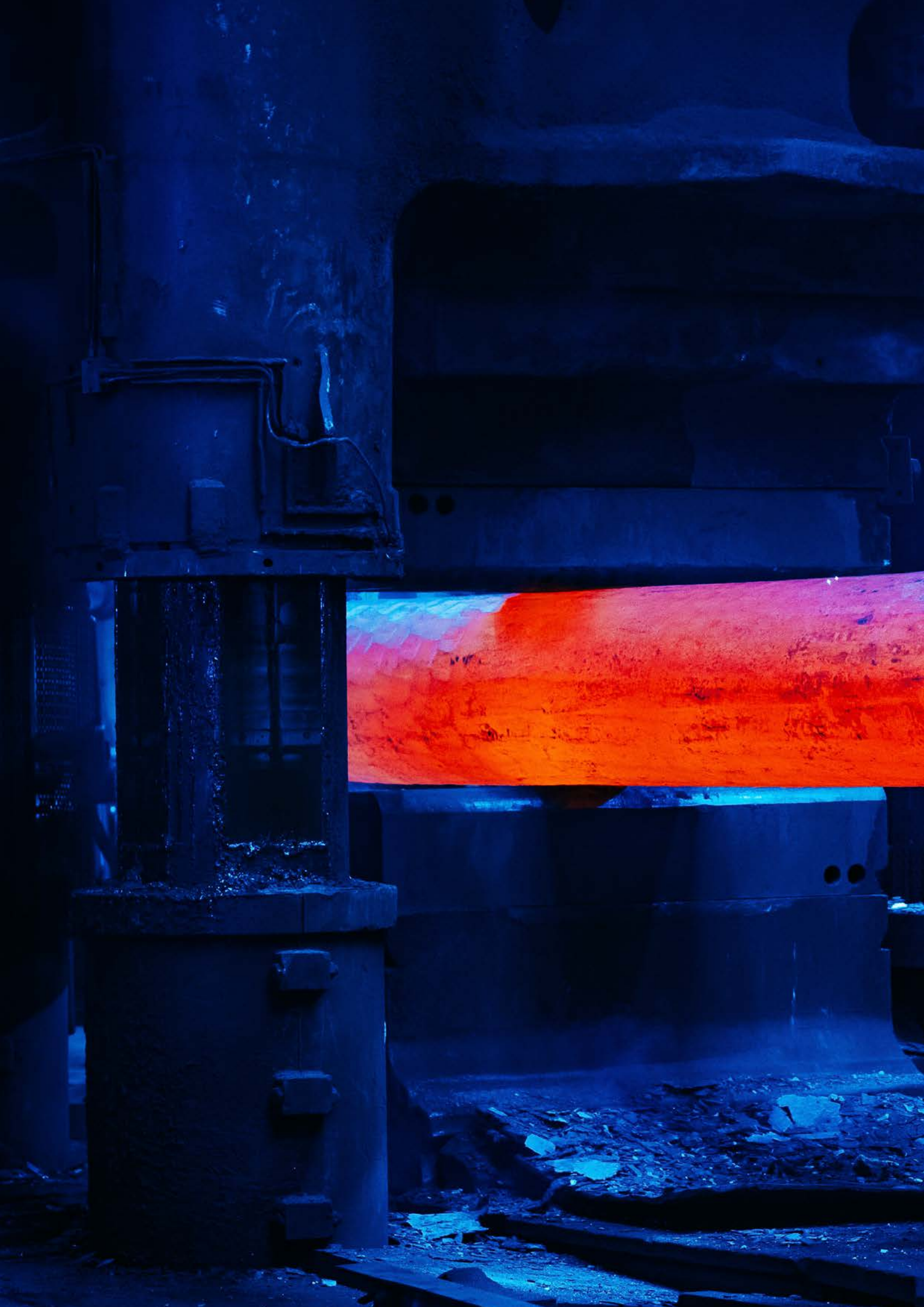
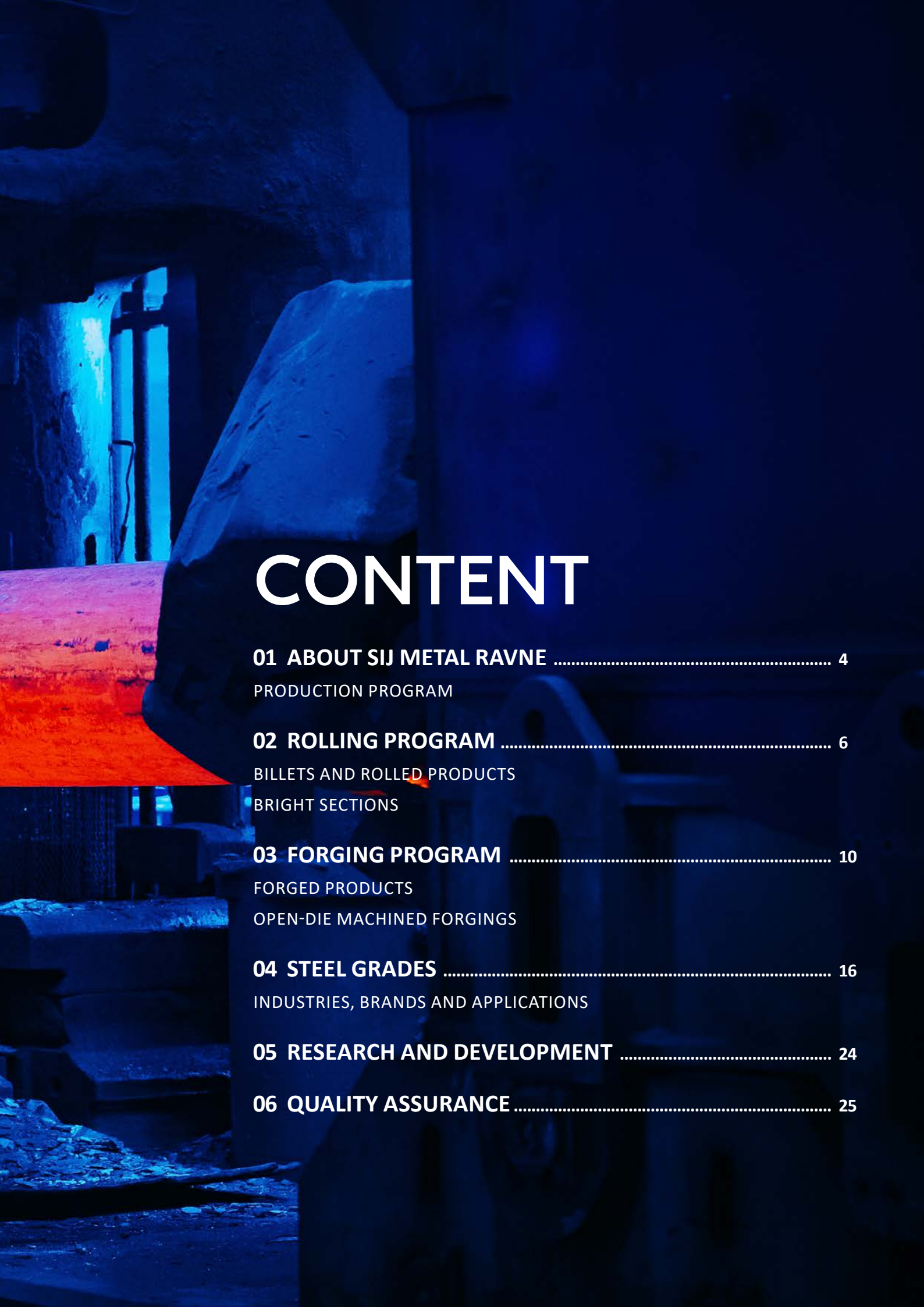


sij | metal ravne

CATALOGUE





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01

ABOUT SIJ METAL RAVNE

SIJ Metal Ravne produces premium-quality tool steels, high-speed steels, and stainless and special steels.

