

TURBINE

TECHNICAL DATA SHEET

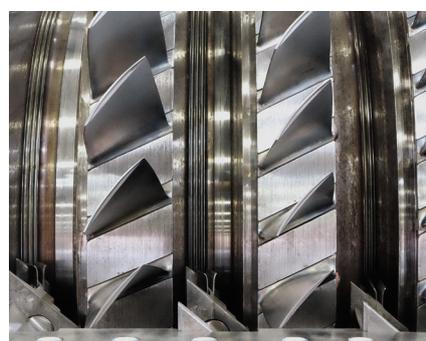
Due to its specific applications (elevated temperatures, lasting constant loads), steel for turbines is very complex as to its technology and quality, requiring a higher level of a continuous production process management.

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 steels.

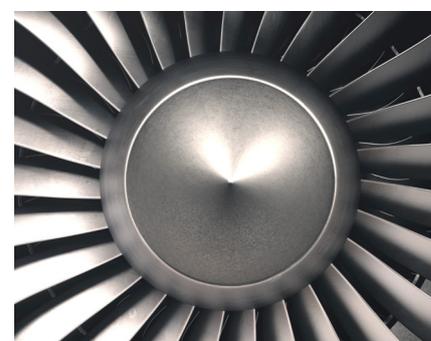
WE PRODUCE FLAT, ROUND AND SQUARE STEEL FOR TURBINES



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 turbines: 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

SIJ Brand	Chemical composition [wt %]	Application
SINOXX 4006 W.Nr. 1.4006, X12Cr13, ~ AISI 410	C 0.12 Si 0.25 Mn 0.60 Cr 12.50	Turbine construction, mechanical engineering, equipment for paper, textile and dairy industry.
SINOXX 4119 X15CrMo13, AISI403/410	C 0.14 Si 0.25 Mn 0.50 Cr 12.0 Mo 0.5	Turbine construction, mechanical engineering (blades, scalpels, bearings, tools).
SINOXX E770 W.Nr. 1.4021, X20Cr13, AISI 420	C 0.20 Si 0.25 Mn 0.60 Cr 13.00 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)	C 0.04 Si 0.25 Mn 0.60 Cr 15.20 Ni 4.00 Nb 0.30 Cu 3.50	Aircraft industry, turbine blades, bolts and spindles in armatures engineering.

Steel resistant at elevated temperatures

SIJ Brand	Chemical composition [wt %]	Application
SINOXX 4923 W.Nr. 1.4923, X22CrMoV12-1	C 0.21 Si 0.25 Mn 0.60 Cr 12.00 Mo 1.00 Ni 0.50 V 0.30	Components for steam turbines and other components, resistant to compressed hydrogen for chemical industry.
SINOXX 4913 W.Nr. 1.4913, X19CrMoNbVN11-1	C 0.19 Si 0.30 Mn 0.55 Cr 10.75 Mo 0.75 Ni 0.55 V 0.20 Nb 0.33 N 0.08 B max 0.0015	Turbine blades, fastening elements in thermal energy plants, screws, nuts.
SINOXX 4938 W.Nr. 1.4938 (1.4939), X11CrNiMo12	C 0.12 Si 0.25 Mn 0.60 Cr 12.00 Mo 1.80 Ni 2.60 V 0.30 N 0.03	Special purpose steel – aircraft industry.
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.
SINOXX 4903 W.Nr. 1.4903, ~AISI F91, X10CrMoVNB9-1	C 0.10 Si 0.35 Mn 0.45 Cr 8.50 Mo 0.95 V 0.22 Nb 0.06 N 0.05 Al max 0.040	Steel for pressure vessels, pipeline construction.
SINOXX 4980 W.Nr. 1.4980, AISI 660, X5NiCrTi26-15, S66286	C 0.05 Si 0.25 Mn 1.20 Cr 14.50 Mo 1.20 Ni 25.00 V 0.20 Ti 2.10	Aviation and power engineering for heavy-duty rotors, gas turbine blades, steam turbines, pressure equipment parts and reactors, jet engines and rockets.

Dimensional range (majority)

Product	Production plant	Dimensions
Billets for further forging	Blooming Mill	Square 90-140 mm
Flat sections	Blooming Mill	Width 90-270 mm with thickness 55-90 mm
Flat sections	Forging machine	Width 80-250 mm with thickness 70-120 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

*For specific grades, the available dimensional range may differ.

Delivery condition

Annealed/quenched + tempered, stress-free annealed.

Surface

Black, sandblasted, milled, ground.

