The name you can trust

sij | metal ravne

sij | group

CONTENT

KEY FACTS:

- 400 YEARS TRADITION
- FOCUS ON STRONG OWN RESEARCH & DEVELOPMENT
- OFFERING MORE THAN 200 DIFFERENT STEEL GRADES
- 80.000 T ANNUAL STEEL PRODUCTION
- GLOBALY EXPANDED SALES NETWORK
- PART OF THE SLOVENIAN STEEL GROUP – SIJ

ABOUT SIJ METAL RAVNE

SIJ METAL RAVNE
IS PRODUCING
PREMIUM QUALITY
TOOL, HIGH-SPEED STEELS AND STAINLESS & SPECIAL STEELS.

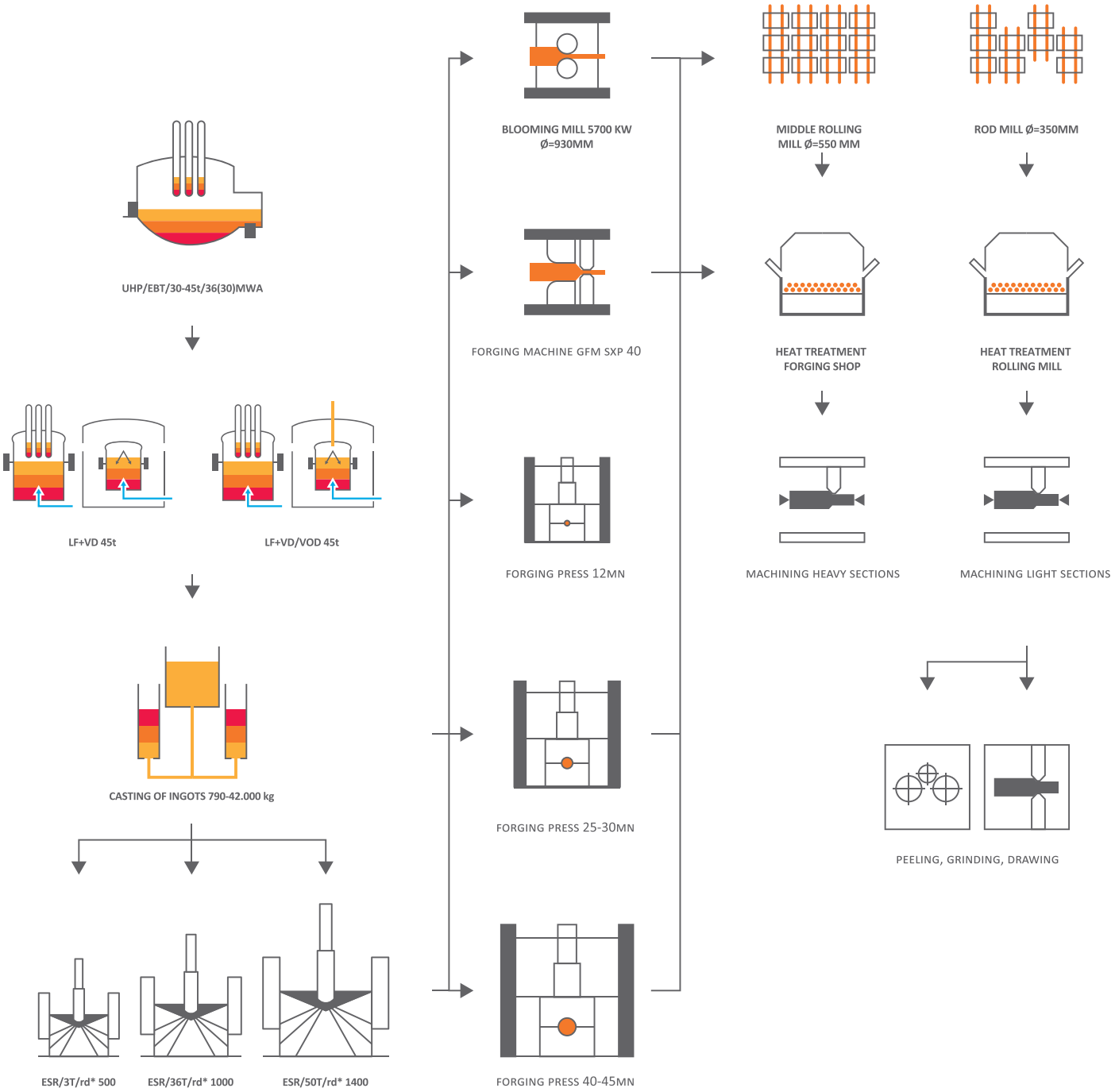
We produce steel in an electric arc furnace, casting it into ingots and rolling or forging into quality long steel products. For the most challenging conditions we use VOD* and ESR** methods. Our own Steel Plant, Forging Shop, Rolling Mill and a wide range of heat treatment and machining processes allow us to produce a rich pallet of more than 200 steel grades in different dimensional shapes.

With 1.000 employees and almost 80.000 ton annual production we belong globally to the group of mini mills. Therefore, we found our opportunity in the so called niche production which is characterized by specific knowledge and experience, larger flexibility and higher added value.

* VOD (Vacuum Oxygen Decarburizaton) is a process for refinement of stainless steel through reduction of carbon content under vacuum.

** ESR (Electroslag remelting) is a process of remelting and refining steel and other alloys for mission-critical applications in aircraft, thermal power stations, nuclear power plants, etc.

PRODUCTION PROGRAM



* rd = round

ROLLING PROGRAM

THIS PROGRAM ENABLES US TO PRODUCE A VERY WIDE SPECTRUM OF PRODUCTS WITH DIFFERENT SURFACE MACHINING FINISH AND VARIOUS FINAL HEAT TREATMENT CONDITIONS.

THE ROLLING PROGRAM JOINS THREE PRODUCTION UNITS:

BILLET ROLLING MILL,

SECTION ROLLING MILL AND

STEEL DRAWING PLANT.

The Billet Rolling Mill uses a modern Blooming rolling stand in addition to many modern heat treatment furnaces and grinding and testing machines.

The Section Rolling Mill can produce round, square and flat sections of various dimensions in its Intermediate Rolling Mill and Rod Mill.

In addition, we have modern heat treatment furnaces; machines for straightening, cutting, sandblasting, varnishing operations and for inspection of rolled products.

The Steel Drawing Plant produces products with a drawn, peeled or ground surface.

BILLETS AND ROLLED PRODUCTS

STANDARD DIMENSIONAL PRODUCTION & SALES PROGRAM:

BILLETS WITH ROUNDED EDGES – TOLERANCE +/-3%

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

WIDE FLAT SECTIONS:

- Width milled: tolerance +2/-0 mm, thickness rolled: tolerance +4/-0 mm
- Width and thickness milled: tolerance +2/-0 mm
- Length: 1600-4500 mm

WIDTH x THICKNESS:

- 85-150 mm x 70-130 mm
- 151-250 mm x 70-90 mm
- 251-505 mm x 25-90 mm

BILLETS AND ROLLED PRODUCTS

ROUND SECTIONS

(ACC. TO EN 10060 STANDARD)

- Bars: Ø 15-105 mm
- Length: 3000-6000 mm
- Surface finish: the surface can be unmachined or roughly peeled. Roughly peeled products are made in dimensions Ø 30-102 mm and in tolerance ±0.3 mm (+0.6 mm/-0 mm); if very narrow tolerance is requested, +0,5/-0 is applied.
- Tolerances for the unmachined version are evident from the table below.
- Achieved straightness of ≤ 2mm/m (valid for all surfaces).