We manufacture steel in an electric arc furnace, cast it into ingots, and roll or forge it into high-quality long steel products. For the most demanding applications, we use the VOD* and ESR** methods.

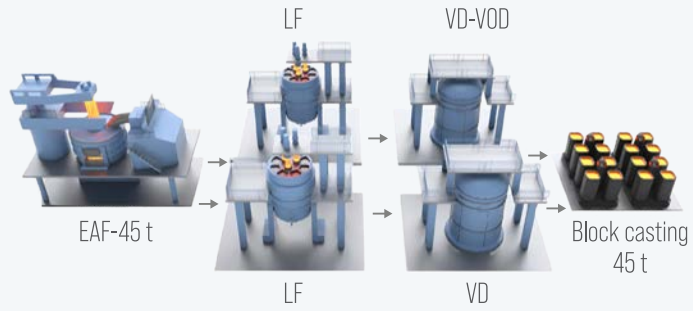
Our own steel plant, forging shop, rolling mill, and a wide range of heat treatment and machining processes enable us to produce a rich palette of more than 200 steel grades in various dimensional shapes. With around 1,000 employees and an annual production of nearly 80,000 tons, we belong to the group of mini mills.

We have found our opportunity in so-called niche production, which is characterized by specialized knowledge and experience, greater flexibility, and higher added value.

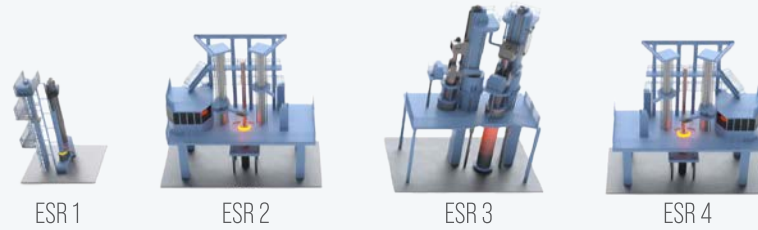
*VOD (Vacuum Oxygen Decarburization) is a process used to refine stainless steel by reducing its carbon content under vacuum.

**ESR (Electro-Slag Remelting) is a remelting and refining process for steel and other alloys used in the most demanding industries, such as toolmaking, energy, automotive, and aviation.

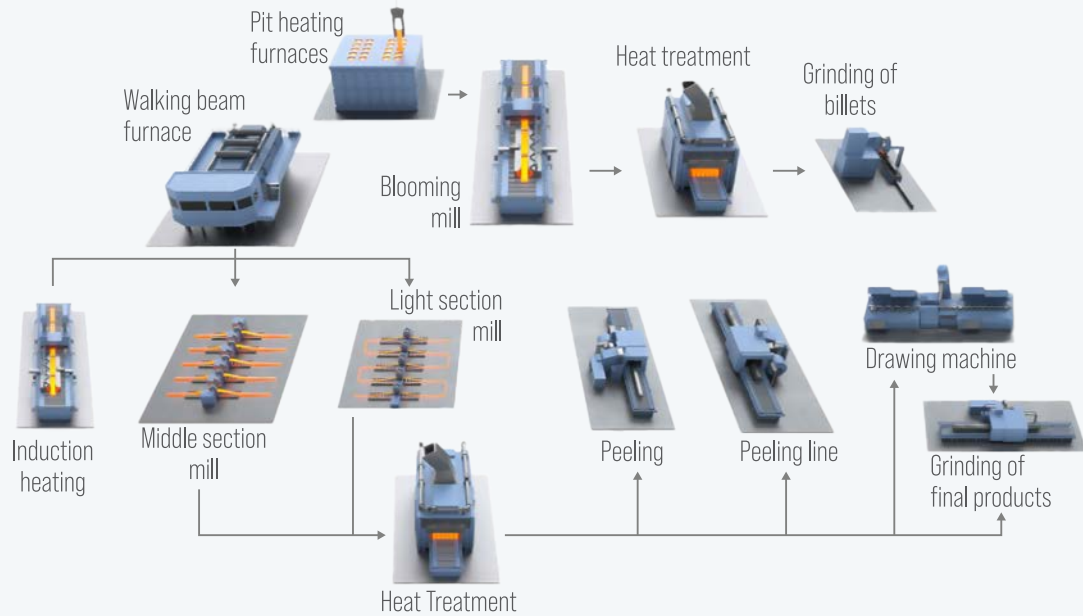
Steel Plant



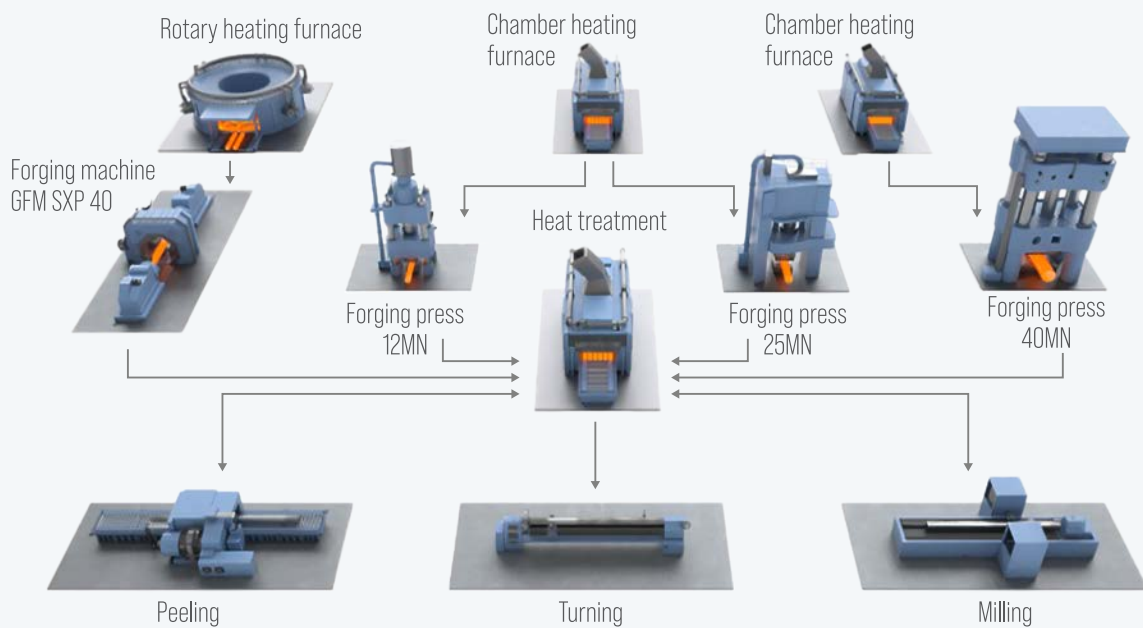
ESR



Rolling Mill



Forging Mill



02

ROLLING PROGRAM

This program enables us to produce a wide range of products with various surface finishes and final heat treatment conditions.

The rolling program integrates three production units: the Billet Rolling Mill, the Section Rolling Mill, and the Steel Drawing Plant.

The **Billet Rolling Mill** operates with a modern blooming rolling stand, supported by advanced heat treatment furnaces as well as grinding and testing equipment.

