BÖHLER

OPEN DIE FORGE

BÖHLER – ONE SOURCE – FROM THE MELT TO THE FINISHED PRODUCT

Forging specialists are at work in BÖHLER's open die forge. Here is where metallurgical expertise, over 100 years of experience in special steels and a passion for precise machining come together.

The result: high-precision components made from materials we tested and developed. The integrated manufacturing process – from melt to finished product – offers the possibility of developing new materials for specific applications and guarantees high quality and safety standards. The advantages for our customers are also apparent in our processes: **one single contact team** is at your side from the enquiry through technical consultations to the offer, from the order to the delivery and invoicing processes.

In short, **your solution provider**, a centre of excellence for special components for the most demanding applications.

OUR STRENGTH – YOUR ADVANTAGE

YOUR MARKET – OUR SEGMENT: ENERGY

For tomorrow's energy

Meeting today's energy demand while at the same time being sensitive to the needs of the environment is one of the challenges we face today. Energy-efficient and cost-effective turbines – gas, steam or hydro-powered – form the basis of environmentally friendly and economical energy production.

In turbines, materials are used under the most extreme thermal and mechanical loads. For such extreme conditions, BÖHLER has developed **high temperature materials**, such as 9-12 % chromium steel grades, nickel based alloys, which guarantee **optimum material properties**. We can therefore count the world's most renowned turbine manufacturers among our customers.

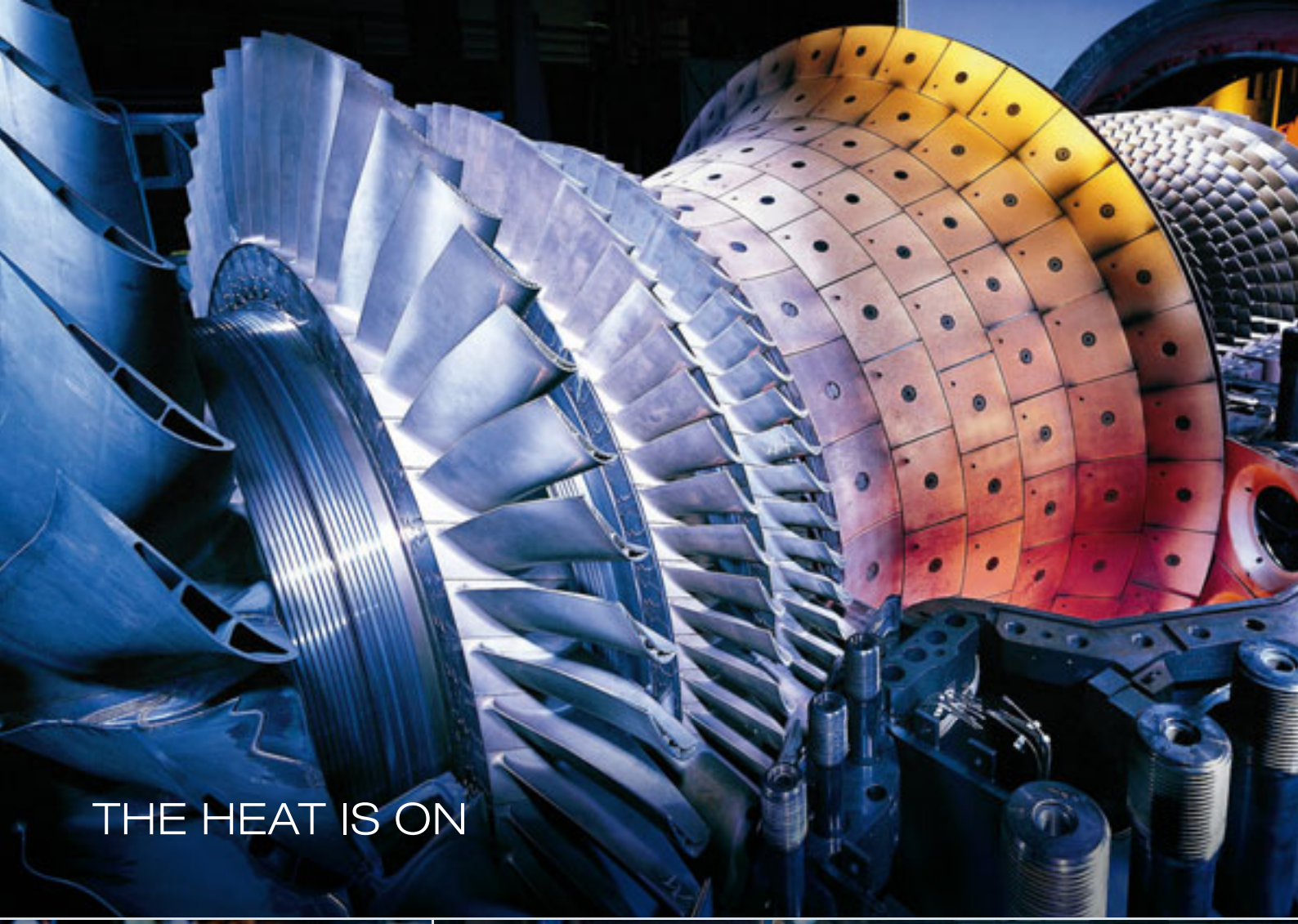
The same applies for components in nuclear power plants, where BÖHLER manufactures parts for the primary circuit with the highest safety and quality requirements in the industry.

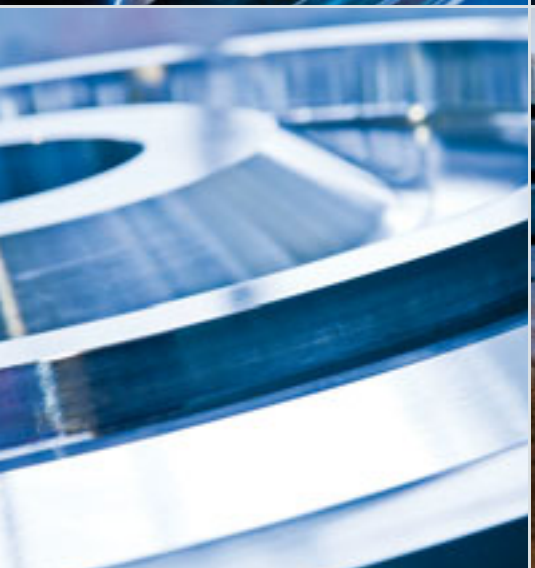
Typical products for energy applications

Compressor and turbine discs, compressor components, high pressure and intermediate pressure rotors, monobloc rotors, shaft ends, hollow shafts, housing components, coolant pump parts, valve and pump bodies, pump shafts, drilled bars and more.