TOLERANCES FOR ROUND UNMACHINED SECTIONS

DIMENSION mm	TOLERANCE mm	DIMENSION mm	TOLERANCE mm	DIMENSION mm	TOLERANCE mm
15	±0,4	36	±0,8	62	±1,0
16	±0,5	37		63	
17		38		64	
18		39		65	
19		40		66	
20		41		68	
21		42		70	
22		43		72	
23		44		73	
24		45		75	
25		46		78	
26	±0,6	47		80	
27		49		82	±1,3
28		50		83	
29		51	±1,0	85	
30		52		88	
31		53		89	
32		54		90	
33		55		92	
34		56		93	
35		58		94	
		60		95	
				97	
				100	
				103	±1,5
				105	

BILLETS AND ROLLED PRODUCTS

SQUARE SECTIONS

(ACC. TO EN 10059 STANDARD)

- Square: 25-75 mm
- Length: 3000-6000 mm
- Tolerance: see the table below.
- Achieved straightness of ≤ 2mm/m.

TOLERANCES FOR SQUARE SECTIONS

DIMENSION mm	TOLERANCE mm	ROUNDNESS OF EDGES mm	DIMENSION mm	TOLERANCE mm	ROUNDNESS OF EDGES mm
25 x 25	±0,5	r ≤ 2	40 x 40	±0,8	r ≤ 2,5
26 x 26	±0,6		42 x 42		
28 x 28			45 x 45		
30 x 30			50 x 50		
32 x 32		r ≤ 2,5	52 x 52		r ≤ 3
35 x 35			55 x 55	±1,0	
36 x 36			60 x 60		
37 x 37			65 x 65		
38 x 38			70 x 70		
			75 x 75		

Sections can be made in plus tolerance only, in plus/minus tolerance or in minus tolerance only.
Intermediate dimensions (by 1 mm increments) can be produced.

BILLETS AND ROLLED PRODUCTS

FLAT SECTIONS

(ACC. TO EN 10058 STANDARD):

- Width 40-150 mm with thickness 7-65 mm
- Width 150-255 mm with thickness 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: surface can be unmachined, sandblasted or varnished.
- Tolerance: see the table below.
- Achieved straightness of ≤ 2mm/m

TOLERANCES FOR SQUARE SECTIONS

	WIDTH **mm**	**TOLERANCE** mm
WIDTH ≤ 150 mm (acc. to EN 10058 standard)	b = 40 40 < b ≤ 80 80 < b ≤ 100 100 < b ≤ 120 120 < b ≤ 120	±0,75 ±1 ±1,5 ±2 ±2,5
	THICKNESS (mm)	TOLERANCE (mm)
	d < 20 20 < d ≤ 40 40 < d ≤ 50	±0,5 ±1,0 ±1,5
WIDTH > 150 mm (acc. to EN 59200 standard)	WIDTH (mm)	TOLERANCE (mm)
	150 < d ≤ 250	±2 % width
	THICKNESS (mm)	TOLERANCE (mm)
	20 < b ≤ 25 25 < b ≤ 30 30 < b ≤ 40 40 < b ≤ 50	-0,5/+0,9 -0,6/+1,0 -0,7/+1,1 -0,9/+1,1

Table provides standard tolerances. Sections can be also made in very narrow tolerances, per width ¾ and per thickness ½ tolerance from the above table. Sections can be made only in plus tolerance, in plus/minus tolerance or only in minus tolerance.

ROLLED PRODUCTS – BRIGHT SECTIONS

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

- Bars: Ø 16–80 mm
- Length: 2500–6000 mm

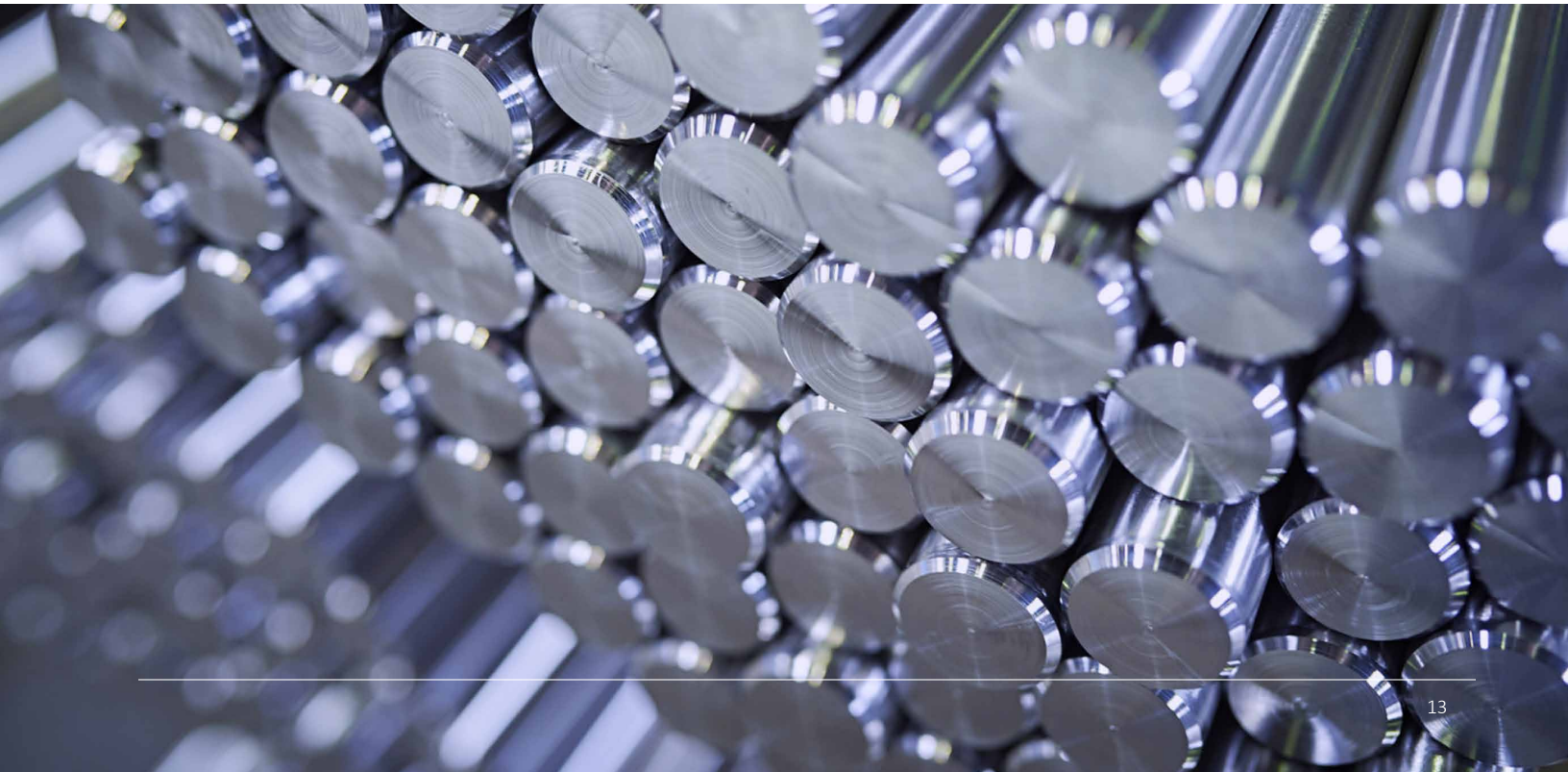
Ground and ground & polished bars (acc. to EN 10278)