The **Section Rolling Mill** produces round, square, and flat sections of various dimensions in its Intermediate Rolling

Mill and Rod Mill. It is equipped with modern heat treatment furnaces, machines for straightening, cutting, sandblasting, varnishing, and inspection of rolled products.

The **Steel Drawing Plant** manufactures products with drawn, peeled, or ground surfaces.



Billets and Rolled products

BILLETS WITH ROUNDED EDGES

- Square: 85–220 mm
- Flat: 151–320 mm x 70–130 mm
- Length: 2000–5500 mm

Tolerances for billets with rounded edges

Tolerance [%]

± 3

WIDE FLAT SECTIONS

- Width x thickness:
 - 85–150 mm x 70–130 mm
 - 151–250 mm x 70–90 mm
 - 251–505 mm x 25–90 mm
- Length: 1600–4500 mm

Tolerances for wide flat sections

Tolerance [mm]

Milled	+2 -0
Rolled	+4 -0

FLAT SECTIONS

acc. to EN 10058 and 59200 standard

- Width x thickness:
 - 40–150 mm x 7–65 mm
 - 150–255 mm x 7–50 mm
- Ratio: for tool steels 1:15, for structural steels 1:18
- Width: minimal thickness +10 mm (applies to all steels except for high-speed steels)
- Length: 3000–6000 mm
- Surface finish: unmachined, sandblasted or varnished.
- Achieved straightness: ≤ 2mm/m

The table provides standard tolerances. Sections can also be produced with very narrow tolerances — $\frac{3}{4}$ of the standard tolerance for width and $\frac{1}{2}$ of the standard tolerance for thickness. Sections can be manufactured with only plus tolerance, with plus/minus tolerance, or with only minus tolerance.

Tolerances for flat sections

WIDTH ≤ 150 mm (acc. to EN 10058 standard)	Width [mm]	Tolerance [mm]
	40	±0.75
	41–80	±1
	81–100	±1.5
	101–120	±2
	121–150	±2.5
	Thickness [mm]	Tolerance [mm]
	< 20	±0.5
	21–40	±1.0
	41–50	±1.5
WIDTH > 150 mm (acc. to EN 59200 standard)	Width [mm]	Tolerance [%]
	150–250	±2
	Thickness [mm]	Tolerance [mm]
	20–25	-0.5 +0.9
	26–30	-0.6 +1.0
	31–40	-0.7 +1.1
	41–50	-0.9 +1.1

ROUND SECTIONS

acc. to EN 10060 standard

- ϕ : 15–105 mm
- Length: 3000–6000 mm
- Surface finish: unmachined
- Achieved straightness: $\leq 2\text{mm/m}$

Tolerances for round unmachined sections

Dimension [mm]	Tolerance [mm]
15	± 0.4
16–25	± 0.5
26–35	± 0.6
36–47, 49, 50	± 0.8
51–56, 58, 60, 62–66, 68, 70, 72, 73, 75, 78, 80	± 1.0
82, 83, 85, 88–90, 92–95, 97, 100	± 1.3
103, 105	± 1.5

BRIGHT SECTIONS

Peeled and peeled & polished bars (acc. to EN 10278 standard)

- ϕ 15–100 mm
- Length: 2500–6000 mm

Ground and ground & polished bars (acc. to EN 10278)

- ϕ 6–80 mm
- Length: 2000–4000 mm

Tolerances for bright sections

Nominal dimension [mm]	Tolerance [mm]		
	h8*	h9	h11
6–10	0.022	0.036	0.090
11–18	0.027	0.043	0.110
19–30	0.033	0.052	0.130
31–50	0.039	0.062	0.160
51–80	0.046	0.074	0.190

*Valid only for ground and ground & polished bars max. ϕ 50 mm.
In addition to these tolerances: f, k, a, g, j.





FORGING PROGRAM

This program includes the core forging equipment and all necessary devices for the production of various forged products.

Forging program products:

- Billets
- Forged bars
- Open-die machined forgings

For smaller dimensions, we use the SX-40 forging machine, while larger dimensions are produced on presses. We operate 12 MN, 25 MN, and 40 MN presses. All products can undergo heat treatment in modern furnaces using various procedures.

In 2021, we invested in a special heat treatment line designed for products used in the most demanding industries, such as energy, aviation, oil and gas, and others. The line consists of two double-chamber furnaces, each comprising a high-temperature and a low-temperature chamber. In addition,

the line includes two cooling pools and a portal manipulator with a load capacity of up to 25 tonnes, ensuring precise product handling. Process accuracy is certified according to the AMS 2750 F standard.

An important part of our forging program is the equipment for machining and cutting of materials.

In addition to black-surfaced products, we also offer products with light surfaces achieved through peeling, turning, or milling. Cutting to customer-specified dimensions is also available.



Forged products

BILLETS

Product used for further hot forming:

- Round: ϕ 90–1000 mm
- Square: 90–900 mm
- Length: 2000–7000 mm

Tolerances for billets

	Dimension [mm]	Tolerance [mm]	
		Tool steel	Other steels
Round	90–200	± 5	± 10
	201–300	± 6	± 6
	> 300	± 10	± 10
Square	90–200	± 5	± 10
	201–300	± 15	± 15
	> 300	± 20	± 20

ROUND FORGED BARS

(According to DIN 7527/6 standard)

- ϕ 90–950 mm
- Length: 2000–7000 mm
- Surface finish: unmachined, peeled, or turned
- Maximum weight of forging:
 - Turned forgings: max. 18.000 kg, length 6 m,
 - cross-section up to ϕ 1100 mm
 - Classic (unmachined): 25.000 kg
 - ESR: max. 23.000 kg

Tolerances for round forged bars

	Dimension [mm]	Tolerance [mm]
Peeled	85–205	-0
		+1
Turned	206–300	-0
		+2
	301–1000	-0
		+3

FLAT FORGED BARS

(According to DIN 7527/6 standard)

- From 90x70 mm to 260x120 mm, or from 261x80 mm to 1600x650 mm
- Length: 2000–7000 mm

Surface finish: unmachined or milled

Tolerances for flat forged bars

	Tolerance [mm]
Milled	-0
	+2

SQUARE FORGED BARS

- 90–850 mm
- Length: 2000–7000 mm

Surface finish: unmachined or milled

Tolerances for square forged bars

	Tolerance [mm]
Milled	-0
	+2

DIMENSIONAL PROGRAM DEPENDING ON STEEL GROUP

SIQUAL...

Unalloyed structural steels

Round: max. ϕ 1000 mm
Square: max. 900 mm
Flat: max. 1600x650 mm
Max. ratio width : thickness is 11:1

SIQUAL...

Alloyed structural steels

Round: max. ϕ 950 mm
Square: max. 850 mm
Flat: max. 1600x600 mm
Max. ratio width : thickness is 11:1

SIMOLD...

Low alloyed tool steels

Round: max. ϕ 850 mm
Square: max. sq. 750 mm
Flat: max. 1550x550mm
Max. ratio – width : thickness is 11:1

SIHARD...

High-alloyed cold-work tool steels

Round: max. ϕ 625 mm
Square: max. 550 mm
Flat: max. 1000x300 mm
Max. ratio width : thickness is 8:1

SITHERM...

High-alloyed hot-work tool steels

Round: max. ϕ 850 mm
Square: max. 750 mm
Flat: max. 1500x450 mm
Max. ratio width : thickness is 10:1

SIRAPID...

High speed steels

Round: max. ϕ 180 mm
Square: max. 160 mm
Flat: max. 250x100 mm
Max. ratio width : thickness is 4:1

SINOXX...