Material types used:

- 9 – 12% Cr steels
- 3 – 3.5% NiCrMoV steels
- 1 – 2% CrMoV steels
- Soft martensitic steels
- Precipitation hardening steels
- Austenitic stainless steels
- Ni-base alloys


THE HEAT IS ON



ENERGY: MATERIALS FOR YOUR DEMANDING APPLICATIONS

BÖHLER grade	Market grade	Standards		Industry Specifications
		ASTM	Others	
Heat treatable steel grades				
BÖHLER V116	26NiCrMoV11-6		1.6948	SEW 555
BÖHLER V128SA	26NiCrMoV15-6 mod.		≈ 1.6957	
Stainless chromium steel grades				
BÖHLER N350	X17CrNi16-2		1.4057	AISI 431, UNS S43100, AMS 5628
BÖHLER N400	X5CrNi13-4	A182-F6 NM	1.4312	UNS S41500, DIN EN10250-4
BÖHLER N403	X3CrNiMo13-4		1.4313	UNS S41500, DIN EN10250-4
PH grades				
BÖHLER N700	X5CrNiCuNb16-4		1.4542	AISI 630, UNS S17400, AMS 5604, JIS SUS630, DIN EN 10250-4
BÖHLER N701	X5CrNiCu15-5	XM-12	1.4545	UNS S15500, AMS 5659
Creep resiting steel grades				
BÖHLER D102	30CrNiMoNi5-11		1.6946	SEW 555
BÖHLER D111	25CrMoV3-8			
BÖHLER D623	22CrMoNiWV8-8		1.6945	SEW 555
9 – 12% Chromium steel grades				
BÖHLER T505SC	X12CrMoWVNbN10-1-1		1.4906	SEW 555, COST E
BÖHLER T507	X14CrMoWVNbN10-1		1.4902	SEW 555, COST F
BÖHLER T550	X21CrMoV12-1		1.4926	SEW 555
BÖHLER T552	X11CrNiMo12		1.4938	UNS S64152, AMS 5719
BÖHLER T559				COST FB 2
BÖHLER T560	X19CrMoNbVN11-1		1.4913	≈ BS S150, AECMAFE-PM36
Austenitic steel grades				
BÖHLER T200	X4NiCrTi25-15	A286	1.4944, 1.4943 1.4980	AISI 660, UNS S66286, AMS 5525, AMS 5731, AMS 5732
BÖHLER A415		A182-F316 LN		
BÖHLER A604SJ	X2CrNi19-11	F304L	1.4306	UNS S30403
BÖHLER A759	X6CrNiNb18-105		1.4553	
BÖHLER A760	X6CrNiNb18-10	F347	1.4550	UNS S34700
Nickel-base alloys				
BÖHLER L617				Inconel 617
BÖHLER L625	NiCr22Mo9Nb		2.4856	UNS N06625, AMS 5599, AMS 5666, Inconel 625
BÖHLER L718	NiCr19NbMo		2.4668	UNS N07718, AMS 5662, AMS 5663, AMS 5664, Inconel 718

TESTING AT IT'S BEST

YOUR MARKET – OUR SEGMENT: OIL AND GAS

The chemistry of life

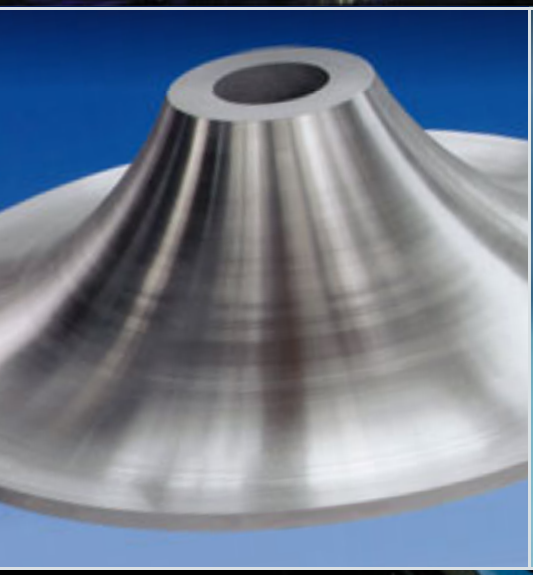
The exploration and extraction of fossil fuels from the bottom of our oceans, the manufacture of plastics or the processing of drinking-water have become common place. Only when these services are disrupted do we notice the extent of our reliance on them. Therefore it is important to offer materials specially designed for highly corrosive environments and extreme mechanical stresses to the industry.

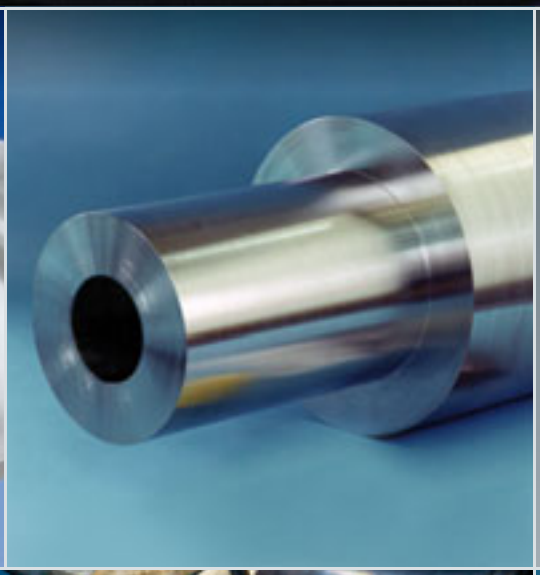
Typical products

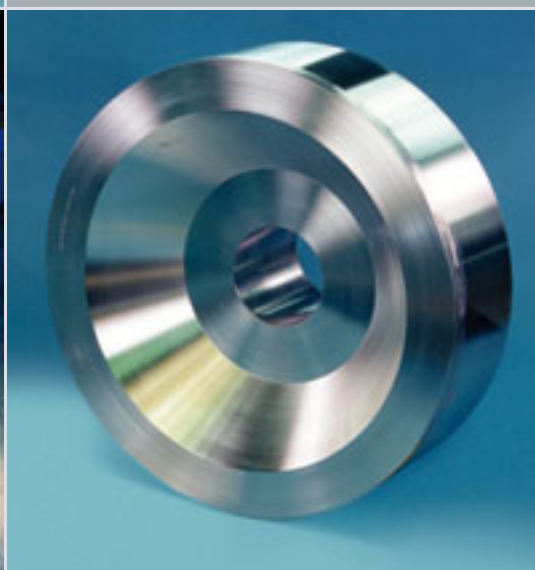
Components for mooring systems (swivels), valve bodies, tubing hangers, hollow bars, hollow shafts, y-pieces, components for centrifugal separators, stabilizers, non-magnetic shafts, impellers, discs, flanges.