- Bars: Ø 7–80 mm
- Length: 2000–4000 mm

TOLERANCES FOR BRIGHT SECTIONS

NOMINAL DIMENSION	TOLERANCE		
mm	h8*	h9	h11
> 6≤ 10	0,022	0,036	0,090
> 10 ≤ 18	0,027	0,043	0,110
> 18 ≤ 30	0,033	0,052	0,130
> 30 ≤ 50	0,039	0,062	0,160
> 50 ≤ 80	0,046	0,074	0,190

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



FORGING PROGRAM

THIS PROGRAM INCLUDES THE BASIC FORGING EQUIPMENT AND ALL OTHER NECESSARY DEVICES FOR THE PRODUCTION OF VARIOUS FORGING PRODUCTS.

FORGING PROGRAM PRODUCTS:

- **BILLETS**
- **FORGED BARS**
- **OPEN-DIE MACHINED FORGINGS**

For smaller dimensions, we use the SX-40 forging machine, while larger ones are made on presses. We have 12 MN, 25 MN and 40 MN presses.

All these products can be subjected to heat treatment in modern heat treatment furnaces using different procedures.

The important part of our Forging Program involves machines for machining and cutting of material.

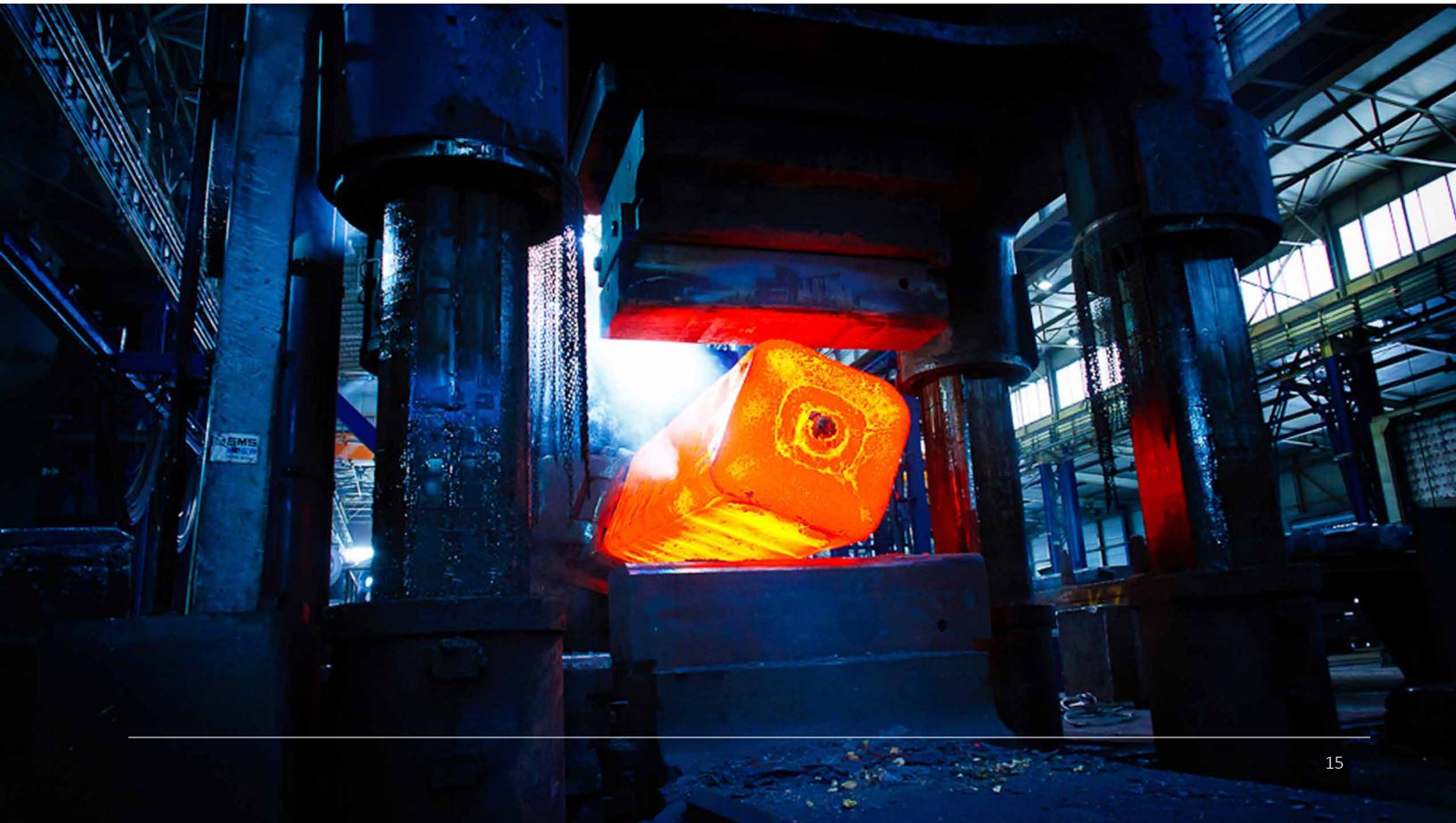
In addition to products with unmachined surfaces, we can also make products with bright surfaces using the method of peeling, turning and milling. All these products can be cut into the required dimensions.

FORGED PRODUCTS

BILLETS

(PRODUCT USED FOR FURTHER HOT FORMING):

- Round: ϕ 90–1000 mm
- Square: sq. 90–900 mm
- Length: 2000–10000 mm
- Tolerances:
  - tool steel from ϕ 90–200 mm ± 5 mm, other steels ± 10 mm
  - tool steel from sq. 90–200 mm ± 5 mm, other steels ± 10 mm
  - from ϕ 201–300 mm ± 6 mm, sq. 201–300 mm ± 15 mm
  - over ϕ 301 mm ± 10 mm, sq. over 301 mm ± 20 mm



FORGED PRODUCTS

FORGED BARS

(ACC. TO DIN 7527/6 STANDARD):

ROUND FORGED BARS:

- ϕ 90–950 mm
- Length: 2000–10000 mm

SURFACE CAN BE UNMACHINED, PEELED OR TURNED:

- **Peeled surface:**
  - ϕ 85–205 mm:
  - ϕ 85–205 mm: tolerance +1/-0 mm
- **Turned surface:**
  - ϕ 206–1000 mm
  - ϕ 206–300 mm: tolerance +2/-0 mm
  - ϕ 301–1000 mm: tolerance +3/-0 mm
- **Max. weight of forging:**
  - turned forgings max. 18000 kg, length 6m, cross section up to ϕ 1100 mm
  - conventional (unmachined): 25000 kg
  - ESR: max. 23000 kg

FLAT FORGED BARS:

- From 80x70 mm to 260x120 mm or 261x80 mm to 1600x550 mm
- Length: 2000–7000 mm
- Surface finish: unmachined or milled.
  Milled in tolerance: +2/-0 mm.
  Max. width 1200 mm, max. weight of forging 10000 kg.