Special steels

Round: max. ϕ 700 mm
Square: max. 650 mm
Flat: max. 1200x300 mm
Max. ratio width : thickness is 8:1

Larger dimensions according to agreement.

TOLERANCES AND ADDITIONS (ACC. TO DIN 7527/BL.6 STANDARD)

Finished [mm]		High-grade steel								Low-grade steel							
		Tool steel				Structural steel				Alloyed and unalloyed steel							
		Length up to 3500 mm		Length over 3500 to 6000 mm		Length up to 3500 mm		Length over 3500 to 6000 mm		Length up to 3500 mm		Length over 3500 to 6000 mm		Length up to 3500 mm		Length over 3500 to 6000 mm	
		Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length
		Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance	Acceptable tolerance
Over	Up to																
16	25	2,6 ±0,6	9 ⁺¹⁰ ₋₇	/	/	/	/	/	/	/	/	/	/	/	/	/	/
25	40	3 ±0,7	9 ⁺¹⁰ ₋₈	/	/	/	/	5 ±0,9	11 ⁺¹⁰ ₋₈	8 ±2,6	16 ⁺¹⁴ ₋₉	/	/	/	/	/	/
40	63	4 ±0,9	10 ⁺¹¹ ₋₈	6 ±1,4	14 ⁺¹¹ ₋₉	6 ±1,1	12 ⁺¹¹ ₋₈	9 ±2,9	17 ⁺¹⁴ ₋₁₀	9 ±2,8	13 ⁺¹³ ₋₉	/	/	/	/	/	/
63	80	5 ±1,1	11 ⁺¹² ₋₉	7 ±1,6	15 ⁺¹² ₋₁₀	7 ±1,4	14 ⁺¹² ₋₉	11 ±3,3	18 ⁺¹⁴ ₋₁₁	11 ±3,1	15 ⁺¹⁴ ₋₉	14 ±4	20 ⁺¹⁸ ₋₁₂				
80	100	6 ±1,3	12 ⁺¹³ ₋₉	8 ±1,9	16 ⁺¹³ ₋₁₀	8 ±1,7	15 ⁺¹³ ₋₉	12 ±3,6	20 ⁺¹⁷ ₋₁₁	12 ±3,4	16 ⁺¹⁶ ₋₁₀	15 ±4,4	21 ⁺²⁰ ₋₁₂				
100	125	7 ±1,5	14 ⁺¹⁴ ₋₁₁	10 ±2,1	17 ⁺¹⁴ ₋₁₀	10 ±2	16 ⁺¹⁴ ₋₁₁	13 ±4	21 ⁺¹⁸ ₋₁₂	14 ±3,8	17 ⁺¹⁷ ₋₁₀	17 ±4,8	22 ⁺²¹ ₋₁₃				
125	160	9 ±1,8	15 ⁺¹⁴ ₋₁₁	12 ±2,5	19 ⁺¹⁵ ₋₁₂	12 ±2,3	18 ⁺¹⁴ ₋₁₁	15 ±4,6	22 ⁺²⁰ ₋₁₃	16 ±4,2	19 ⁺¹⁸ ₋₁₁	19 ±5,4	24 ⁺²² ₋₁₄				
160	200	11 ±2,2	17 ⁺¹⁴ ₋₁₄	14 ±2,9	21 ⁺¹⁶ ₋₁₄	14 ±2,8	20 ⁺¹⁴ ₋₁₄	18 ±5,2	25 ⁺²² ₋₁₄	18 ±4,9	22 ⁺²⁰ ₋₁₃	21 ±6,3	26 ⁺²² ₋₁₅				
200	250	13 ±2,6	20 ⁺¹⁶ ₋₁₆	17 ±3,5	23 ⁺¹⁷ ₋₁₇	17 ±3,4	23 ⁺¹⁶ ₋₁₆	21 ±6	27 ⁺²⁴ ₋₁₆	21 ±5,6	24 ⁺²² ₋₁₄	24 ±7,2	29 ⁺²⁶ ₋₁₇				
250	315	16 ±3,2	23 ⁺¹⁸ ₋₁₈	21 ±4,2	26 ⁺¹⁹ ₋₁₉	21 ±4,2	26 ⁺¹⁸ ₋₁₈	24 ±7	30 ⁺²⁷ ₋₁₈	25 ±6,5	28 ⁺²⁶ ₋₁₅	28 ±8,4	32 ⁺²⁹ ₋₁₉				
315	400	19 ±4	27 ⁺²¹ ₋₂₁	26 ±5	30 ⁺²² ₋₂₂	26 ±5,1	30 ⁺²¹ ₋₂₁	29 ±8,4	35 ⁺³¹ ₋₂₀	30 ±7,7	32 ⁺²⁸ ₋₁₈	33 ±10	36 ⁺³³ ₋₂₂				
400	500	24 ±4,9	32 ⁺²⁵ ₋₂₅	32 ±6,2	35 ⁺²⁶ ₋₂₆	32 ±6,3	36 ⁺²⁵ ₋₂₅	35 ±10	40 ⁺³⁵ ₋₂₄	36 ±9,2	38 ⁺³³ ₋₂₂	40 ±11,9	42 ⁺³⁸ ₋₂₅				
500	630	30 ±6	38 ⁺²⁹ ₋₂₉	39 ±7,5	41 ⁺³¹ ₋₃₁	39 ±7,8	42 ⁺²⁹ ₋₂₉	42 ±12	47 ⁺⁴² ₋₂₈	44 ±11	45 ⁺³⁹ ₋₂₅	48 ±14,3	49 ⁺⁴⁶ ₋₂₉				
630	800	37 ±7,4	47 ⁺³⁵ ₋₃₅	49 ±9,4	49 ⁺³⁶ ₋₃₆	49 ±9,8	52 ⁺³⁵ ₋₃₅	52 ±14,9	55 ⁺⁴⁹ ₋₃₃	54 ±13,5	55 ⁺⁴⁵ ₋₃₀	58 ±17,4	58 ⁺⁵¹ ₋₃₄				
800	1000	46 ±9,3	57 ⁺⁴² ₋₄₂	61 ±11,6	53 ⁺⁴⁴ ₋₄₄	61 ±12,1	63 ⁺⁴³ ₋₄₂	64 ±18,1	66 ⁺⁵⁹ ₋₄₀	66 ±16,2	67 ⁺⁵⁵ ₊₃₆	71 ±21,3	69 ⁺⁶¹ ₋₄₀				

Open-die machined forgings

Open-die machined forgings manufactured by SIJ Metal Ravne include rolls, shafts and mandrels. All open-die machined forgings can be subjected to heat treatment (normalizing, soft annealing, hardening and tempering, quenching, etc.) and mechanically treated with turning, milling, drilling, etc.