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

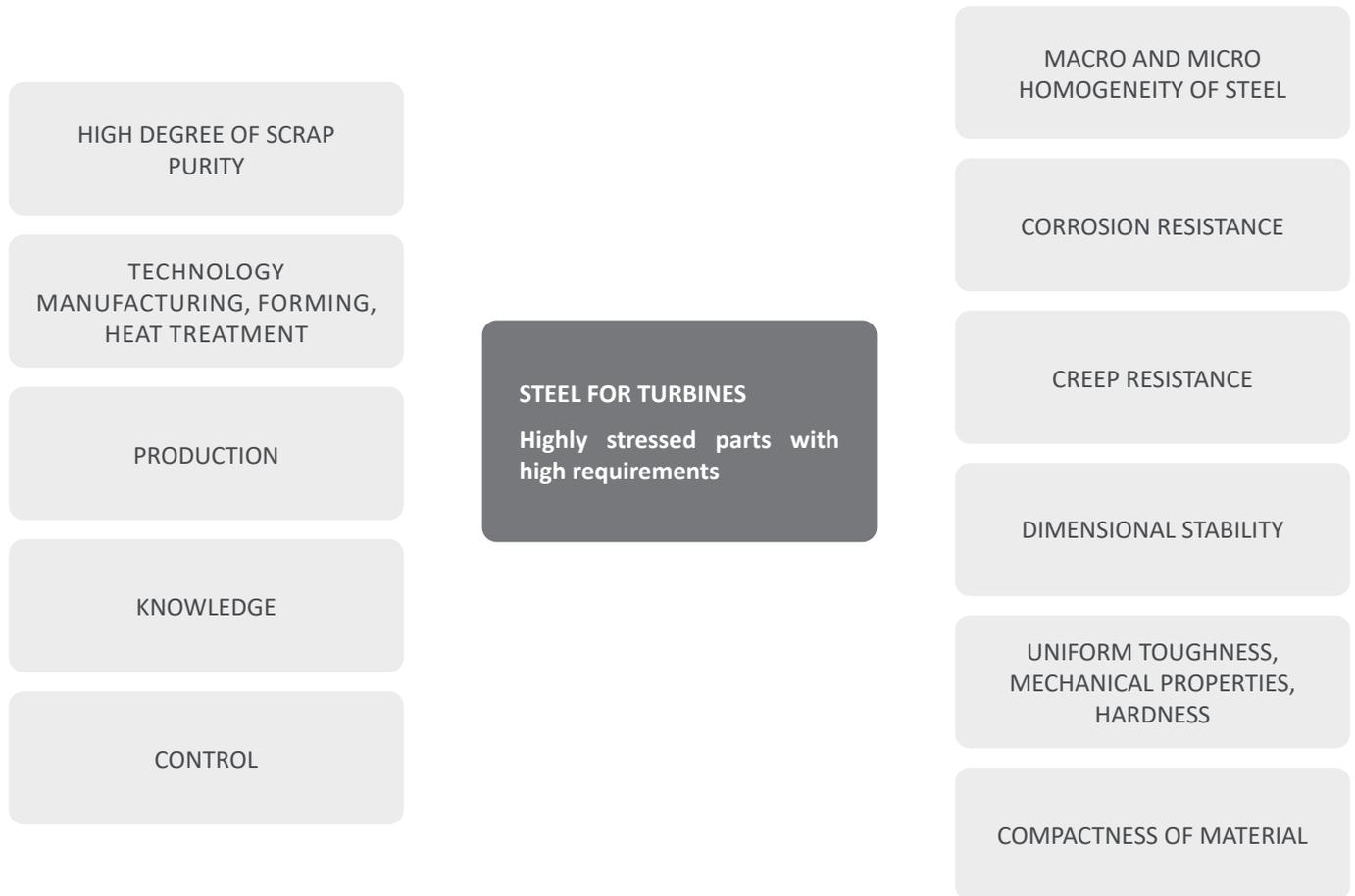
For turbine steels, we use an extensive and a very precise final control. Final inspection is performed on every finished product to ensure that customer's specifications have been fully met. We determine mechanical properties, toughness, macrostructure, microstructure, grain size and cleanliness, hardness 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.

Our quality control and research equipment includes: optical microscopes, an X-ray diffractometer, a scanning electron microscope (SEM) with EDS microanalysis, a dilatometer, mechanical testing machines, and creep-stress machines.



 PARAMETERS FOR STEEL PRODUCTION AND CUSTOMER DEMANDS



When producing steel for turbines, 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 turbines.

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.

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