High-Alloy Materials

saarschmiede
Freiformschmiede

Introduction to Saarschmiede

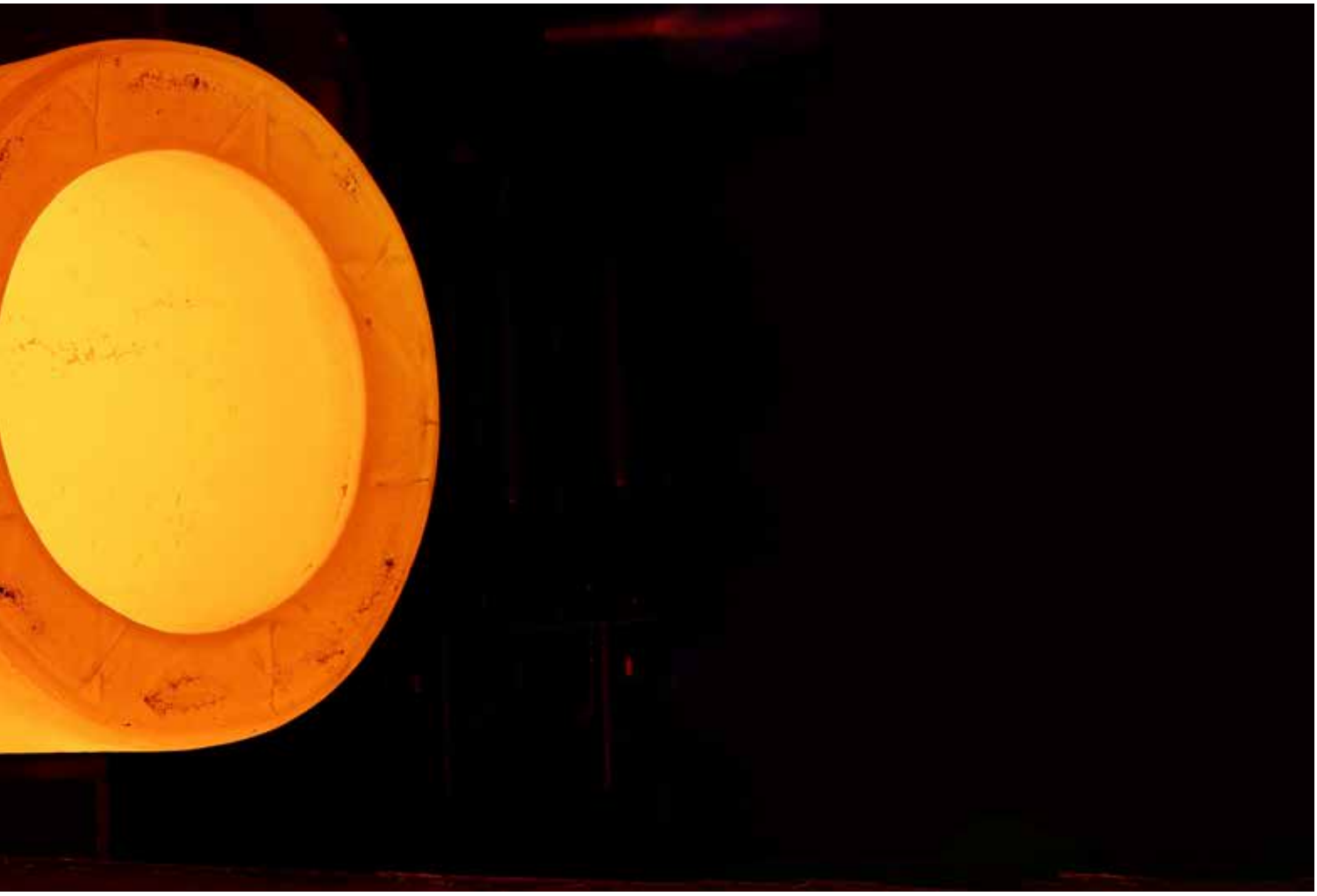
As an open-die forge, we are specialized in the manufacture of high-quality forgings of various dimensions. We offer our customers the complete production process – from melting, forging and heat treatment through to machining on CNC-controlled equipment – from one source.

We are also pleased to carry out contract work in the areas of remelting, forging, heat treatment as well as mechanical processing.