BÖHLER grade	Market grade	Standards		Industry Specifications
		ASTM	Others	
Heat treatable steel grades				
BÖHLER N400	X5CrNi13-4	A182-F6 NM	1.4312	UNS S41500, DIN EN10250-4
BÖHLER N404	X4CrNiMo16-5-1		1.4418	AFNOR Z6CND16-05-01
PH grades				
BÖHLER N700	X5CrNiCuNb16-4		1.4542	AISI 630, UNS S17400, AMS 5604, JIS SUS630, DIN EN 10250-4
BÖHLER N701	X5CrNiCu15-5	XM-12	1.4545	UNS S15500, AMS 5659
Nickel-base alloys				
BÖHLER L625	NiCr22Mo9Nb		2.4856	UNS N06625, AMS 5599, AMS 5666, Inconel 625
BÖHLER L718	NiCr19NbMo		2.4668	UNS N07718, AMS 5662, AMS 5663, AMS 5664, Inconel 718
Non-magnetic steel grades				
BÖHLER P501	X2CrNiMoNNb21-16-5-3	≈ XM-19	1.3964	≈ UNS S20910
BÖHLER P503	X2CrNiMoNNb23-17-6-3		1.3974	
Duplex and super-duplex steel grades				
BÖHLER A903	X2CrNiMoN22-5-3	F51	1.4462	UNS S31803, AFNOR Z2CND22-5 AZ
BÖHLER A911	X2CrNiMoCuWN25-7-4		1.4501	UNS S32760

SEA WATER RESISTANT







YOUR MARKET – OUR SEGMENT: AEROSPACE

Safety accepts no compromise

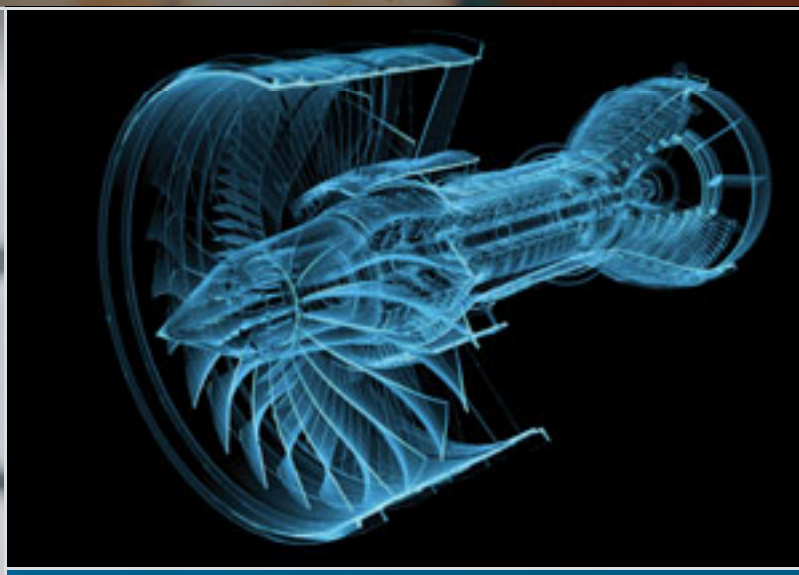
Manufacturing components for aviation and space programs requires the highest technological standards, strict quality management setup and a great deal of responsibility from the people involved in order to meet the requirements of the world's most significant manufacturers of aircraft engines.

Typical products

Helicopter rotor shafts, turbine shafts, stub shafts, casing and cover turbine pump starters (Ariane V), drive train shafts, pancake discs for prototyping.

BÖHLER grade	Market grade	Standards		Industry Specifications
		ASTM	Others	
Heat treatable steel grades				
BÖHLER V124SC	≈ 40NiCrMo6	AISI 4340		UNS G43400, AMS 6414
BÖHLER V132	41SiNiCrMoV7-6		≈ 1.6928	AMS 6257, AMS 6419
BÖHLER V140	≈ 40NiCrMo6	AISI 4340	≈ 1.6565	UNS K23028, AMS 6414
BÖHLER V358	39CrMoV13-9		1.8523	3 S132
PH grades				
BÖHLER N700	X5CrNiCuNb16-4		1.4542	AISI 630, UNS 17400, AMS 5604, JIS SUS630, DIN EN 10250-4
BÖHLER N701	X5CrNiCu15-5	XM-12	1.4545	UNS S15500, AMS 5659
BÖHLER N709	X3CrNiMoAl13-8-2	XM-13	1.4534	UNS S13800, AMS 5629
BÖHLER T670	X5CrNiMoCuNb14-5	≈ XM-25	1.4594	UNS S45000, BS S143
Creep resiting steel grades				
BÖHLER T552	X12CrNiMoV12-3		1.4933, 1.4938 1.4939	≈ S151, ≈ S538, AISI XM-32
BÖHLER T200	X4NiCrTi25-15	A286	1.4943, 1.4944 1.4980	UNS S66286, AMS 5731, AMS 5732
Maraging steel grades				
BÖHLER V720	X2NiCoMo18-9-5	Marage 300	1.6354	UNS K93120, UNS K93160, AMS 6521, AMS 6514
BÖHLER V723	X2NiCoMo18-8-5	Marage 250	1.6359	UNS K92890, AMS 6512
Nickel-base alloys				
BÖHLER L625	NiCr22Mo9Nb		2.4856	UNS N06625, AMS 5599, AMS 5666, Inconel 625
BÖHLER L718	NiCr19NbMo		2.4668	UNS N07718, AMS 5662, AMS 5663, AMS 5664, Inconel 718