SQUARE FORGED BARS:

- 80–850 mm
- Length: 2000–7000 mm
- Surface finish: unmachined or milled.
  Milled in tolerance: +2/-0 mm
  max. width 1200 mm, max. weight of forging 10000 kg.

FORGED PRODUCTS

DIMENSIONAL PROGRAM DEPENDING ON STEEL GROUP

(FORGED DIMENSIONS)

GROUP 1:

UNALLOYED STRUCTURAL STEELS:
round: max. ϕ 950 mm
square: max. sq. 850 mm
flat: max. 1600x550 mm

(max. ratio – width : thickness is 11:1).

GROUP 2:

ALLOYED STRUCTURAL STEELS:
round: max. ϕ 950 mm
square: max. sq. 850 mm
flat: max. 1600x550 mm

(max. ratio – width : thickness is 11:1).

GROUP 3:

LOW-ALLOYED TOOL STEELS:
round: max. ϕ 850 mm
square: max. sq. 750 mm
flat: max.1550x550mm

(max. ratio – width : thickness is 11:1).

GROUP 4:

HIGH-ALLOYED COLD-WORK TOOL STEELS:
round: max. ϕ 625 mm
square: max. sq. 550 mm
flat: max. 1000x300 mm

(max. ratio – width : thickness is 8:1).

GROUP 5:

HIGH-ALLOYED HOT-WORK TOOL STEELS:
round: max. ϕ 850 mm
square: max. sq. 750 mm
flat: max.1500x350mm

(max. ratio – width : thickness is 10:1)

GROUP 6:

HIGH-SPEED STEELS:
round: max. ϕ 180 mm
square: max. sq. 160 mm
flat: max. 250x100 mm

(max. ratio – width : thickness is 4:1).

GROUP 7:

SPECIAL STEELS:
round: max. ϕ 700 mm
square: max. sq. 650 mm
flat: max. 1200x300 mm

(max. ratio – width : thickness is 8:1).

Larger dimensions according to agreement.

FORGED PRODUCTS

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

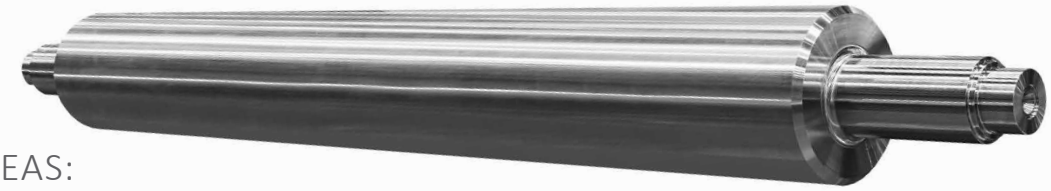
FINISHED DIMENSIONS mm		HIGH-GRADE STEEL								LOW-GRADE STEEL			
		TOOL STEEL				STRUCTURAL STEEL				ALLOYED AND UNALLOYED STEEL			
		Length up to 3500 mm		Length over 3500 to 6000 mm		Length up to 3500 mm		Length over 3500 to 6000 mm		Length up to 3500 mm		Length over 3500 to 5000 mm	
		Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length	Cross-section	Length
OVER	UP TO	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance	Additional tolerance
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 +42 -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 are a special part of SIJ Metal Ravne production program. Their aim is to improve the quality of products. Better quality means a more homogeneous microstructure and better mechanical properties. All open-die forgings can be subjected to heat treatment (normalizing, soft annealing, hardening &tempering, quenching, etc.) and machining by turning, milling, drilling, etc.

The advantages of machined forgings are shared by both customer as well as producer:

- more accurate ultrasound analysis
- surface free of any defects
- elimination of dimensional deviations
- no problems with storage of cut material on the side of customer



APPLICATION AREAS:

- Mechanical engineering (rolls, shafts)
- Hot-forming rolls (for steel, aluminium, aluminium foil)
- Mining industry (shafts, gears)
- 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)

DIMENSIONAL RANGE:

ROLLS, AXLES, SHAFTS	
max. dia.	1000 mm
max. length	10000 mm
max. weight	20000 kg

RINGS, DISCS	
max. external dia.	2000 mm
max. weight	15000 kg

BUSHES	
max. dia.	1400 mm
max. length	2200 mm
max. weight	15000 kg

STEEL GRADES

OUR STEEL CONSUMERS ARE VARIOUS INDUSTRIES:

- Energy
- Oil & gas industry
- Automotive
- Aerospace
- Toolmaking
- Machine building
- Industrial rolls
- Industrial knives
- Transport
- Medicine

THE POWER OF OUR BRANDS

By establishing SIJ Group brands we will achieve a uniform classification of a wide range of steels. An individual brand represents an identifiable group of steels and products, which serve a clearly defined application and at the same time reflect the superior quality of SIJ Group products. Every brand is characterised by the letters SI, middle name and three dots. The letters SI are derived from the name of the SIJ Group, thus connecting these. The three dots represent our three values. The middle brand name describes the properties of each steel group and products bearing the brand name. Brands are instantly recognisable and fully embrace SIJ Group steel products.