We have acquired our special know-how in many years of practice. Today, Saarschmiede is one of the top suppliers of special materials and superalloys for the most demanding requirements, and this worldwide.
Our product portfolio includes high-strength quenched and tempered steels, maraging steels, high temperature steels, stainless steels including stainless precipitation hardening steels, bearing steels and high-temperature nickel- and cobalt-based alloys.

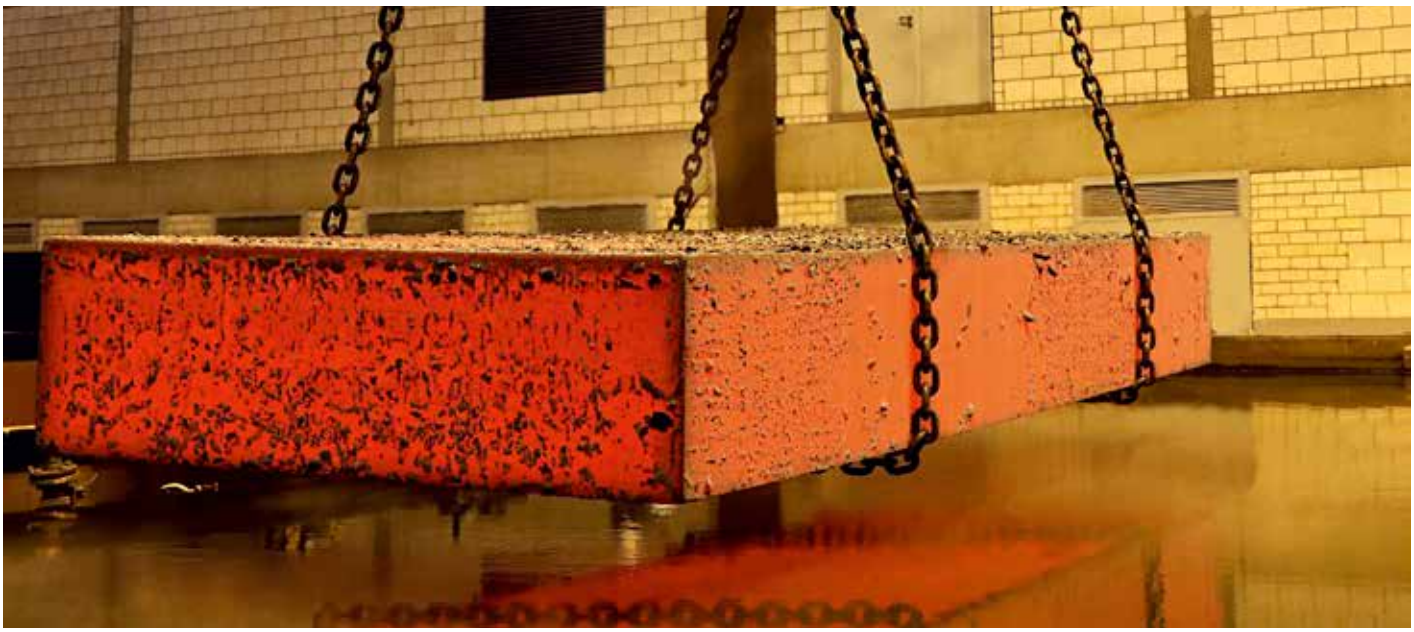
Overview: Products

- Pre-/finished forgings according to customer requirements
- Steel bars
- Semi-finished products
- Ingots
- Remelted ingots via vacuum arc remelting (VAR) or electro-slag remelting (ESR)
- Contract work according to customer requirements



Industries

- Tools
- Oil & gas
- Nuclear (waste storage, ITER, nuclear propulsion)
- Chemical industry / Petrochemical industry
- Compressor construction
- Power engineering (gas turbines / 700 °C technology)



Manufacturing

MELTING

125 t-UHP-Electric Arc Furnace

The 125 t-UHP-electric arc furnace in the electric steel plant has an electric power of 60 MVA and an eccentric bottom tap. The 18 MVA ladle furnace and the vacuum degassing equipment with the option of VOD form the basis for ladle metallurgy to improve quality. The ingots are cast by top and bottom pouring or in a vacuum. The maximum ingot weight for double casting (pouring two melts together) is 230 t.