HIGH FLYING MATERIALS



YOUR MARKET – OUR SEGMENT: EXTRUSION

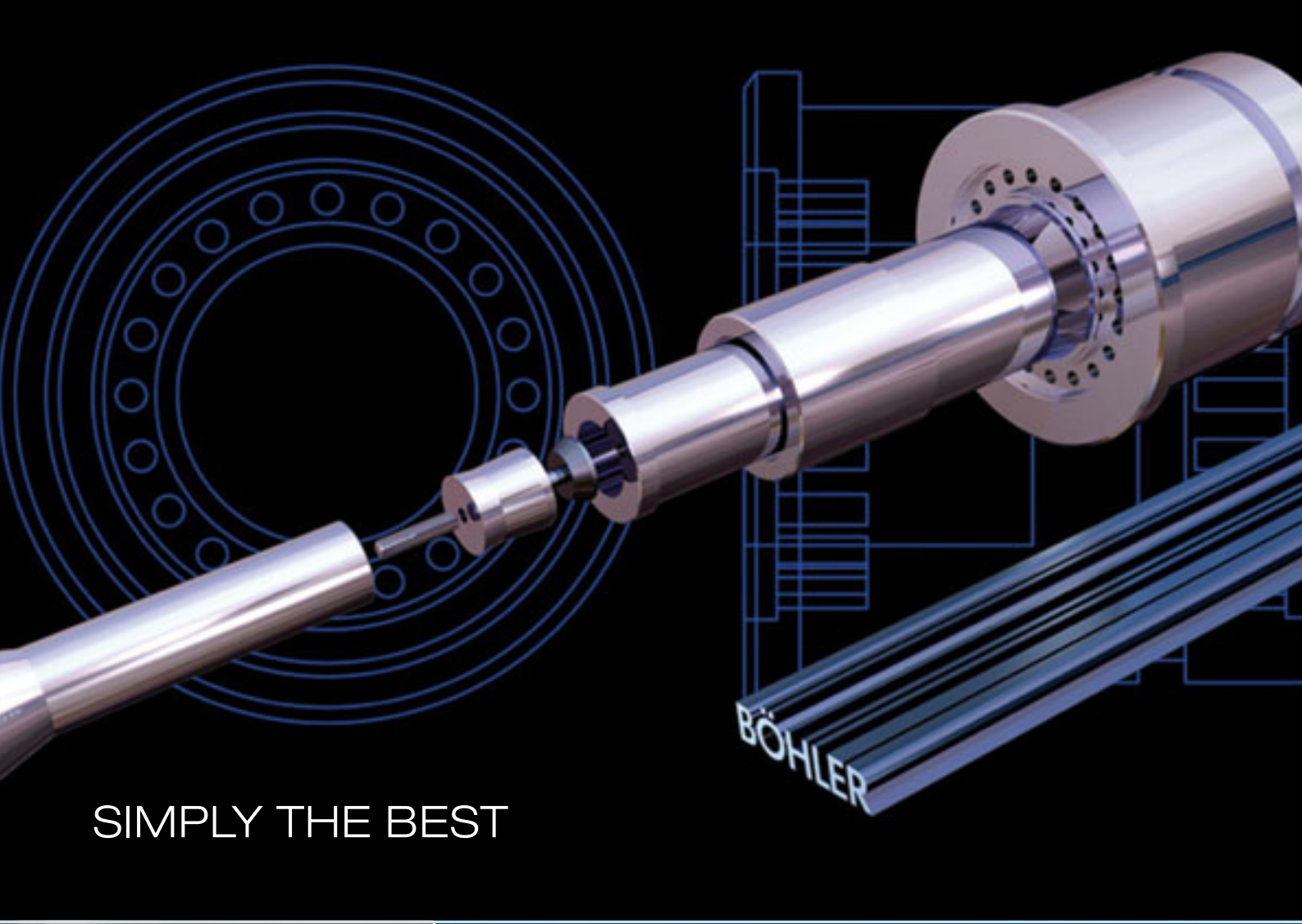
Complex solutions

BÖHLER is the world leader in tool steel manufacturing and research. This experience is incorporated into our extrusion products. With highly sophisticated FEM analysis tools we simulate your process conditions to provide the right solutions.

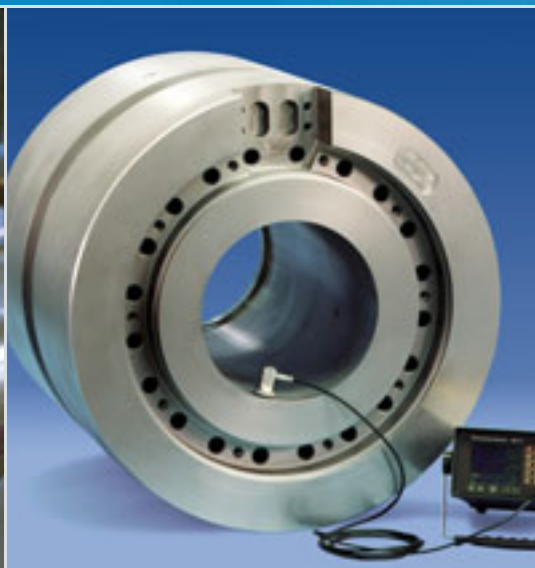
Typical products

Fully equipped containers, mantles, liners, stems, refitting services.

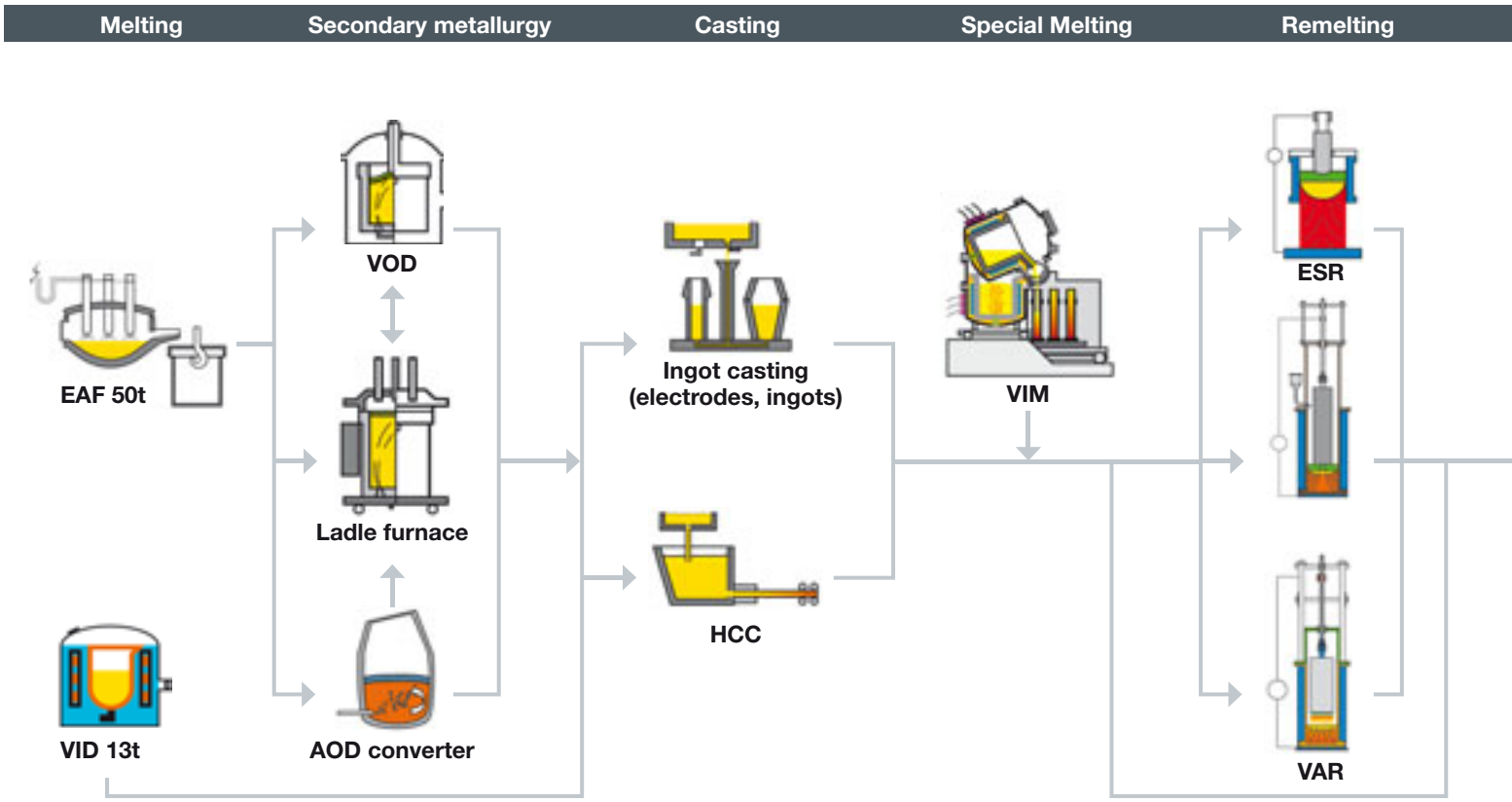
BÖHLER grade	Standard			Industry Specifications
	DIN	BS	AISI	
BÖHLER W300	1.2343, X38CrMoV5-1	≈ BH11	H11	UNS T20811
BÖHLER W400 VMR®	≈ 1.2343	≈ BH11	≈ H11	≈ UNS T20811
BÖHLER W302	1.2344, X40CrMoV5-1	GH13	H13	UNS T20813
BÖHLER W303	1.2367, X38CrMoV5-3			
BÖHLER W403 VMR®	≈ 1.2367, ≈ X38CrMoV5-3			
BÖHLER W320	1.2365, X32CrMoV3-3	BM10	≈ H10	UNS T20810
BÖHLER W326	1.2323, 48CrMoV6-7			
BÖHLER W350				
BÖHLER W360				
BÖHLER W720	≈ 1.2709, 1.6354			UNS K93160, UNS K93120, ASTM Marage 300
BÖHLER W750	≈ 1.2779, X6NiCrTi26-15		≈ 660	≈ ASTM A286, ≈ UNS 566286
BÖHLER L718	2.4668, NiCr19NbMo			AMS 5662, AMS 5663, AMS 5664, UNS N07718, ASTM B637, ASTM B670
BÖHLER L901	2.4662, NiCr13Mo6Ti3	HR53		AMS 5660, AMS 5661