STAINLESS STEEL

DESIGNATION		CHEMICAL COMPOSITION (WT. %)									MICRO-STRUCTURE	STANDARD WORK STRENGTH/ HARDNESS
SIJ BRAND	W. NR.	C	Si	Mn	Cr	Mo	Ni	V	Nb	OTHER		
SINOXX 4006	1.4006	0.12	0.25	0.60	12.50	-	-	-	-	-	M	Rm: min 650 Mpa, A: MIN 15 %
SINOXX 4016	1.4016	0.03	0.25	0.60	17.00	-	-	-	-	-	F	Rm: min 400 Mpa, A: MIN 20 %
SINOXX 4021	1.4021	0.19	0.25	0.60	13.00	-	-	-	-	-	M	Rm: min 800 Mpa, A: MIN 11 %
SINOXX 4034	1.4034	0.47	0.25	0.60	13.00	-	-	-	-	-	M	Rm: min 850 Mpa, A: MIN 8 %
SINOXX 4112	1.4112	0.90	0.40	0.40	18.00	1.00	-	0.10	-	-	M	Hardened: min 55 HRC
SINOXX 4116	1.4116	0.50	0.25	0.60	14.50	0.60	-	0.15	-	-	M	Hardened: min 55 HRC
SINOXX 4125	1.4125	1.05	0.25	0.60	17.00	0.60	-	-	-	-	M	Hardened: min 58 HRC
SINOXX 4313	1.4313	0.03	0.25	0.60	13.00	0.50	4.00	-	-	N 0.03	M	Rm: min 900 Mpa, A: MIN 15 %
SINOXX 4542	1.4542	0.04	0.25	0.60	15.20	-	4.00	-	0.30	Cu 3.50	PH	Rm: min 1310 Mpa, A: MIN 10 %
SINOXX 4550	1.4550	0.03	0.25	0.60	18.00	-	10.00	-	0.40	-	A	Rm: min 510 Mpa, A: MIN 40 %
SINOXX 4923	1.4923	0.21	0.25	0.60	12.00	1.00	0.50	0.30	-	-	M	Rm: min 900 Mpa, A: MIN 11 %
SINOXX 4938	1.4938	0.12	0.25	0.60	12.00	1.80	2.60	0.30	-	N 0.03	M	Rm: min 930 Mpa, A: MIN 14 %
SINOXX 4980	1.4980	0.05	0.25	1.20	14.50	1.20	25.00	0.20	-	Ti 2.10	PH	Rm: min 900 Mpa, A: MIN 15 %
SINOXX S490	-	0.05	3.00	8.00	17.00	-	8.50	-	-	-	A	Rm: min 655 Mpa, A: MIN 35 %
SINOXX S690	1.3964	0.03	0.50	5.00	22.00	2.25	0.20	12.25	0.20	N 0.30	A	Rm: min 690 Mpa, A: MIN 35%

M - Martensite | F - Ferrite | A - Austenite | PH - Precipitation hardened

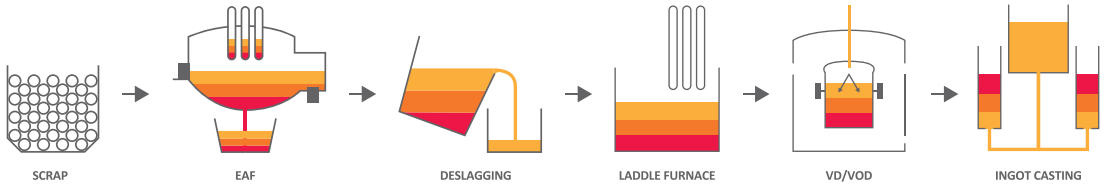
APPLICATION:

- **Steel for fittings:** SINOXX 4006, SINOXX 4313, SINOXX S490, SINOXX S690, SINOXX 4980.
- **Steel for turbine blades:** SINOXX 4923, SINOXX 4938.
- **Steel for surgical instruments:** SINOXX 4021, SINOXX 4034, SINOXX 4112, SINOXX 4116, SINOXX 4125.
- **Steel for pressure vessels:** SINOXX 4923, SINOXX 4938.
- **Steel for pump shafts:** SINOXX 4542, SINOXX 4980, SINOXX S690.
- **Bearing steel:** SINOXX 4034, SINOXX 4112, SINOXX 4125.
- **Chemical industry:** SINOXX 4021, SINOXX 4550, SINOXX 4938, SINOXX S690.
- **Food-processing industry:** SINOXX 4006, SINOXX 4016, SINOXX 4021, SINOXX 4112, SINOXX 4550.

SPECIAL STAINLESS STEEL FOR SPECIAL PURPOSES:

VACUUM OXYGEN DECARBURIZATON (VOD) STEEL

VOD (Vacuum Oxygen Decarburizaton) is a process for refinement of stainless steel through reduction of carbon content under vacuum. The proces is based on oxidation of carbon which has to be reduced below 0.1 wt. % for better corrosion resistance of stainless steels.



Molten steel is transferred from EAF into a separate vessel where it is heated by electric current and stirred with argon inert gas. Oxygen is blown on the top of steel in the vacuum chamber. Carbon is oxidized and carbon monoxide/dioxide is formed. Gases as nitrogen, hydrogen, oxygen and carbon monoxide/dioxide are drained out of the vessel with vacuum pumps. Thermodynamical laws under vacuum allow that chromium is not oxidized or very small amounts go into slag as Cr2O3. This makes the VOD process a very good choice for the production of high-chromium steels with low carbon content.

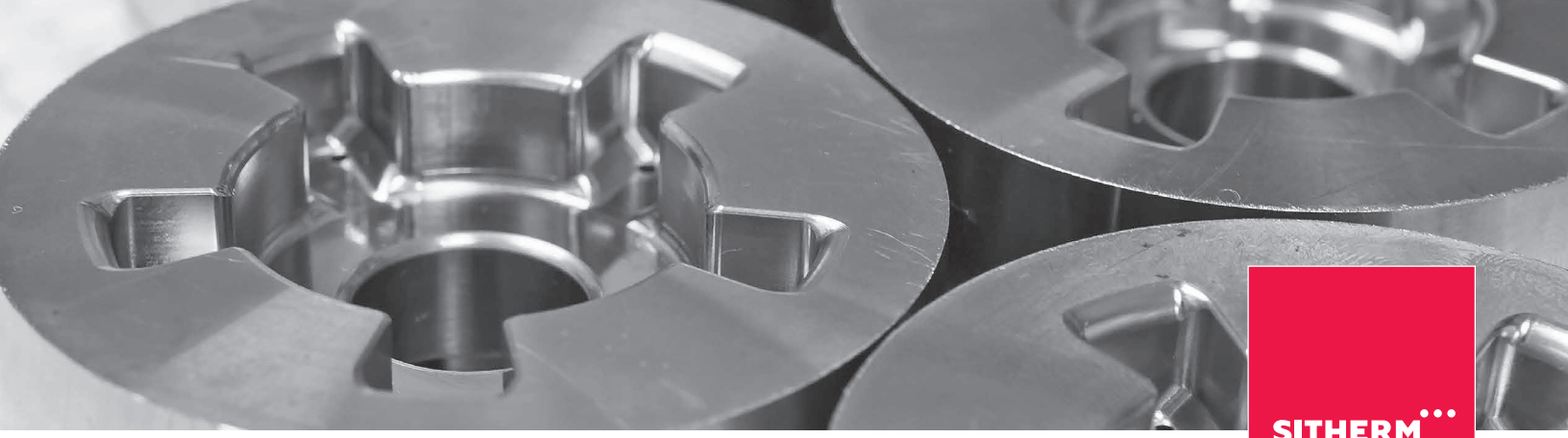
MAIN APPLICATIONS

- applications at high temperatures and in oxidizing environments (e.g. power generation like turbine blades),
- applications where higher resistance to pitting and intergranular corrosion is required,
- chemical industry,
- nuclear power plants,
- tubing,
- construction of treatment plants and plants for energy and construction sectors,
- welding applications,
- aircraft applications.