16 t Vacuum Induction Furnace (VI)

The vacuum induction furnace has two melting crucibles with 8 and 16 t melting weight. Electrode blocks from 1.9 t to 16 t can be produced – an optimum starting point for the manufacture of a comprehensive range of products made of special materials, high performance steels and superalloys. In the manufacturing process of these special materials, lowest levels of trace elements and lowest gas contents as well as a superb non-metallic cleanliness are required.

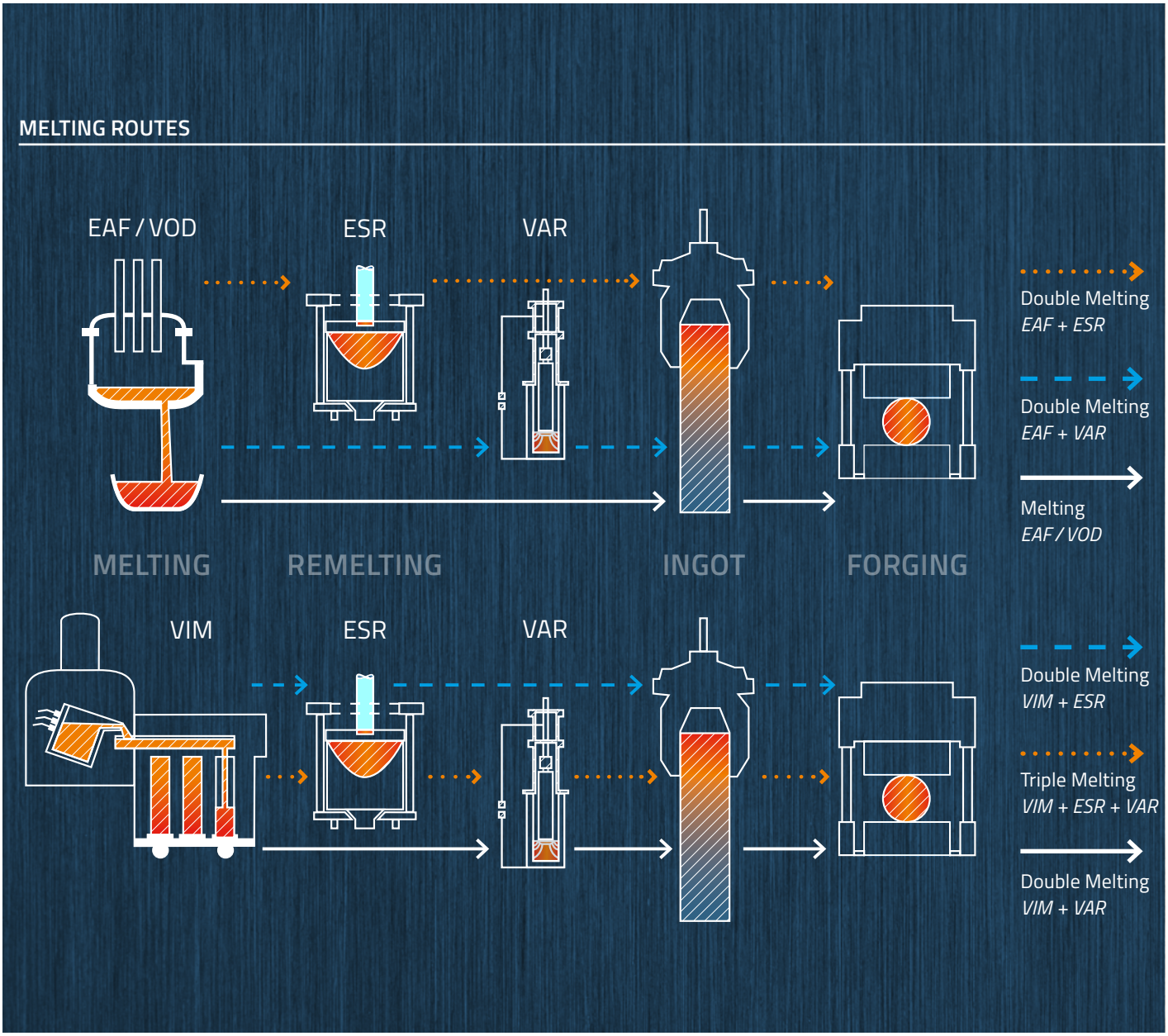
REMELTING

5.5 t- and 30 t-Vacuum Arc Remelting (VAR)

Special materials are further refined by remelting them as electrodes from the electric arc furnace or from the vacuum-induction furnace in the so-called VAR process.
Our objective is the highest homogeneity of the ingots as well as the maximum decrease in damaging gas contents and lowest levels of trace elements with a vacuum pressure of up to 10^{-4} mbar during the remelting process.