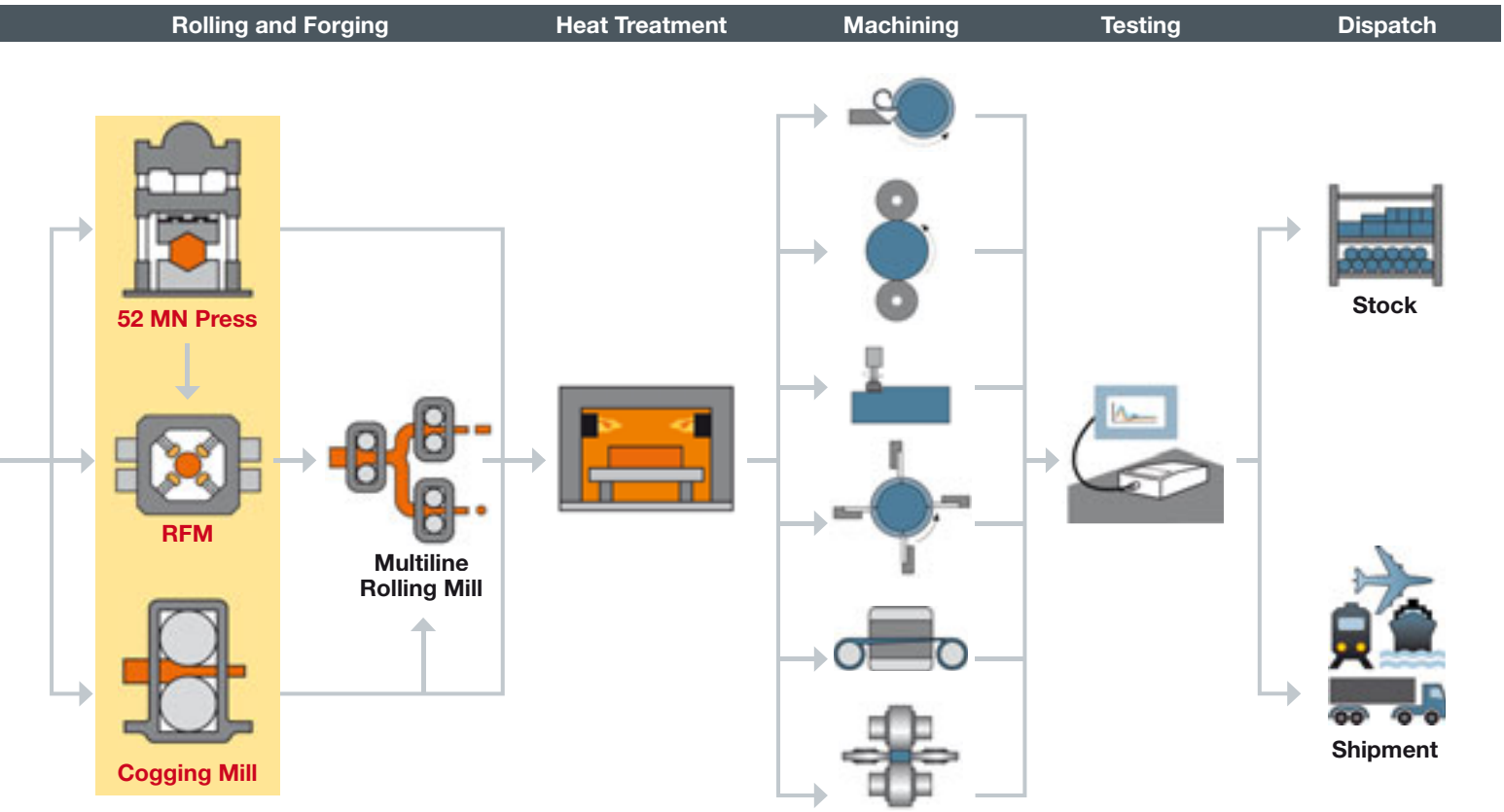
SIMPLY THE BEST



FLOW OF MATERIAL



STATE OF THE ART TECHNOLOGY














PRODUCTION PROGRAM

State-of-the-art equipment

Production facilities – Melting		
Conventional steel mill	Primary melting in 50 t electric arc furnace or 14 t vacuum induction furnace treatment in 50 t argon oxygen decarburisation converter and attached secondary metallurgy	Ingots, HCC casted billets
Special melting and remelting plant	Primary melting in 16 t vacuum induction melting furnace, 8 vacuum arc remelting facilities, 4 open and 4 pressure/protective gas electro-slag remelting facilities	Vacuum melted electrodes and vacuum remelted ingots max. 16 t for double and triple melt routes; ingots ESR/PESR max. 32 t; High alloyed products for high demanding applications in aerospace, energy, oil and gas and special alloys.