BENEFITS

Find out the benefits of special steels made according to VOD process from a classically cast ingot in comparison with continuous casting:

- possibility for the production of larger forging blocks, also from a 40 ton ingot,
- higher rate of hot forming, with better mechanical properties, finer grains and a homogeneous microstructure throughout the whole product section,
- option to use EAF+VOD+ESR material with an even better micropurity, lower micro segregations and better mechanical properties,
- products made from these steels have a longer life period under extreme operation conditions of final product, in particular due to a higher stability of material. You will enjoy lower cost of material and, which is the most important: satisfied customers!



SITHERM
HOT WORK TOOL STEEL

HOT WORK TOOL STEEL

DESIGNATION		CHEMICAL COMPOSITION (WT. %)								HARDENED STEEL (HRC)	WORK HARDNESS (HRC)
SIJ BRAND	W. NR.	C	Si	Mn	Cr	Mo	V	Ni	OTHER		
SITHERM 2343*	1.2343	0.37	1.00	0.40	5.00	1.30	0.40	-	-	50 - 56	43 - 48
SITHERM 2344*	1.2344	0.39	1.05	0.40	5.15	1.35	1.00	-	-	52 - 56	43 - 50
SITHERM 2345*	1.2345	0.51	0.95	0.30	5.00	1.35	0.90	-	-	55 - 57	45 - 52
SITHERM 2365*	1.2365	0.32	0.25	0.30	2.95	2.75	0.55	-	-	52 - 56	40 - 48
SITHERM 2367*	1.2367	0.38	0.40	0.40	5.00	2.95	0.50	-	-	53 - 57	44 - 50
SITHERM 2885*	1.2885	0.32	0.25	0.30	2.80	2.80	0.50	-	Co: 2.80	52 - 54	44 - 50
SITHERM S140R	-	0.36	Max. 0.20	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 S354R	-	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	1.60	0.60	1.60	+	52 - 56	44 - 50

* also in ESR

APPLICATION:

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

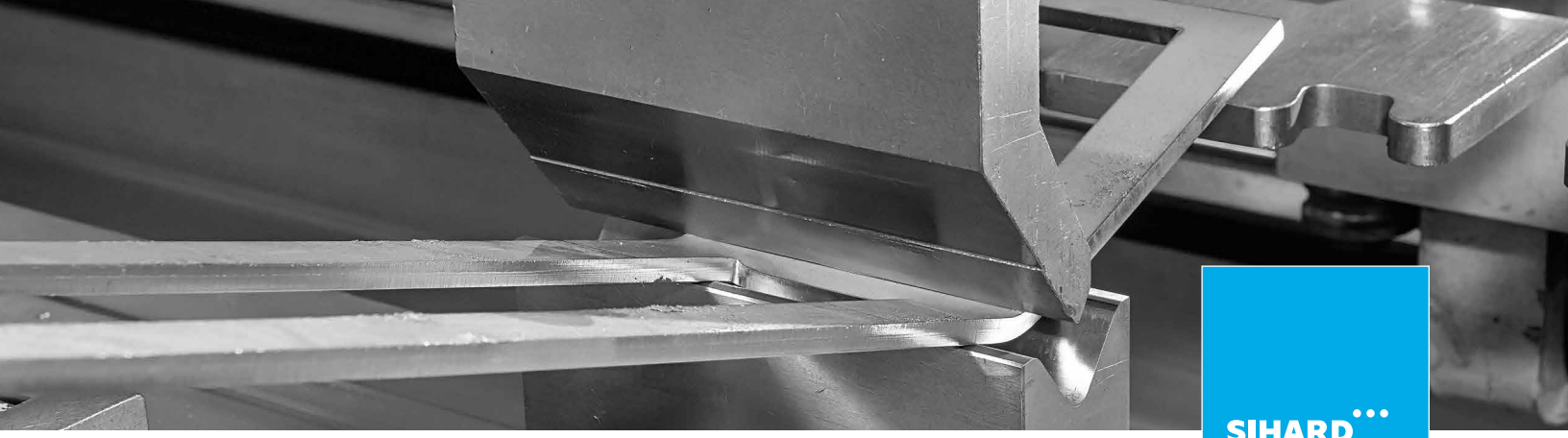
** inserts
R - Remelted

- **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, S360R**, SITHERM S361R.

- **Hot stamping:** SITHERM 2367, SITHERM S360R, SITHERM S140R.



SIHARD
COLD WORK TOOL STEEL

COLD WORK TOOL STEEL

DESIGNATION		CHEMICAL COMPOSITION (WT. %)									HARDNESS AFTER HARD. (HRC) MIN.	WORK HARDNESS (HRC)
SIJ BRAND	W. NR.	C	Si	Mn	Cr	Mo	Ni	V	W	OTHER		
SIHARD 2080	1.2080	2.05	0.25	0.30	11.50	-	-	-	-	-	64	57 - 62
SIHARD 2357	1.2357	0.50	0.60	0.60	3.30	1.50	-	0.10	-	-	60	55 - 60
SIHARD 2361	1.2361	0.90	0.50	0.50	18.00	1.10	-	0.10	-	-	57	50 - 55
SIHARD 2363	1.2363	1.00	0.30	0.55	5.20	1.05	-	0.20	-	-	63	57 - 61
SIHARD 2379	1.2379	1.55	0.25	0.30	11.50	0.70	-	1.00	-	-	64	57 - 61
SIHARD 2510	1.2510	0.95	0.25	1.10	0.60	-	-	0.10	0.60	-	64	57 - 62
SIHARD 2767	1.2767	0.45	0.25	0.30	1.35	0.25	4.00	-	-	-	56	52 - 55
SIHARD 2842	1.2842	0.90	0.25	2.00	0.35	-	-	0.10	-	-	64	57 - 62
SIHARD K560	-	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	-	0.90	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 - 61

APPLICATION:

Blades, knives, punching dies, moulds, 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 2510.

PLASTIC MOLD STEEL

DESIGNATION		CHEMICAL COMPOSITION (WT. %)											WORK HARDNESS
SIJ BRAND	W. NR.	C	Si	Mn	Cr	Mo	Ni	V	S	AL	Cu	P	
SIMOLD 2311	1.2311	0.40	0.40	1.50	1.90	0.20	-	-	-	-	-	-	255 - 310 HBW
SIMOLD 2312	1.2312	0.40	0.40	1.50	1.90	0.20	-	-	0.07	-	-	-	255 - 310 HBW
SIMOLD 2738*	1.2738	0.40	0.30	1.40	1.90	0.20	1.00	-	-	-	-	-	280 - 325 HBW
SIMOLD S131	1.2738 HH	0.28	max. 0.3	1.40	1.50	0.50	1.00	0.15	-	-	-	-	320 - 360 HBW
SIMOLD S133	-	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
SIMOLD 2083	1.2083	0.35	0.40	0.25	13.00	0.20	0.20	-	-	-	-	-	38 - 43 HRC
SIMOLD 2085	1.2085	0.30	0.35	0.80	15.00	-	-	-	0.07	-	-	-	50 - 54 HRC
SIMOLD 2316	1.2316	0.39	max. 1.00	max. 1.00	16.50	max. 1.05	max. 1.00	-	-	-	-	-	28 - 36 HRC**
Other plastic mold steel													
SINOXX 4034*	1.4034	0.46	0.50	0.50	13.00	-	-	-	-	-	-	-	55 - 57 HRC
SINOXX 4125*	1.4125	1.05	0.50	0.50	17.00	0.50	-	-	-	-	-	-	min. 58 HRC
SITHERM 2343*	1.2343	0.38	1.00	0.40	5.10	1.25	-	0.40	-	-	-	-	43 - 48 HRC
SIQUAL 8550	1.8550	0.34	0.25	0.55	1.65	0.20	1.00	-	-	1.00	-	-	25 - 32 HRC
SIHARD 2379	1.2379	1.55	0.25	0.30	11.50	0.70	-	1.00	-	-	-	-	62 - 64 HRC
SIHARD 2767	1.2767	0.45	0.25	0.30	1.35	0.25	4.00	-	-	-	-	-	56 HRC

* also in ESR

** depending on section

APPLICATION:

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.

