

STEEL FOR:

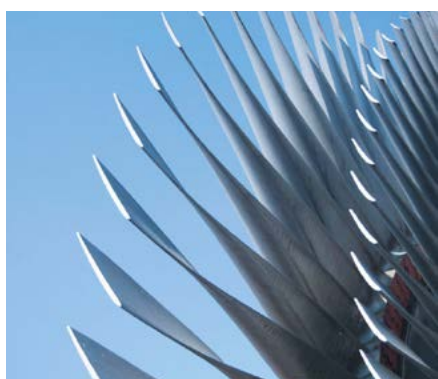
- STEAM TURBINE BLADES
- GAS TURBINE BLADES
- AIRCRAFT INDUSTRY BLADES

SPECIFICATION SHEET

Due to their specific applications (elevated temperatures, lasting constant loads), steel for turbine blades is very complex as to its technology and quality, requiring a higher level of a continuous production process management.

We at SIJ Metal Ravne are proud of our knowledge and skills which helped us develop new technologies and win a larger share on the demanding market of certified suppliers of turbine blade steels.

WE PRODUCE FLAT STEEL FOR TURBINE BLADES



Steam turbine blades



Gas turbine blades



Aircraft industry blades

Products are incorporated into the most heavily loaded parts of turbines for the production of electric energy. Parts have to guarantee 100 % performance, and therefore material must meet the highest quality standards.

▮ TYPES AND APPLICATIONS

We produce two main quality groups of steel for the production of turbine blades: stainless and chemical-resistant steels and steels resistant at elevated temperatures. The main parts of steels contain around 11 % chromium or more. Chromium and carbon are balanced for the required hardness and hardenability. Alloying elements like molybdenum, vanadium, niobium, boron are added to improve tempering and creep resistance. Steels are used at different working temperatures up to approximately 550°C or more, which depends on the content of alloying elements.

Stainless and chemical – resistant steel

STEEL	TYPICAL ANALYSIS	APPLICATION
SINOXX ^{***} 4006, W.Nr. 1.4006, X12Cr13, ~ AISI 410, GOST 12CH13, 1CH13	C 0.12 Cr 12.5	Turbine construction, mechanical engineering, equipment for paper, textile and dairy industry.
SINOXX ^{***} 4021, W.Nr. 1.4021, X20Cr13, AISI 420, GOST 20CH13, 2CH13 SINOXX ^{***} E770, GOST 20CH13, 2CH13	C 0.21 Cr 13.0 Ni 0.60	Turbine blades, constructional parts with higher load, surgical instruments.
SINOXX ^{***} 4542, W.Nr. 1.4542, X5CrNiCuNb16-4, ~ AISI 630, (17-4 PH), GOST 05CH16N4D2B	C 0.03 Si 0.3 Mn 0.4 Cr 15.2 Ni 4.4 Cu 3.4 Nb 0.25	Aircraft industry, turbine blades, bolts and spindles in armatures engineering, etc.

Steel resistant at elevated temperatures

STEEL	TYPICAL ANALYSIS	APPLICATION
SINOXX ^{***} 4923, W.Nr. 1.4923, X22CrMoV12-1, GOST 20CH12VNMF, 2CH12VNMF	C 0.2 Si 0.3 Mn 0.5 Cr 11.3 Mo 1.0 Ni 0.6 V 0.3	Components for steam turbines and other components, resistant to compressed hydrogen for chemical industry.
SINOXX ^{***} 4913, W.Nr. 1.4913, X19CrMoNbVN11-1, GOST 18CH11MNFb	C 0.19 Si 0.3 Mn 0.55 Cr 10.75 Mo 0.75 Ni 0.55 V 0.2 Nb 0.33 N 0.08 B max. 0.0015	For fastening elements in thermal energy plants, screws, nuts.
SINOXX ^{***} 4938, W.Nr. 1.4938 (1.4939), X11CrNiMo12, GOST 11CH11N2V2MF, GOST CH12N2VMF	C 0.11 Si 0.18 Mn 0.7 Cr 11.75 Mo 1.75 Ni 2.7 V 0.33 N 0.035.	Special purpose steel – aircraft industry.
SQUAL ^{***} 7709, W.Nr. 1.7709, 21CrMoV5-7, GOST 25CH1M1F	C 0.2 Si 0.22 Mn 0.47 Cr 1.3 Mo 0.75 V 0.27.	Screws and nuts and forged components for steam engines and other.
SINOXX ^{***} 4906, W.Nr. 1.4906, X12CrMoWVNbN10-1-1	C 0.12 Si 0.1 Mn 0.4 Cr 10.2 Mo 1.0 W 1.0 Ni 0.7 V 0.20 Nb 0.05 N 0.05	Heat resistant steel for turbine blades and other components.

Dimensional range (majority)

PRODUCT	PRODUCTION PLANT	DIMENSIONS
Billets for further forging	Blooming Mill	Square 90-150 mm
Flat sections	Blooming Mill	Thickness 55-90 mm, width 90-270 mm
Flat sections	Forging machine	Thickness 70-120 mm, width 80-250 mm
Square sections	Forging machine	Square 80-140 mm
Flat sections	Section Rolling Mill	width 40-150 mm with thickness 7-65 mm, width 150-250 mm with thickness 7-55 mm
Square sections	Section Rolling Mill	Square 25-75 mm

Delivery condition:

Annealed/quenched + tempered, stress-free annealed.

