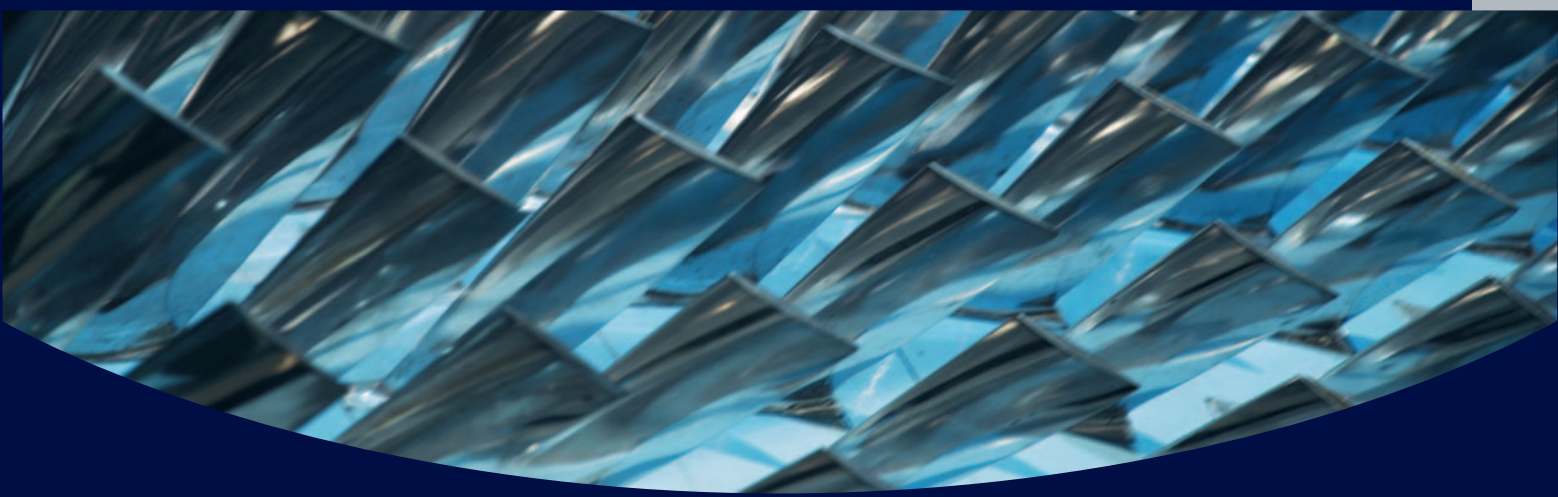
METAL RAVNE

The name
you can
trust

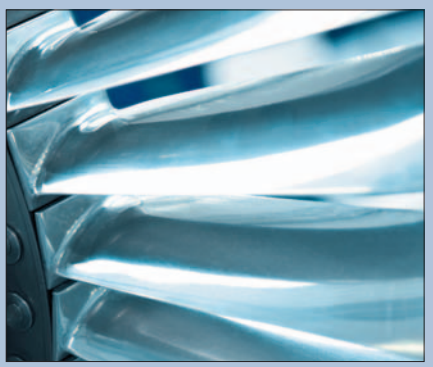


STEEL FOR

- STEAM TURBINE BLADES
- GAS TURBINE BLADES
- AIR-CRAFT INDUSTRY BLADES

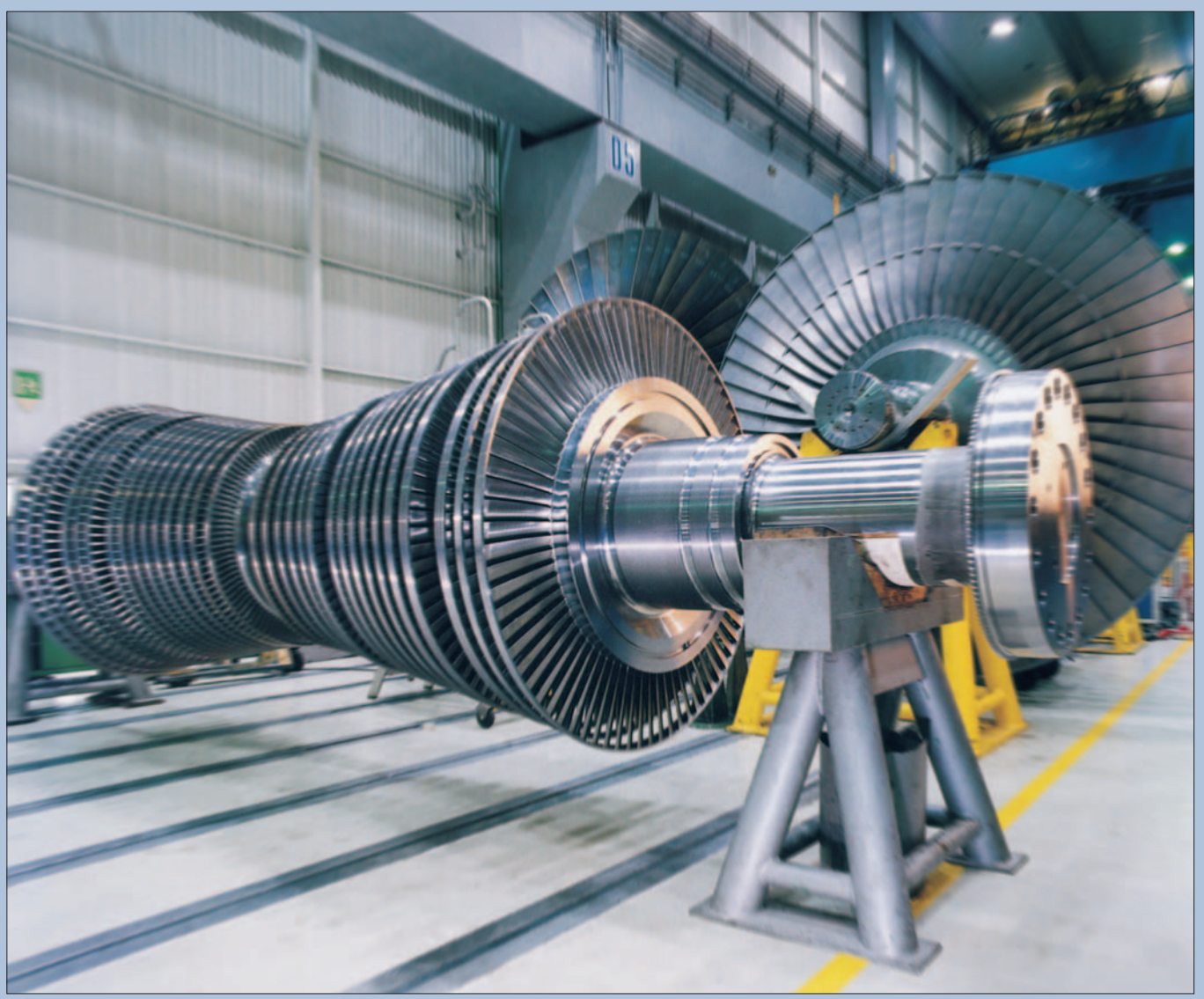
Due to its specific applications (elevated temperatures, lasting constant loads), steel for turbine blades is very complex as to its technology and quality, requiring a higher level of a continuous production process management.
We at METAL RAVNE are proud of our knowledge and skills which helped us develop new technologies and win a larger share on the demanding market of certified suppliers of turbine blade steel.

STEAM TURBINE BLADES



GAS TURBINE BLADES

AIR-CRAFT 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 requirements.