R – Remelted

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

SIRAPID
HIGH SPEED STEEL

HIGH-SPEED STEEL

DESIGNATION		CHEMICAL COMPOSITION (WT. %)						ACHIEVABLE HARDNESS (HRC) MIN.
SIJ BRAND	W. NR.	C	Cr	Mo	V	W	Co	
SIRAPID 3343	1.3343	0.90	4.10	5.00	1.90	6.30	-	64
SIRAPID 3346	1.3346	0.82	3.90	8.50	1.20	1.70	-	63
SIRAPID 3344	1.3344	1.20	4.10	5.00	2.90	6.30	-	64
SIRAPID 3351	1.3351	1.32	4.10	4.60	3.90	5.60	-	64
SIRAPID 3355	1.3355	0.78	4.10	-	1.10	17.90	-	63
SIRAPID 3302	1.3302	1.27	4.10	0.90	3.70	12.00	-	65

APPLICATION:

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.

RESEARCH AND DEVELOPMENT

THE STEELMAKING TRADITION WE TAKE PRIDE IN, CAN BE PRESERVED AND UPGRADED ONLY THROUGH DYNAMIC DEVELOPMENT.

- Our R&D Department performs metallurgical research, develops new products, and **implements and optimizes new technologies.**
- It employs a team of highly **competent and skilled experts,** and it is constantly upgraded since our desire to provide our customers with added value is set on a long-term basis.
- For research, we have **modern research equipment** including optical microscopes, a portable digital microscope, a scanning electron microscope with an EDS analyser, an X-ray diffractometer and a dilatometer.
  In our laboratories we can determine thermal conductivity of steels and test polishing capabilities of tool steels.
  In addition, we have a well equipped mechanical and chemical laboratory as well as laboratory heat-treatment furnaces.
- Our R&D team collaborates closely also with external institutions
- On a yearly basis, we develop approx. **100 new products** and implement **6-10 new steel grades** in production.
- Newly developed products represent about 7% of our annual turnover.

QUALITY ASSURANCE

OUR MAIN GOAL IS TO BE A SUCCESSFUL COMPANY WITH SENSITIVE COMMITMENT TOWARDS THE ENVIRONMENT IN WHICH WE OPERATE.

Our main strategic guideline is Total Quality Management (TQM) which includes the environment management system. This is also confirmed by the certificate we received according to the **EN ISO 14001:2015** standard.

Modern chemical, mechanical and metallographic laboratories, professionally trained and skilled personnel and our longterm experience enable us to realize the quality policies as set, going beyond **EN ISO 9001:2015** standard.

Employees form the basic cell of our company and at the same time its major asset. Ensuring a safe working place is one of the principle rights, duties and responsibilities of all our employees. Therefore we are introducing the system of safety and health at work **OHSAS 18001:2007** into the central strategy of SIJ Metal Ravne.

In June 2018 our laboratory has successfully passed an assessment according to the requirements of the **SIST EN ISO/IEC: 17015:2005** standard and obtained an accreditation document as a testing laboratory. This accreditation signifies the highest level of quality and guarantees the independence, impartiality, and the international comparability of test results.

OUR AGENTS AND REPRESENTATIVES

AMERICA

NORTH AND CENTRAL AMERICA, CANADA

KOPO INTERNATIONAL

One River Center
331 Newman Springs Road, Suite 104
Red Bank, NJ 07701
Tel.: + 1 732 203 1505
E-mail: inquiry@kopointl.com
www.kopointl.com
Contact: Mr. Andrew Towey,
Mr. Colin Newberry

BRASIL AND ARGENTINA

QUANTUM INTERNATIONAL BUSINESS CORP.

Rua Vieira de Moraes 1713 cjto 102
04617-015 São Paulo – SP
Brazil
Tel: + 55 11 5093 6500
E-mail: fernando.valente@quantumsteel.com.br
www.quantumsteel.com.br
Contact: Mr. Fernando Valente

EUROPE

GERMANY

SIJ MWT GMBH

Celsiusstrasse 17
86899 Landsberg am Lech
Germany
Tel: + 49 8191 94 77 0
Mobile: + 49 170 652 99 77
E-mail: Matjaz.Volk@sij-mwt.de
www.sij-mwt.de
Contact: Mr. Matjaž Volk

ITALY

COMSTEEL S.R.I.

Via XXIV Maggio 8
20854 Vedano al Lambro (MI)
Italy
Mobile: + 39 0335 6080121
E-mail: info.comsteel@gmail.com
Contact: Mr. Marco Colombo

SIDERTOCE S.P.A.

Zona industriale - via XX Settembre 198
28883 Gravellona Toce (VB)
Italy
Tel.: + 39 0323 865208
Mobile: + 39 335 6106449
E-mail: carmela@sidertoce.com
www.sidertoce.com
Contact: Mrs. Carmela Criseo

EUROPE

UNITED KINGDOM

EURONORM LTD

Birks Green Farm
Brown Hills Lane
Sheffield, S10 4PE
England
Tel: + 44 (0)1142302444
Mobile: + 44 (0)7753796301
E-mail: mg@euronormuk.com
Contact: Mr. Michael Green

SCANDINAVIA

STENA STAL AB

Fabriksgatan 14
331 35 Värnamo
Sweden
Tel: + 46 10 445 3725
Mobile: + 46 70 866 9919
E-mail: andreas.heiel@stenastal.se
www.stenastal.se
Contact: Mr. Andreas Heiel

SPAIN AND PORTUGAL

EUSKOSTEEL CONSULTING

Astigarragako bidea, 2
Oficinas Mamut, Planta 3a - Local 16
20180 - Oiartzun - Gipuzkoa
Spain
Tel.: + 34 943 26 10 40
E-mail: jmbalerdi@euskosteel.com
Contact: Mr. Jose Manuel Balerdi

TURKEY

OYAL METAL ÇELIK SAN. VE TIC. LTD. ŞTI.

GENÇOSMAN MAHALLESI
TOPÇU SOK NO: 4
34165 Güngören Istanbul
Turkey
Tel.: + 90 212 568 1919
E-mail: ramis.ozturk@oyalmetal.com
www.oyalmetal.com
Contact: Mr. Ramis Ozturk

SLOVENIA

KOVINTRADE, D. D.