Surface:

Black, sandblasted, milled.

Additional:

We also supply different open-die machined forgings and round profiles for energy as well as for other industry sectors (oil&gas, mechanical engineering, automotive, etc.).

CONTROL AND TESTING OF MATERIAL

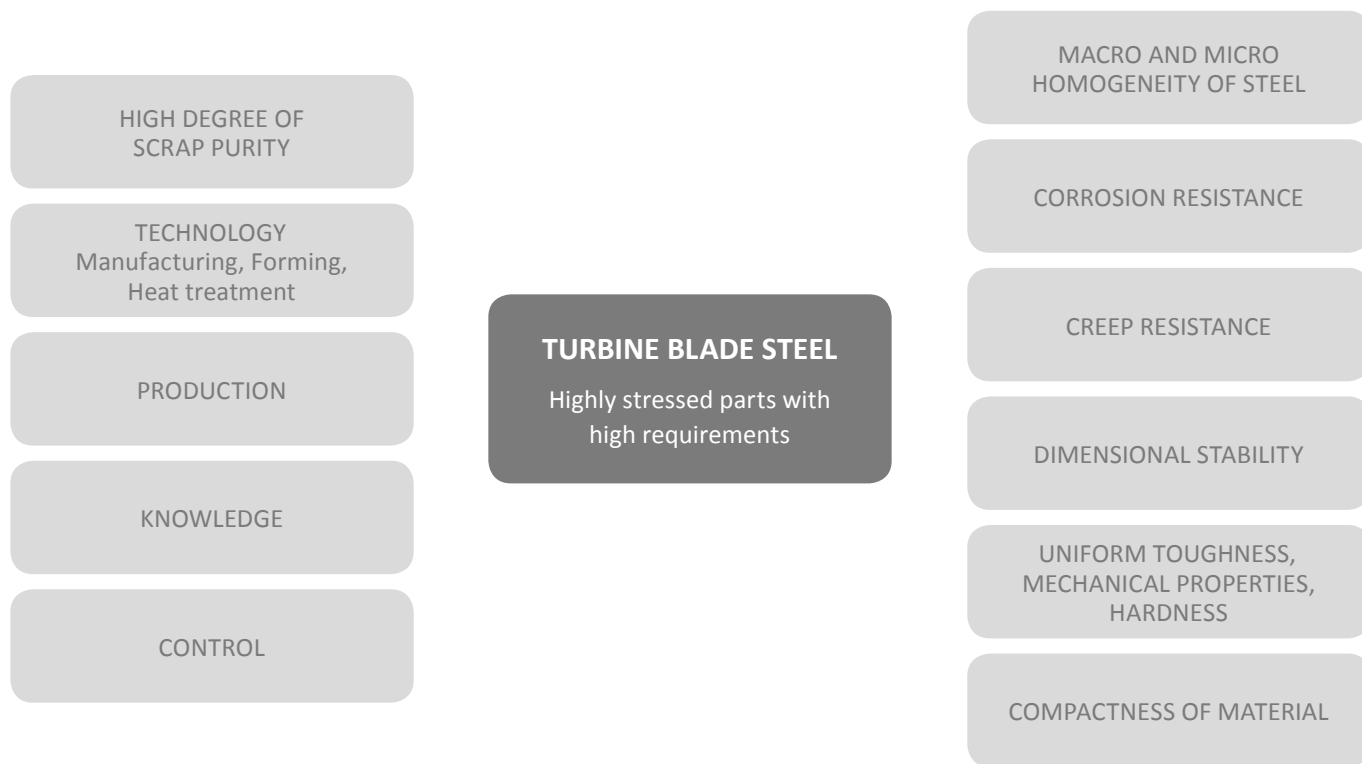
For turbine blade steels, we use an extensive and a very precise final control. Final inspection is performed on every finished product to ensure that customer's specifications have been fully met. We determine mechanical properties, toughness, macrostructure, microstructure, grain size and cleanliness, hardness and make visual and dimensional controls, ultrasonic testing and identity control. If specifically required by customers, we also determine FATT (Fracture Appearance Transition Temperature) and examine morphology of fracture steel surfaces, evaluate the share of intercrystalline fracture.

With own metallurgical research, we foster development of new grades, products and improvement of technologies together with our customers. We also advise our customers as to which steel is best for their applications.

We have quality control&research equipment such as: optical microscopes, SiS imaging and analysis system for optical microscopes, x-ray diffractometer, scanning electron microscope (SEM), microanalysis system (EDS), dilatometer, tension testing, testing machine for elevated temperatures and a creep rupture testing machine.

We also supply different open-die machined forgings and round profiles for energy as well as for other industry sectors (oil&gas, mechanical engineering, automotive, etc.)

PARAMETERS FOR STEEL PRODUCTION AND CUSTOMER DEMANDS



When producing steel for turbine blades, we must keep control over the whole production process of manufacturing, heat treatment and control of material. Today, we supply our steel to the major global producers of turbine blades.

Our goal is not only to pursue customers' requirements but also to join our forces with customers and our development staff to create and design high-quality products.

DISCLAIMER

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