The advantages of open-die machined forgings are shared by both customer and manufacturer:

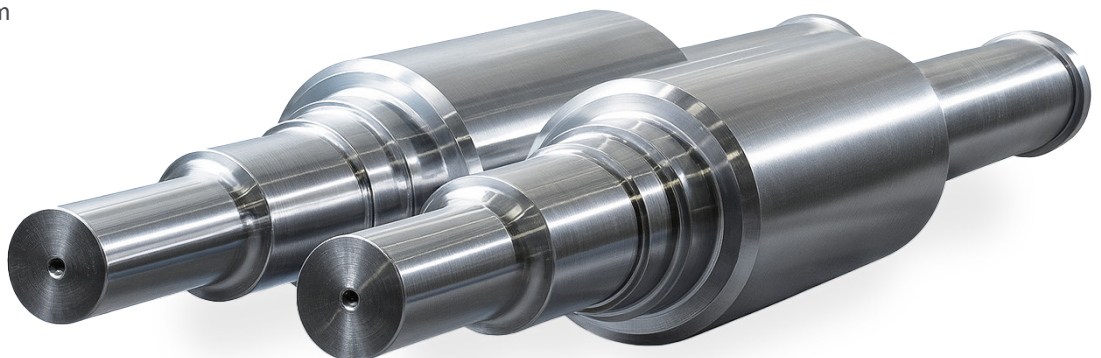
- more precise ultrasonic analysis
- reduced possibility of surface defects
- reduced possibility of dimensional deviations
- the customer has less issues with material storage and cutoffs
- more homogeneous microstructure
- improved mechanical properties

DIMENSIONAL RANGE:

- max. diameter 1000 mm
- max. length 10000 mm
- max. weight 20000 kg

APPLICATION AREAS:

- Mechanical engineering (rolls)
- Hot-forming rolls (for steel, aluminium, aluminium foil)
- Automotive (dies, frames)
- Shipbuilding industry (shafts, stabilizers)
- Metallurgical industry (tools, mandrels, extrusion sleeves)
- Metalworking industry (sleeves, rings for cutting dies)
- Energy industry (turbine shaft housing, sealing rings, shafts)
- Oil & gas industry (tubes, connectors)
- Graphic industry (rolls for newspaper printing)



04

STEEL GRADES

Our steel provides solutions for a wide range of industries and applications.



SIQUAL

QUALITY STEEL

SIJ Brand	W.Nr.	DIN	EN	AISI / ASTM / ASME
SIQUAL 2764	1.2764	X19NiCrMo4	-	-
SIQUAL 5860	1.5860	14NiCr18	-	-
SIQUAL 6511	1.6511	36CrNiMo4	36CrNiMo4	~ 9840
SIQUAL 6580	1.6580	30CrNiMo8	30CrNiMo8	-
SIQUAL 6582	1.6582	34CrNiMo6	34CrNiMo6	~4337
SIQUAL 6747	1.6747	30NiCrMo16-6	30NiCrMo16-6	-
SIQUAL 6773	1.6773	36NiCrMo16	36NiCrMo16	-
SIQUAL 6957	1.6957	27NiCrMoV15-6	27NiCrMoV15-6	A(SA)723 grade 3
SIQUAL 6959	1.6959	35NiCrMoV12-5	-	-
SIQUAL 7225	1.7225	42CrMo4	42CrMo4	~ 4142, 4140
SIQUAL 7362	1.7362	X12CrMo5	X12CrMo5	~A182 F5
SIQUAL 7380	1.7380	10CrMo9-10	10CrMo9-10	~A182 F22
SIQUAL 7711	1.7711	40CrMoV4-6	40CrMoV4-6	-
SIQUAL 7734	1.7734	-	-	-
SIQUAL 7765	1.7765	32CrMoV12-10	-	~6481C
SIQUAL 8070	1.8070	21CrMoV5-11	-	-
SIQUAL 8159	1.8159	51CrV4	51CrV4	~6145, ~6150
SIQUAL 8550	1.8550	34CrAlNi7-10	34CrAlNi7-10	~A355Cl.C

SIJ Metal Ravne brands

SIJ Brand	W. Nr.	AISI / ASTM / ASME	Chemical composition (wt %)								Reference strength Rm	A5 [%]	Reference impact toughness KV2 [J]
			C	Si	Mn	Cr	Mo	Ni	V	Other			
SIQUAL S130	≈1.6582	~4340	0.41	0.2	0.75	0.8	0.25	1.8			1100-1300	14	45
SIQUAL S133	≈1.6657	SAE 9310	0.1	0.2	0.6	1.3	0.1	3.3			1150	14	32
SIQUAL S140	≈1.6657	3310	0.12	0.25	0.45	1.5		3.5			1100	14	28
SIQUAL S142	1.6580+C		0.47	0.25	0.55	1.9	0.65	1.9			900	10	45
SIQUAL M250	-	-	0.4	0.2	0.2	1.6	0.9	3.7	0.3		1200-1350	14	40
SIQUAL M350	≈1.2764		0.23	0.25	0.35	1.5		4.15		W 0,9	1050	11	70

APPLICATIONS

- **Case hardening components:** SIQUAL 2764, SIQUAL S133, SIQUAL M350, SIQUAL 8550
- **Fasteners:** SIQUAL 6958, SIQUAL 6957, SIQUAL 6580, SIQUAL 6582, SIQUAL 8070
- **Gears and powertrain components:** SIQUAL S133, SIQUAL 6511, SIQUAL 7225, SIQUAL 6582, SIQUAL 6773, SIQUAL 8161, SIQUAL S142, SIQUAL 5860
- **Pressure vessel components:** SIQUAL 6580, SIQUAL 6957, SIQUAL S130, 1.8070, SIQUAL 7380, SIQUAL 7362
- **Special engineering:** SIQUAL 6957, SIQUAL 6958, SIQUAL 7711, SIQUAL 7765

SINOXX

STAINLESS STEEL

SIJ Brand	W.Nr.	EN	AISI / ASTM / ASME
SINOXX 4006	1.4006	X12Cr13	~410, CA-15
SINOXX 4016	1.4016	X6Cr17	~51430, 430
SINOXX 4021	1.4021	X20Cr13	~51420, 420
SINOXX 4034	1.4034	X46Cr13	~51420, 420
SINOXX 4112	1.4112	X90CrMoV18	~51440B, 440B
SINOXX 4116	1.4116	X50CrMoV15	~51440A, 440A
SINOXX 4125	1.4125	X105CrMo17	~440C
SINOXX 4313	1.4313	X3CrNiMo13-4	~415, F6NM
SINOXX 4462	1.4462	X2CrNiMoN22-5-3	-
SINOXX 4542	1.4542	X5CrNiCuNb16-4	~630 (17-4PH)
SINOXX 4545	1.4545	X5CrNiCu15-5	~630, 15-5 PH, S15500
SINOXX 4550	1.4550	X6CrNiNb18-10	~30347, 347, 348
SINOXX 4923	1.4923	X22CrMoV12-1	-
SINOXX 4938	1.4938	X12CrNiMoV12-3	-
SINOXX 4980	1.4980	X5NiCrTi26-15	~660, A286
SINOXX S490	-	-	~S21800, Nitronic 60
SINOXX S690	1.3964	X2CrNiMnMoNNb21-16-5-3	~Nitronic 50, UNS S20910, XM-19
SINOXX 4301	1.4301	X5CrNi18-10	~30304, 304, 304H
SINOXX 4305	1.4305	X8CrNiS18-9	~30300, 303
SINOXX 4541	1.4541	X6CrNiTi18-10	~30321, 321
SINOXX 4401	1.4401	X5CrNiMo17-12-2	~30316, 316
SINOXX 4571	1.4571	X6CrNiMoTi17-12-2	~316Ti
SINOXX 4435	1.4435	X2CrNiMo18-14-3	~30316L, 316L
SINOXX 4418	1.4418	X4CrNiMo16-5-1	-
SINOXX E770	-	X20Cr13	420
SINOXX 4913	1.4913	X19CrMoVNBn11-1	-
SINOXX 4903	1.4903	X10CrMoVNB9-1	~F91