Mariborska 7
3000 Celje
Slovenia
Tel: + 386 3 42 78 171
E-mail: simon.hercog@kovintrade.si
www.kovintrade.si
Contact: Mr. Simon Hercog

SIJ RAVNE STEEL CENTER D.O.O.

Litostrojska 60
1000 Ljubljana
Slovenia
Mobile.: + 386 51 623 321
E-mail: adler@rsc.si
www.rsc.si
Contact: Mr. Gregor Adler

EUROPE

POLAND

POLAND METALTRADE SP., Z. O. O.

Ul. Wolska 84/86
01-141 Warszawa
Poland
Tel: + 48 22 379 16 70
E-mail: jure.cesen@multistal.com.pl
www.metaltrade.pl
Contact: Mr. Jure Česen

BOLGARIA

KOVINTRADE BULGARIA EOOD

5 "Viktor Grigorovich" Str, entr. A, app. 2
1606 Sofia
Bolgaria
Tel: + 359 2 951 51 22 / +359 884 457 505
E-mail: office@kovintrade-bg.com
www.kovintrade-bg.com
Contact: Mr. Matej Karničnik

HUNGARY

KOVINTRADE HUNGARY KFT.

II. Rákóczi Ferenc út 100
2314 Haásztelek, Pf. 24
Hungary
Tel: + 36 24 518 425
E-mail: sandor.prec@kovintrade.hu
www.kovintrade.hu
Contact: Mr. Sandor Prec

ROMANIA

KOVINTRADE ROMANIA S. R. L.

B-dul Iuliu Maniu nr. 7, corp A
et.3, cam 28-30
Bucuresti-Sector 6
Romania
Tel: + 40 31 228 80 72
E-mail: vasja.kukovic@kovintrade.ro
www.kovintrade.ro
Contact: Mr. Vasja Kukovič

CZECH REPUBLIC

KOVINTRADE SPOL. S.R.O.

Holečkova 39, Praha 5
15000 Praha
Czech Republik
Tel: + 420 2 510 91 611
E-mail: central@kovintrade.cz
www.kovintrade.cz
Contact: Mr. Gregor Jurak

SLOVAK REPUBLIC

KOVINTRADE BRATISLAVA S.R.O.

Dúbravská cesta 2
84 104 Bratislava
Slovakia
Tel: + 421 2 547 73 123
E-mail: kovintrade@kovintrade.sk
www.kovintrade.sk
Contact: Mr. Renato Rupnik

ASIA

INDIA

USBCO STEELS PRIVATE LIMITED

73, Bentinck Street
Kolkata 700001
India
Tel.: + 91 33 22365216/5613
E-mail: sales@usbcosteels.com
www.usbcosteels.com
Contact: R.S. Kejriwal / P. Kejriwal / Ravi Kejriwal

CHINA, SOUTHEAST ASIA AND AFRICA

PRIMEX STEEL TRADING GMBH

Königsallee 60 D
40212 Düsseldorf
Germany
Tel.: + 49 211 8668477
Mobile + 49 170 6992946
E-mail: jpollak@primex-steel.de
www.primex-steel.de
Contact: Mr. Jens Pollak

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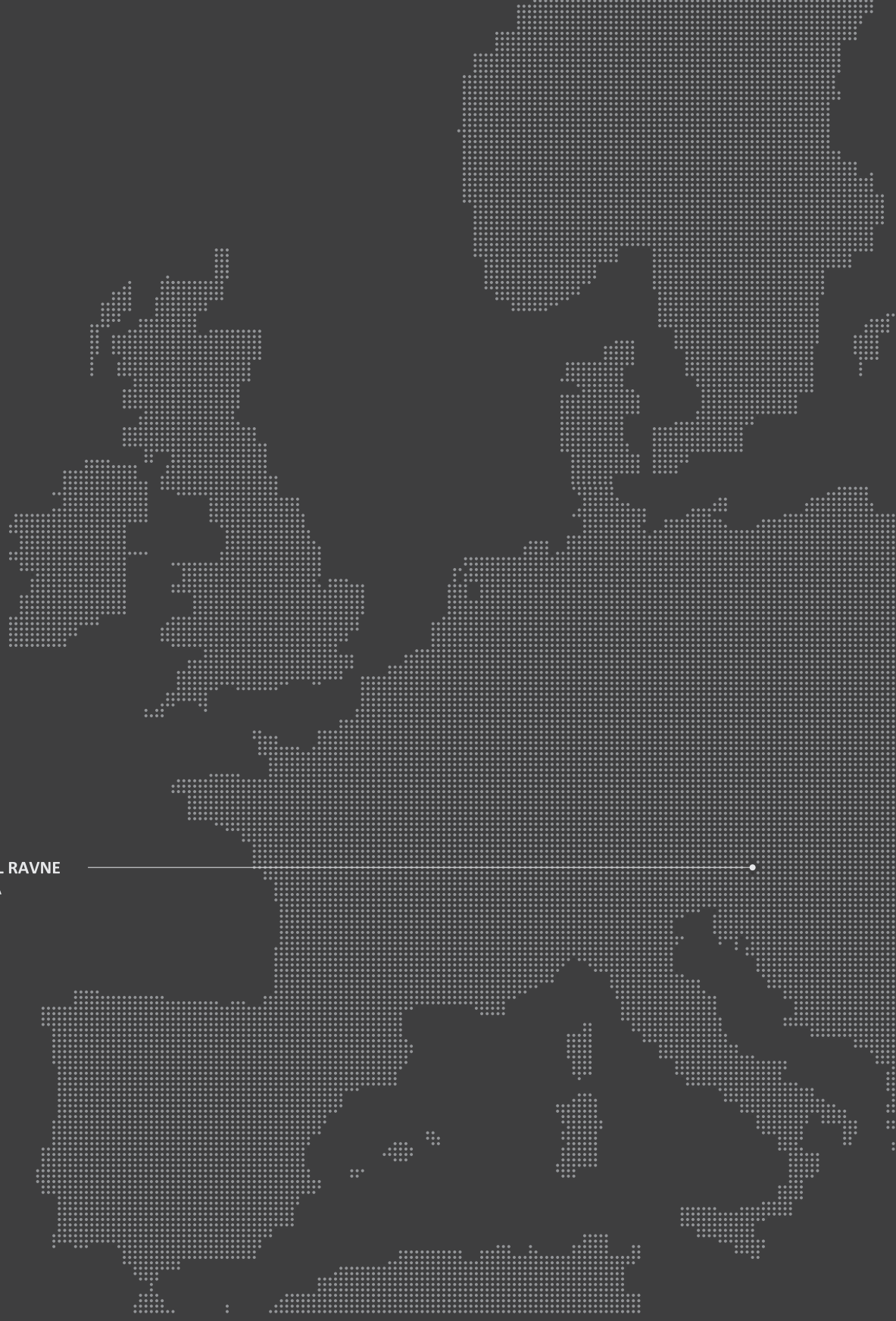

SIJ METAL RAVNE, d. o. o.
Koroška cesta 14
SI–2390 Ravne na Koroškem, Slovenia, EU

marketing@metalravne.com
sij.metalravne.com

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