TYPES AND APPLICATIONS

METAL RAVNE produces two main quality groups of steel for the production of turbine blades: stainless and chemical-resistant steel and steel resistant at elevated temperatures. This steel contains approximately 11 % of chromium or more. Chromium and carbon are balanced for the required hardness and hardenability. Some elements like molybdenum, vanadium, niobium, boron are added for 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
PK330, W.Nr. 1.4006, X12Cr13, ~ AISI 410	0.12 C - 12.5 Cr	Stainless steel for tempering. Turbine construction, mechanical engineering, equipment for paper, textile and dairy industry.
PK3NI, W.Nr. 1.4021, X20Cr13, AISI 420	0.21 C - 13.0 Cr - 0.60 Ni	Stainless steel for tempering. Turbine blades, more loaded constructional parts, surgical instruments.
PK346, W.Nr. 1.4542, X5CrNiCuNb16-4, ~ AISI 630, (17-4 PH)	0.03 C - 0.3 Si - 0.4 Mn - 15.2 Cr - 4.4 Ni - 3.4 Cu - 0.25 Nb	High-alloy precipitation hardening stainless steel. ESR Steel. Aircraft industry, turbine blades, bolts and spindles in armatures engineering etc.

STEEL RESISTANT AT ELEVATED TEMPERATURES

STEEL	TYPICAL ANALYSIS %	APPLICATION
PT929, W.Nr. 1.4923, X22CrMoV12-1	0.2 C - 0.3 Si - 0.5 Mn - 11.3 Cr - 1.0 Mo - 0.6 Ni - 0.3 V	Creep resistant. Components for steam turbines and other components, resistant to compressed hydrogen for chemical industry.
PK323, W.Nr. 1.4913, X19CrMoNbVN11-1	0.19 C - 0.3 Si - 0.55 Mn - 10.75 Cr - 0.75 Mo - 0.55 Ni - 0.2 V - 0.33 Nb - 0.08 N - B max. 0.0015	For fastening elements in thermal energy plants, screws, nuts.
PK942, W.Nr. 1.4938 (1.4939), X11CrNiMo12	0.11 C - 0.18 Si - 0.7 Mn - 11.75 Cr - 1.75 Mo - 2.7 Ni - 0.33 V - 0.035 N.	Conventional and ESR steel. Special purpose steel - aircraft industry.
PT759, W.Nr. 1.7709, 21CrMoV5-7	0.2 C - 0.22 Si - 0.47 Mn - 1.3 Cr - 0.75 Mo - 0.27 V.	Screws and nuts and forged components for steam engines and other.
PT955, W.Nr. 1.4906, X12CrMoWVNbN10-1-1	0.12 C - 0.1 Si - 0.4 Mn - 10.2 Cr - 1.0 Mo - 1.0 W - 0.7 Ni - 0.20 V - 0.05 Nb - 0.05 N	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 100 - 270 mm
Flat sections	Forging machine	Thickness 50 - 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 - 255 mm with thickness 7 - 50 mm
Square sections	Section Rolling Mill	Square 25 - 75 mm

Delivery condition:
Annealed / quenched + tempered, stress annealed.

Surface:
Black, sandblasted, milled, peeled, ground.

We can produce also round profiles for other parts in turbines.

Other: according to an agreement

CONTROL AND TESTING OF MATERIAL

For turbine blade steel, we use an extensive and 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 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 machine for elevated temperatures and a creep rupture testing machine.

PARAMETERS FOR STEEL PRODUCTION AND CUSTOMER DEMANDS

HIGH DEGREE OF SCRAP PURITY

TECHNOLOGY
Manufacturing, Forming,
Heat treatment

PRODUCTION

KNOWLEDGE

CONTROL

TURBINE BLADE STEEL
Highly stressed parts with high requirements

MACRO AND MICRO HOMOGENEITY OF STEEL

CORROSION RESISTANCE

CREEP RESISTANCE

DIMENSIONAL STABILITY

UNIFORM TOUGHNESS, MECHANICAL PROPERTIES, HARDNESS

SURFACE WITHIN TOLERANCE RANGE

COMPACTNESS OF MATERIAL

When producing steel for turbine blades, we must keep control over the whole production process of manufacturing, heat treatment and control of material. With these facts, we managed to accomplish high quality customer demands for macro and microhomogeneity, corrosion resistance, creep resistance, dimensional stability, uniform toughness and mechanical properties over cross section, hardness, surface free of defects and compactness 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.

Metal Ravne is the name you can trust.

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