APPLICATIONS

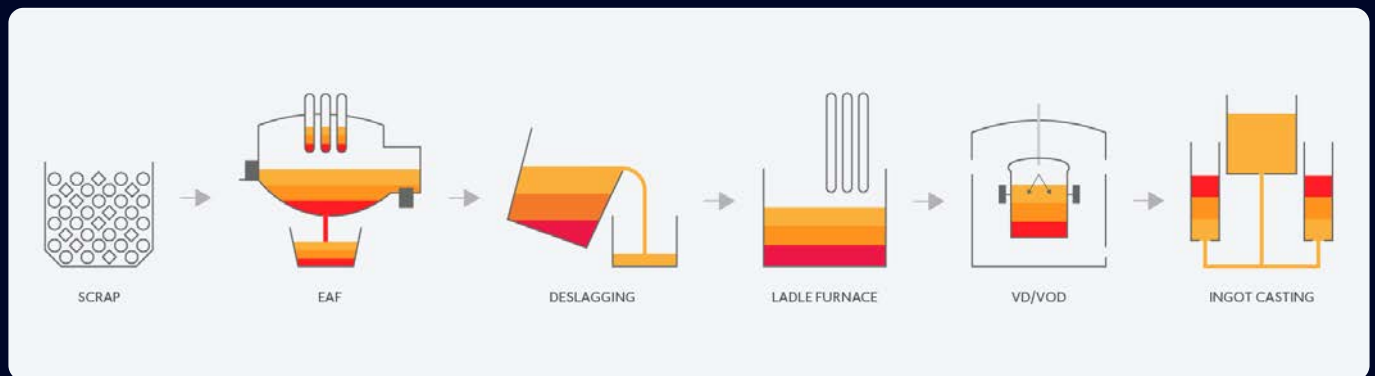
- **Steel for fittings:** SINOXX 4006, SINOXX 4313, SINOXX 4462, SINOXX S490, SINOXX S690, SINOXX 4980, SINOXX 4305, SINOXX 4913
- **Steel for turbine blades:** SINOXX 4923, SINOXX 4938, SINOXX 4418, SINOXX E770, SINOXX 4913
- **Steel for surgical instruments:** SINOXX 4021, SINOXX 4034, SINOXX 4112, SINOXX 4116, SINOXX 4125, SINOXX 4401, SINOXX 4435
- **Steel for pressure vessels:** SINOXX 4923, SINOXX 4938, SINOXX 4541, SINOXX 4435, SINOXX 4913, SINOXX 4903
- **Steel for pump shafts:** SINOXX 4542, SINOXX 4980, SINOXX S690, SINOXX 4418
- **Bearing steel:** SINOXX 4034, SINOXX 4112, SINOXX 4125
- **Chemical industry:** SINOXX 4021, SINOXX 4462, SINOXX 4550, SINOXX 4938, SINOXX S690, SINOXX 4301, SINOXX 4401, SINOXX 4435
- **Food-processing industry:** SINOXX 4006, SINOXX 4016, SINOXX 4021, SINOXX 4112, SINOXX 4550, SINOXX 4301, SINOXX 4401
- **Power industry:** SINOXX 4541, SINOXX 4418
- **Aerospace industry:** SINOXX 4418, SINOXX 4125, SINOXX 4301, SINOXX 4305, SINOXX 4401, SINOXX 4418, SINOXX 4541, SINOXX 4542, SINOXX 4550, SINOXX 4980

STAINLESS STEEL FOR SPECIAL PURPOSES

VACUUM OXYGEN DECARBURIZATION (VOD) STEEL

VOD (Vacuum Oxygen Decarburization) is a process used to refine stainless steel by reducing its carbon content under vacuum. The process is based on the oxidation of carbon,

which must be lowered below 0.1 wt.% to achieve improved corrosion resistance in stainless steels.



Molten steel is transferred from the electric arc furnace into a separate vessel, where it is heated by electric current and mixed with inert argon gas. Oxygen is blown onto the surface of the steel in a vacuum chamber, where carbon is oxidized to form carbon monoxide and carbon dioxide. These gases, along with nitrogen, hydrogen, and oxygen, are removed from the vessel by vacuum pumps.

Under vacuum conditions, thermodynamic laws ensure that chromium oxidation is minimized — only very small amounts of chromium enter the slag as Cr_2O_3 . This makes the VOD process an excellent choice for producing high-chromium steels with very low carbon content.

Main applications

- Aircraft industry
- High-temperature and oxidizing environments (e.g., power generation, turbine blades)
- Applications requiring high resistance to pitting and intergranular corrosion
- Chemical industry
- Petrochemical industry
- Glass processing tools
- Energy industry
- Welding applications

Benefits

The advantages of special steels produced by the VOD process from classically cast ingots compared to continuously cast materials:

- Ability to produce larger forging blocks, also from a 40-ton ingots.
- Higher hot-forming rates, improved mechanical properties, finer grains, and a homogeneous microstructure across the entire cross-section.
- Option to combine EAF + VOD + ESR processes for even greater micro purity, lower micro segregation, and enhanced mechanical properties.
- Longer service life of components under extreme operating conditions, due to greater material stability.
- Lower material costs and, most importantly, greater customer satisfaction.

SITHERM

HOT WORK TOOL STEEL

SIJ BRAND	W. Nr.	DIN	EN	AISI / ASTM / ASME
SITHERM 2343	1.2343	X38CrMoV5-1	X37CrMoV5-1	~H11
SITHERM 2344	1.2344	X40CrMoV5-1	X40CrMoV5-1	~H13
SITHERM 2345	1.2345	X50CrVMo5-1	-	Approx. H13
SITHERM 2365	1.2365	X32CrMoV33	32CrMoV12-28	~H10
SITHERM 2367	1.2367	X38CrMoV5-3	-	-
SITHERM 2885	1.2885	X32CrMoCoV3-3-3	-	~H10A

SIJ Metal Ravne brands

SIJ Brand	W. Nr.	Chemical composition (wt %)								Hardened steel [HRC]	Work hardness [HRC]
		C	Si	Mn	Cr	Mo	V	Ni	Other		
SITHERM S140R	-	0.36	Max. 0.30	0.20	Max. 0.20	3.20	-	2.10	W: 1.20 Co: +	50	44 – 48
SITHERM S350R	-	0.36	0.20	0.30	5.00	1.35	0.45	-	-	50 – 54	43 – 48
SITHERM S353R	-	0.38	0.25	0.40	5.00	2.40	0.60	-	-	53 – 57	44 – 50
SITHERM S355R	-	0.38	0.20	0.50	5.00	1.80	0.70	-	+	52 – 56	44 – 50
SITHERM S360R	-	0.52	0.25	0.30	4.80	3.00	0.60	0.60	+	min. 60	48 – 56
SITHERM S361R	-	0.37	0.25	0.40	4.90	1.80	0.60	1.60	+	52 – 56	44 – 50
SITHERM S251	-	0.35	0.25	0.35	2.80	2.00	0.35	1.60	+ +	52 - 54	42 - 48

All the grades are available in ESR and classic form.