Production facilities – Forging		
5200 to press	The 5200 ton press with its two integrated manipulators forms the heart of our forging shop.	Rotors for turbines and generators, turbine discs, open die forgings, rings, hollow shafts, discs, round/square/flat bar; forging weight appr. 40 t, max. forging length approx. 12 m
Rotary forging machine	The rotary forging machine with its high performance and precise dimensional tolerances is the ideal forging tool for the production of steel bars and open die forgings.	Rotationally-symmetrical and contour shaped open die forgings; round, square, flat bar; forging weight 8 t max.; max. forging length 21 m

Production facilities – Heat Treatment		
Boogie hearth furnace	30 gas heated furnaces, max. load 150 t, max. size 11,300 (16,000) x 3,100 x 1,850 (2,500) mm, temperature range 450 – 1250°C, furnace class accord: AMS 2750-2-4	Forgings to optimise microstructure and mechanical properties according to customer specification
Spray hardening equipment	Length 1.0 – 10 m, diameter 250 – 1,100 mm, max. load 30 t Spraying with water-air mixture or compressed air	Rotors and shafts to achieve rotationally symmetrical structure formation, minimal deformation and the possibility to adjust different specific structural properties on a single piece

Production facilities – Machining		
Turning	1. Five CNC vertical turning and boring lathes: max. Ø 2,900 x 1,900 mm 2. Two CNC horizontal lathes without tailstock: max. Ø 1,000 x 400 mm 3. Four small/medium CNC horizontal lathes (one with milling device) max. Ø 1,000 x 6,000 mm resp. Ø 700 x 10,000 mm 4. Five large CNC horizontal lathes (one with milling device) max. Ø 2,000 x 12,000 mm	Components for steam and gas turbines (discs, rings, hollow shafts, rotors, housings), components for nuclear, extrusion, oil & gas and aviation applications
Boring, milling	One CNC milling and drilling machine max. 2,000 x 3,000 x 4,000 mm, max. weight 25 tons	Extrusion components
Deep hole drilling	Two drilling machines max. Ø 400 x 8,000 – 10,000 mm, max. weight 15 tons	Aerospace, energy, oil & gas, nuclear and extrusion components
Sawing	Three band saws max. Ø 1,800 x 6,000 mm, max. 30 tons	Discs, housings, rotors, steel bars
Container relining centre	Max. size of parts: dia 2,000 mm x 2,300 mm Range of temperature: max. 520 °C Max. weight: 20 tons	Extrusion container

Quality control		
Manufacture of specimens	Fourteen turning and milling lathes	Test specimens for mechanical tests
Thermal stability testing	Checking the stability of turbine rotors at elevated/operating temperatures	Rotors for steam and gas turbines up to 1,300 mm dia x 6,000 (10,000) mm heated (total) length, max. weight 20 t
Ultrasonic equipment (UT)	1. Automatic ultrasonic testing: two ultrasonic testing facilities for internal defects (NDT) with automatic drive and data acquisition system 2. Manual ultrasonic testing: for internal defects (NDT)	Discs, rings and hollow shafts, max. dia 3,200 mm, height 2,200 mm, max. weight 35 t Forgings in all dimensions i.e. shafts, discs, rotors
Magnetic particle equipment (MPI) dye penetrant testing (FPI)	Surface defects testing with magnetic particle or dye penetrant inspection (visible or fluorescent method)	Forgings in all dimensions i.e. shafts, discs, rotors
Measuring equipment	Dimensional checking	
Microscope	Scanning electron microscope (SEM) for investigations of the microstructure	
Mechanical testing equipment	Checking the mechanical properties of the material on state of the art automatic testing equipment	

ULTIMATIVE FORGING

52 MN press

The heart of the open die forge is our 5200 t forging press, where materials are shaped to meet exact customer demands. Forged pieces are used whenever the requirements for the mechanical properties of certain components are high.

We at BÖHLER are well aware of these requirements and offer you custom-made open die forgings or round and flat steel bars in high alloyed materials. Piece weight from 3 to 30 tons can be produced to order.

Rotary forging machine

With this most modern and unique production line, BÖHLER is venturing into a new dimension of forged bars and open die forgings.

With its high throughput and precise dimensional tolerances, BÖHLER will now be able to manufacture forgings from 110 to 700 mm in diameter and a maximum of piece weight of 8,000 kg in contured shapes and multiple pieces as well.

The maximum forging force of 2,000 t, the high-performance and rapid manipulators for precisely moving parts or ingots during the forging process ensure the highest quality and precision.


GFM

SUPERLATIVE MACHINING

From rough maching to aerospace – as you like it

The machine shop, the highlight at the end of the production chain. Here is where all of the production steps come together to be matched to your individual requirements. This guarantees the full quality control cycle from a single source.

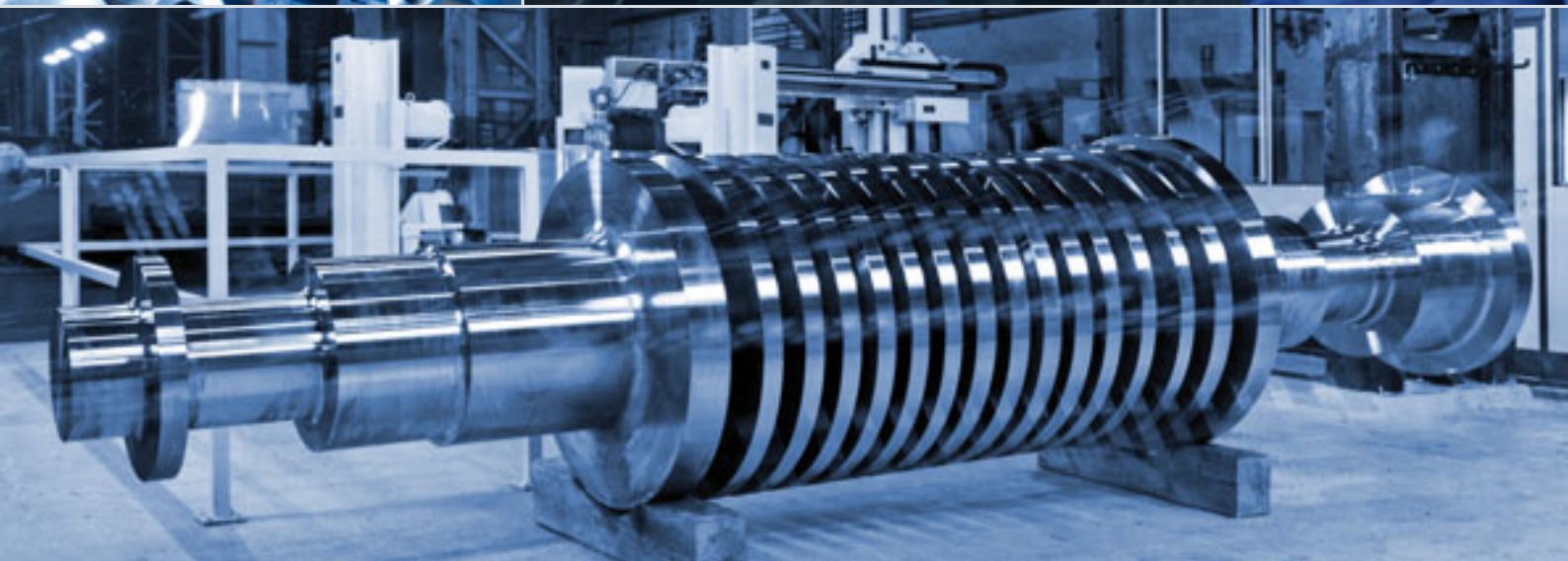
The forged parts are rough machined on state-of-the-art CNC milling, drilling and turning machines in accordance with the specifications and drawings.