APPLICATIONS

Pressure die casting tools, die forging tools, extrusion dies

- **Die forging tools:** SITHERM 2343, SITHERM 2344, SITHERM 2345, SITHERM 2365, SITHERM 2367, SITHERM S350R, SITHERM S353R, SITHERM S360R, SITHERM S361R
- **Pressure die casting tools for Al and Al-Mg-alloys:** SITHERM 2343, SITHERM 2344, SITHERM 2345***, SITHERM 2367, SITHERM S350R, SITHERM S360R***, SITHERM S361R, SITHERM S140R
- **Pressure die casting tools for Cu and Cu-alloys:** SITHERM 2344, SITHERM 2365, SITHERM 2367, SITHERM 2885, SITHERM S353R, SITHERM S354R, SITHERM S360R***, SITHERM S361R, SITHERM S140R
- **Hot Cutting:** SITHERM 2345, SITHERM S360R
- **Extrusion dies for Al and Al-alloys:** SITHERM 2343, SITHERM 2344, SITHERM 2367, SITHERM S350R, SITHERM S353R, SITHERM S360R***, SITHERM S361R

- **Extrusion dies for Zn and Pb-alloys:** SITHERM 2343, SITHERM 2344, SITHERM 2365, SITHERM 2367, SITHERM S350R, SITHERM S353R, SITHERM S360R***, SITHERM S361R, SITHERM S140R
- **Extrusion dies for Cu and Cu-alloys:** SITHERM 2367, SITHERM 2885, SITHERM S360R***, SITHERM S361R
- **Hot stamping:** SITHERM 2367, SITHERM S360R, SITHERM S140R

*** inserts

R – Remelted

SIHARD

COLD WORK TOOL STEEL

SIJ Brand	W.NR.	DIN	EN	AISI / ASTM / ASME
SIHARD 2080	1.2080	X210Cr12	X210Cr12	~D3
SIHARD 2357	1.2357	50CrMoV13-14	-	~S7
SIHARD 2355	1.2355	50CrMoV13-15	50CrMoV13-15	~S7
SIHARD 2361	1.2361	X91CrMoV18	~X90CrMoV18	~440B
SIHARD 2363	1.2363	X100CrMoV5	X100CrMoV5	~A2
SIHARD 2379	1.2379	X153CrVMo12-1	X153CrMoV12	~D2
SIHARD 2510	1.2510	100MnCrW4	~95MnWCr5	~O1
SIHARD 2767	1.2767	45NiCrMo16	45NiCrMo16	-
SIHARD 2842	1.2842	90MnCrV8	90MnCrV8	~O2

SIJ Metal Ravne brands

SIJ Brand	W. Nr.	AISI / ASTM / ASME	Chemical composition (wt %)										Hardness after hard. [min HRC]	Work hardness [HRC]
			C	Si	Mn	Cr	Mo	Ni	V	W	Other			
SIHARD K560	1.2360 mod	A8 mod.	0.50	1.15	0.35	7.30	1.40	-	0.55	-	-	57	55 – 57	
SIHARD S460	-	-	1.00	1.10	0.30	8.00	2.30	-	0.30	-	-	63	57 – 61	
SIHARD S470	-	-		0.25	0.40	8.00	1.50	-	2.10	-	-	62	57 – 61	
SIHARD S471	-	-	1.10	1.00	0.35	7.90	1.50	-	2.10	1.20	-	64	57 – 62	
SIHARD S671	-	-	1.25	0.20	0.30	10.00	1.00	-	Max. 1.00	-	Ti: +	62	57 – 60	

APPLICATIONS

Cutting tools, knives, punching dies, bushes, piercing mandrels, reamers, rolls, stamping dies, roller bearings, die plates, surgical instruments

- **Cutting-off tools:** SIHARD 2080, SIHARD 2361, SIHARD 2363, SIHARD 2379, SIHARD 2842, SIHARD K560, SIHARD S471 AND SIHARD S671

- **Extrusion dies:** SIHARD 2080, SIHARD 2379, SIHARD S471, SIHARD S671
- **Permanent impact loading tools:** SIHARD 2357, SIHARD 25



PLASTIC MOLD STEEL

SIJ Brand	W.NR.	DIN	EN	AISI / ASTM / ASME
SIMOLD 2311	1.2311	40CrMnMo7	-	Approx. P20
SIMOLD 2312	1.2312	40CrMnMoS8-6	-	-
SIMOLD 2738*	1.2738	40CrMnNiMo8-6-1	40CrMnNiMo8-6-4	P20 Mod.
SIMOLD 2083	1.2083	X42Cr13	X40Cr14	~51420, 420
SIMOLD 2085	1.2085	X33CrS16	-	-
SIMOLD 2316	1.2316	X36CrMo17	X38CrMo16	-

Other plastic mold steel

SIJ Brand	W.NR.	DIN	EN	AISI / ASTM / ASME
SINOXX 4034*	1.4034	-	X46Cr13	~51420, 420
SINOXX 4125*	1.4125	-	X105CrMo17	~440C
SITHERM 2343*	1.2343	X38CrMoV5-1	X37CrMoV5-1	~H11
SIQUAL 8550	1.8550	34CrAlNi7	34CrAlNi7-10	~A335Cl.C, K52440
SIHARD 2379	1.2379	X155CrVMo12-1	X153CrMoV12	~D2
SIHARD 2767	1.2767	X45NiCrMo4	X45NiCrMo16	-

SIJ Metal Ravne brands

SIJ Brand	W. Nr.	AISI / ASTM / ASME	Chemical composition (wt %)									Work hardness
			C	Si	Mn	Cr	Mo	Ni	V	Al	Cu	
SIMOLD S131	1.2738 HH	P20 Mod.	0.28	max. 0.3	1.40	1.50	0.50	1.00	0.15	-	-	320 – 360 HBW
SIMOLD S133	1.2738 HH	P20 Mod.	0.28	max. 0.4	1.40	1.40	0.50	1.00	0.22	-	-	350 – 390 HBW
SIMOLD S150R	-		0.13	0.31	1.50	0.25	0.30	2.85	-	0.95	1.00	40 – 42 HRC

* also in ESR

APPLICATIONS

Compression molding, injection molding, extrusion (inserts, dies, cores, frame)

- **Case-hardening and nitriding steel:** SIQUAL 7147, SIQUAL 8550
- **Through-hardening steel:** SITHERM 2343, SIHARD 2767, SIHARD 2379

- **Maraging steel:** SIMOLD S150R
- **Hardening & tempering steel:** SIMOLD 2311, SIMOLD 2312, SIMOLD 2738, SIMOLD S131 & SIMOLD S133
- **Corrosion-resistant steel:** SIMOLD 2083, SIMOLD 2085, SIMOLD 2316, SINOXX 4034 AND SINOXX 4125

R – Remelted

SIRAPID

HIGH SPEED STEEL

SIJ Brand	W.NR.	DIN	EN	AISI / ASTM / ASME
SIRAPID 3343	1.3343	HS6-5-2C	HS6-5-2C	~M2 regular C"
SIRAPID 3346	1.3346	HS2-9-1		M1
SIRAPID 3327	1.3327		HS1-8-1	~M1
SIRAPID 3348	1.3348	HS2-9-2	HS2-9-2	M7
SIRAPID 3344	1.3344	HS6-5-3	HS6-5-3	~M3 Class 2
SIRAPID 3351	1.3351	HS6-5-4	HS6-5-4	~M4
SIRAPID 3355	1.3355	HS18-0-1	HS18-0-1	~T1

APPLICATIONS

Twist drills, tap drills, cutting tools, milling cutters, reamers, saw blades and segments, turning machine tools, planing machine tools, broaches, broach needles, wear-resistant inserts for tools, Sendzimir rolls

- **Tools for machining of steel and Fe-alloys:** SIRAPID 3343, SIRAPID 3355, SIRAPID 3346, SIRAPID 3344, SIRAPID 3302, SIRAPID 3351
- **Woodworking tools:** SIRAPID 3343, SIRAPID 3355, SIRAPID 3344

- **Tools for machining of non-ferrous metals:** SIRAPID 3343, SIRAPID 3355, SIRAPID 3346, SIRAPID 3344, SIRAPID 3302, SIRAPID 3351
- **Tools for treatment of plastics:** SIRAPID 3343, SIRAPID 3344
- **Sendzimir rolls:** SIRAPID 3343, SIRAPID 3346, SIRAPID 3344



05

RESEARCH AND DEVELOPMENT

The steelmaking tradition we take pride in can be preserved and enhanced only through continuous and dynamic development.