BÖHLER
Quality is my business.
Around-the-clock.
WFL
H 120

PRODUCTION PROGRAM

Weight and size limits

	Line of business	Max Diameter mm / inch	Max length mm / inch	Max weight t / lbs
Disc	Energy, Oil & Gas	3,000 / 118.1	650 / 25.6	25 / 55,115
Shaft end	Energy	2,000 / 78.7	–	15 / 33,069
Rotor shafts	Energy, Oil & Gas, Aerospace, Extrusion	1,500 / 59.0	10,000 / 393.7	18 / 39,683
Hollow shafts	Energy, Oil & Gas, Extrusion	2,000 / 78.7	–	20 / 44,092
Rings	Energy, Oil & Gas	3,000 / 118.1	–	25 / 55,115



QUALITY IS OUR PASSION

Principle of Success

All of the planning, testing and productions steps involved in the manufacturing of forged billets are, of course, included in our Quality Assurance System. We have been certified by numerous national and international inspection bodies in accordance with various national and international standards such as ISO 9001, EN 29001 and BS 5750/1.

We make sure you can rely on our products.
Quality is an obligation to us.

Some of our system and material approvals

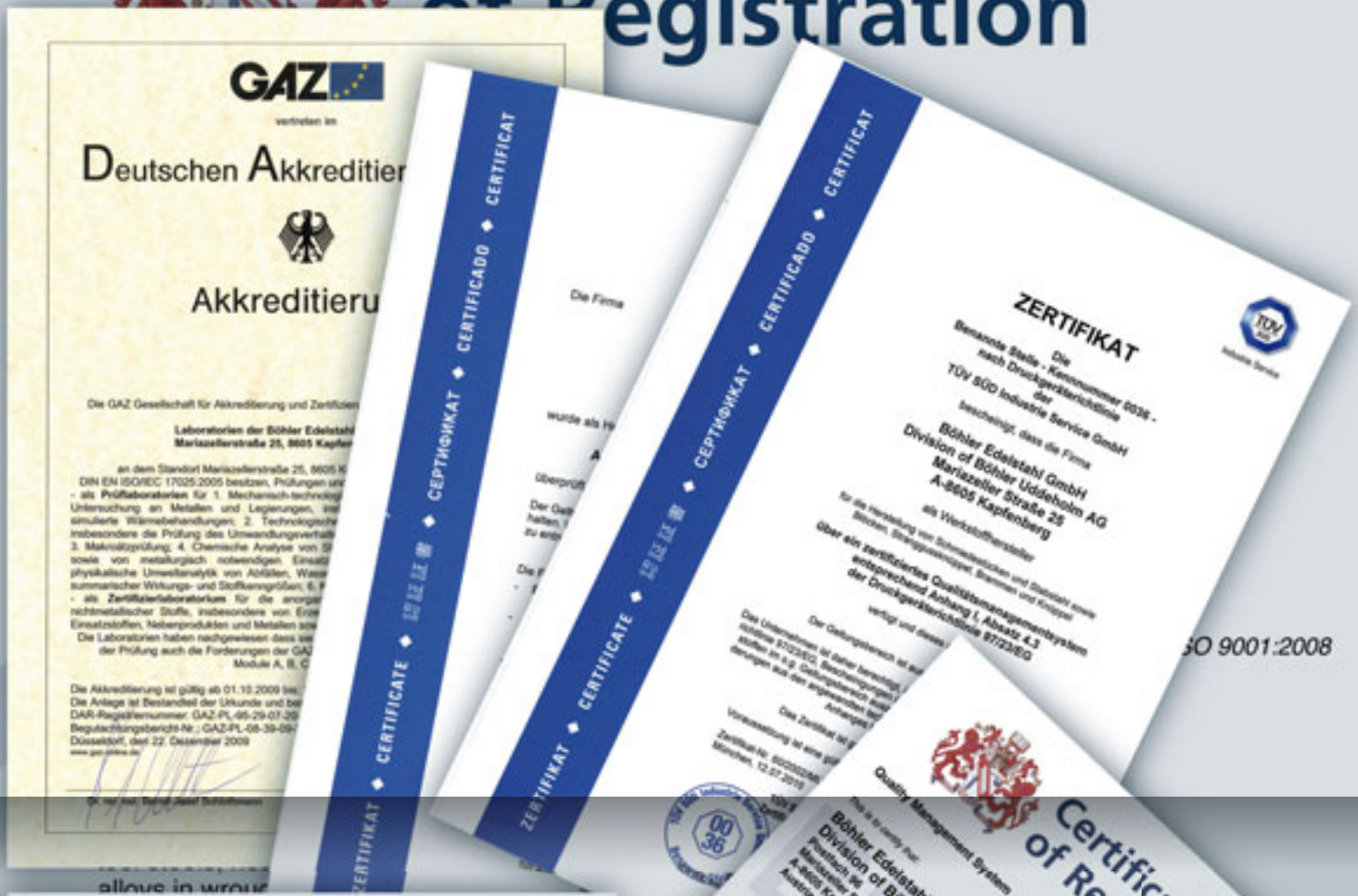
Material approvals

Institution	Certificates	Specification
VdTÜV	WB 508	1.4462 / BÖHLER A903
VdTÜV	WB 479	2.4602 / BÖHLER L328
VdTÜV	WB 400	2.4819 / BÖHLER L330SA
VdTÜV	WB 424	2,4610 / BÖHLER L333
NORSOK	M-CR-650	ASTM A182-F51 / BÖHLER A903
NORSOK	M-CR-650	ASTM A182-F55 / BÖHLER A911
NORSOK	M-CR-650	ASTM A182-F53 / BÖHLER A913
NORSOK	M-CR-650	ASTM A182-F61 / BÖHLER A926
NORSOK	M-CR-650	ASTM A182-F44 / BÖHLER A965
VdTÜV	HD-AGA	ASTM A564 15 5PF / BÖHLER N701
API	API 6A718	alloy 718 / (BÖHLER L343)

System approvals

Institution	Certificates	Specification
BSI	FM 00777	BS EN ISO 9001
BSI	FM 62106	QS 9000
GAZ	P-95-29-07-2001	EN ISO / IEC 17025
TÜV-Süd	28.04.2004	AD W0 / HP0 / TR100 / KTA 2301.1
TÜV-Süd	60/2002/MUC	PED 97/23/EG

Certificate of Registration



Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO/TS 16949:2009

This is to certify that:

Böhler Edelstahl GmbH & Co KG
Division of Böhler-Uddeholm AG
Postfach 96
Mariazeller Strasse 25
Kapfenberg
A-8605
Austria

Holds Certificate No: **TS 507782**
and operates a Quality Management System which complies with the requirements of ISO/TS 16949:2009 for the following scope:

The manufacture of cast and fabricated products to customer requirements for the automotive industry.

Permitted exclusions: Product design and development.

For and on behalf of BSI:

Managing Director, BSI EMEA

Originally registered: **24/12/2009** Latest issue: **04/04/2011** Expiry Date: **23/12/2012**
IATF Number: 0095750

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BSI

BSI

RESEARCH

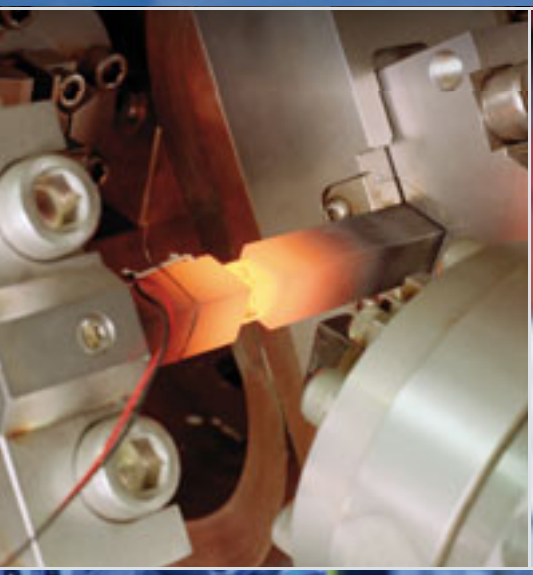
It is the mind that controls the body

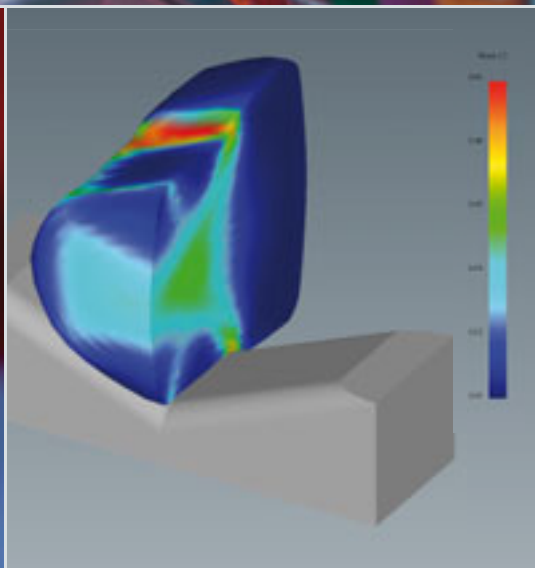
Today, to a certain degree, it is possible to design new materials at the computer. A quantum leap. Targeted use of simulation programmes allows complex alloying systems to be captured numerically and to predict the phases which will appear, their composition and their volume fractions. This leads to a better understanding of the materials and also reduces laboratory time and costs during development. In this way, materials and tailor-made properties can be designed.

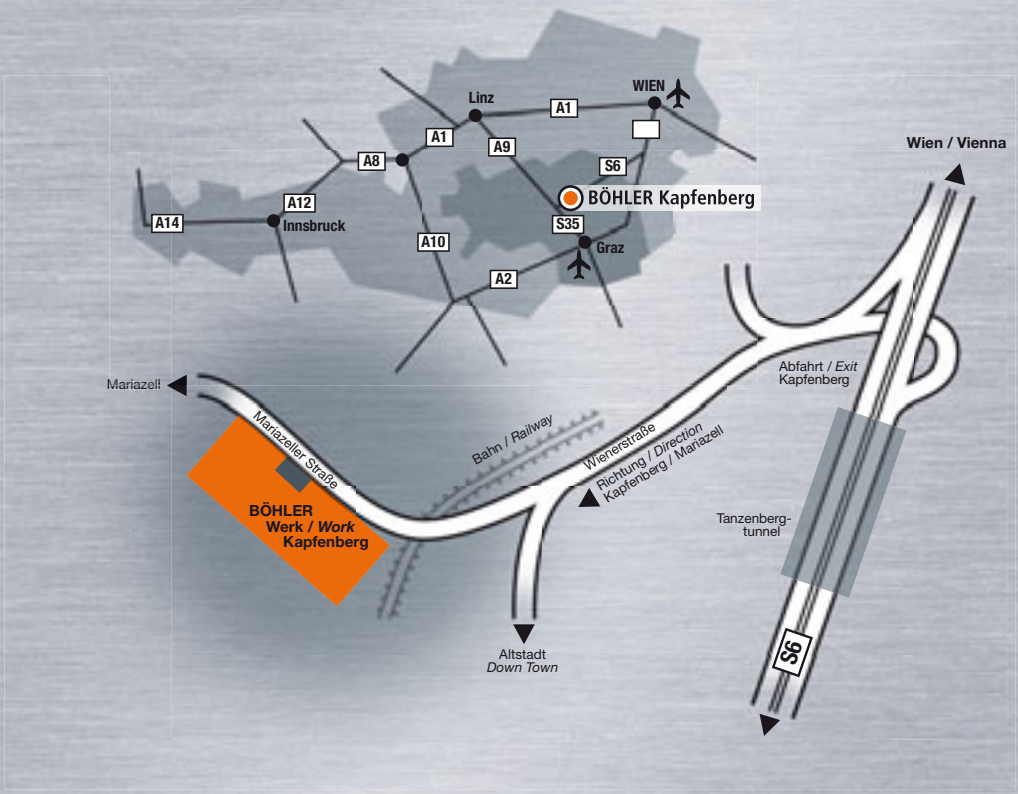
State-of-the-art facilities allow materials properties to be measured which form the basis for the development of alloys with improved properties. In addition, this data is the indispensable basis for the numerical simulation of metallurgical processes from which the optimum manufacturing parameters can be determined.

The development work within the European Cost research programs is a good basis in working together with customers, universities and research institutes which has resulted in the successful development of new generation materials. But not only steels also Ni-base alloys are also emphasised at BÖHLER. In the framework of the European collaboration works Thermie AD700, BÖHLER contributed to manufactuing a full-scale trial forging in alloy 625 for the 700 °C power generation technology. In future BÖHLER will be a member of the European KMM-VIN action and will also be involved in developing other materials for the highest requirements.

We are further involved in material research programmes together with customers in oil & gas, aerospace and many other high-demand applications. Based on our long history of breakthrough innovations in new materials for tooling applications we are heavily involved in creating totally new alloying concepts.







BÖHLER

SPECIAL STEEL FOR THE WORLD´S TOP PERFORMERS

Your partner:

BÖHLER Edelstahl GmbH & Co KG
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