Our R&D Department conducts metallurgical research, develops new products, and implements as well as optimizes advanced technologies. We employ a team of highly qualified and experienced professionals who are committed to constant improvement and lifelong learning, ensuring long-term added value for our customers.

Our research facilities are equipped with state-of-the-art instruments, including optical microscopes, a portable digital microscope, a scanning electron microscope with an

EDS analyzer, an X-ray diffractometer, and a dilatometer. In our laboratories, we can determine the thermal conductivity of steels and test the polishing performance of tool steels. Additionally, we operate well-equipped mechanical and chemical laboratories, as well as laboratory-scale heat treatment furnaces.

Our R&D team also collaborates closely with external research institutions and partners. Each year, we develop around 100 new products and introduce 5–10 new steel grades. Newly developed products account for approximately 5% of our annual turnover.



QUALITY ASSURANCE

Our primary goal is to be a successful company guided by bold ambitions that drive continuous and sustainable improvement of our management systems in the areas of quality, environmental protection, occupational health and safety, and efficient energy use.

Our company has implemented and maintains a Quality Management System covering the design, development, production, and sale of forged and rolled products made from special steels and alloys. These processes involve various metallurgical methods, heat treatment, and machining, all in compliance with the **EN 9100** standard. This standard is technically equivalent to **AS 9100D** and **JISQ 9100**, which apply to aviation, space, and defense organizations, and include all the requirements of the **ISO 9001** Quality Management System.

A key objective of our long-term vision is to operate according to the principles of sustainable development and the circular economy. We continuously develop products and processes aimed at preventing pollution and minimizing environmental impact — efforts that are confirmed by our **ISO 14001** certification.

SIJ Metal Ravne has also implemented an Occupational Health and Safety Management System in accordance with **ISO 45001** requirements. Through various preventive measures, we reduce risks and provide a safe, healthy, and creative working environment — a commitment we continuously reinforce through active dialogue with our employees.

In June 2018, our laboratory successfully passed an assessment according to the **ISO/IEC 17025** standard and obtained accreditation as a testing laboratory. This accreditation demonstrates the highest level of quality and ensures the independence, impartiality, and international comparability of our test results.

Furthermore, SIJ Metal Ravne has established an Energy Management System in line with the **ISO 50001** standard. This framework promotes efficient energy management, supports the adoption of alternative energy sources, and ensures a reliable and sustainable energy supply.

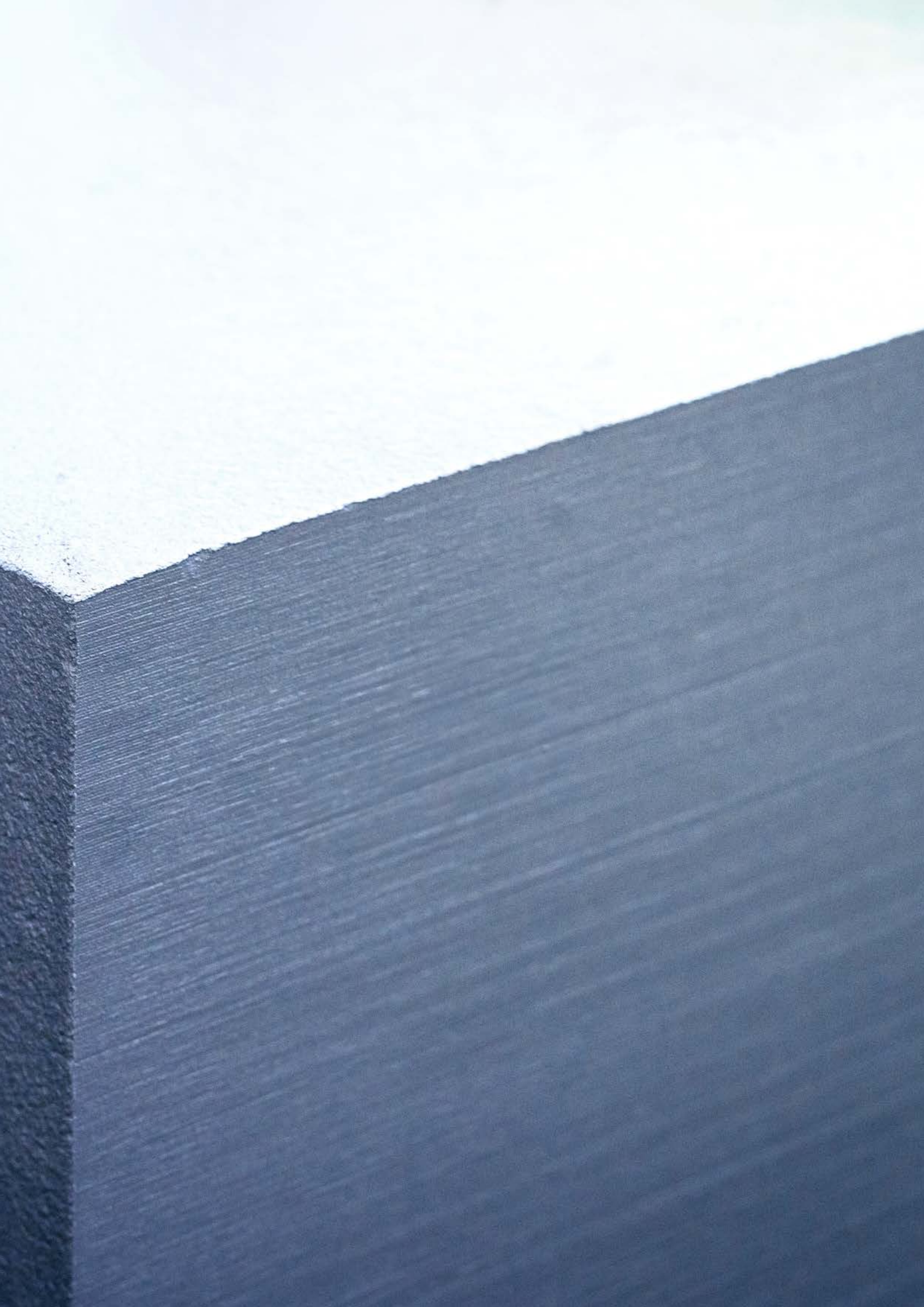
By achieving **ResponsibleSteel™** certification in March 2024, the SIJ Group joined the ranks of the world's most responsible and sustainable steel producers. ResponsibleSteel™ is the first global initiative to standardize and certify responsible and sustainable practices in the steel industry. Through its standards and certification processes, this international organization helps reduce environmental, social, and corporate risks across the entire steel value chain — while also promoting global recognition of steel as a sustainable material.





SIX GOOD REASONS WHY SIJ METAL RAVNE IS THE RIGHT PARTNER IN BUSINESS:

- We collaborate with our customers to develop innovative and customized solutions.
- We ensure the highest quality of our products and services.
- We take pride in the exceptional skills of our employees, passed down from one generation to the next.
- We specialize in niche and flexible production of the most demanding products with high added value.
- We leverage the synergy within the SIJ Group, the largest vertically integrated metallurgical group in Slovenia.
- We act with responsibility toward a sustainable future.



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THE NAME
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SIJ Metal Ravne | +386 2 870 7000 | info@metallravne.com | metallravne.com/en