Electro-Slag Remelting (ESR) facilities

The ESR facilities have sliding and stationary crucibles in which ingots from 2.7 t to 225 t are produced. The ingots produced have excellent sulphidic and oxydic cleanliness, the lowest possible segregation of alloying elements, a deeply reduced sulfur content with the most homogeneous structure and excellent technological properties. Special protective measures and special slag compositions guarantee lowest hydrogen contents. In addition, it is also possible to carry out the remelting process under inert gas atmospheres, depending on requirements.



FORMING

The forming of the work process is mainly done with our main open die forging press with a maximum press force of 85 MN. The handling of the workpieces during the forming process is carried out on the presses by appropriately dimensioned rail-bound forging manipulators. The presses are equipped with state of the art plant technology, which guarantees the highest precision and speed in forming even with complex contours. Our forging furnaces meet the most stringent requirements in terms of temperature uniformity and energy efficiency.

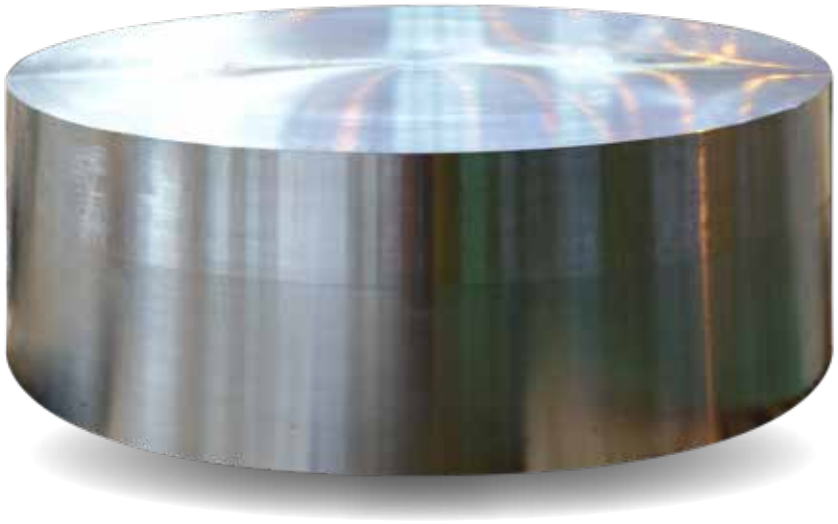
HEAT TREATMENT, FURNACES

We have:

- Car-bottom furnaces for horizontal heat treatment in dimensions of 4.5 m width, 4 m height and 15 m length.
- Vertical heat treatment furnaces: up to a diameter of 2.20 m and a maximum depth of 12 m.
- The temperature accuracy or uniformity of these furnaces is crucial for the process and guaranteed by means of regular inspections. Furthermore, our heat treatment furnaces also meet the highest requirements with regard to energy efficiency.
- For achieving the required mechanical properties the rate of cooling during quenching can be varied in a wide range. This includes air cooling, liquid quenching in oil or water as well as spray quenching with water.
- All heat treatment data is recorded by the system and archived according to internal prescriptions and/or customer specifications.

MECHANICAL PROCESSING

- Our mechanical processing workshop is equipped for all necessary machining operations such as milling, turning, drilling, sawing and honing.
- CNC-controlled processes ensure a high degree of manufacturing quality and reliability.
- Horizontal machining: workpieces max. 18.5 m length, 3.30 m diameter and 200 t clamping weight.
- Vertical machining: workpieces max. diameter of 3.7 m, a turning height of 3.2 m and a clamping weight of 100 t.



NON-DESTRUCTIVE TESTING

In the field of non-destructive testing we have the following possibilities for testing:

- Manual ultrasonic testing
- Automated ultrasonic testing
  (multi-channel testing system, etc.)

  Shaft testing

  Component weight: max. 100 t

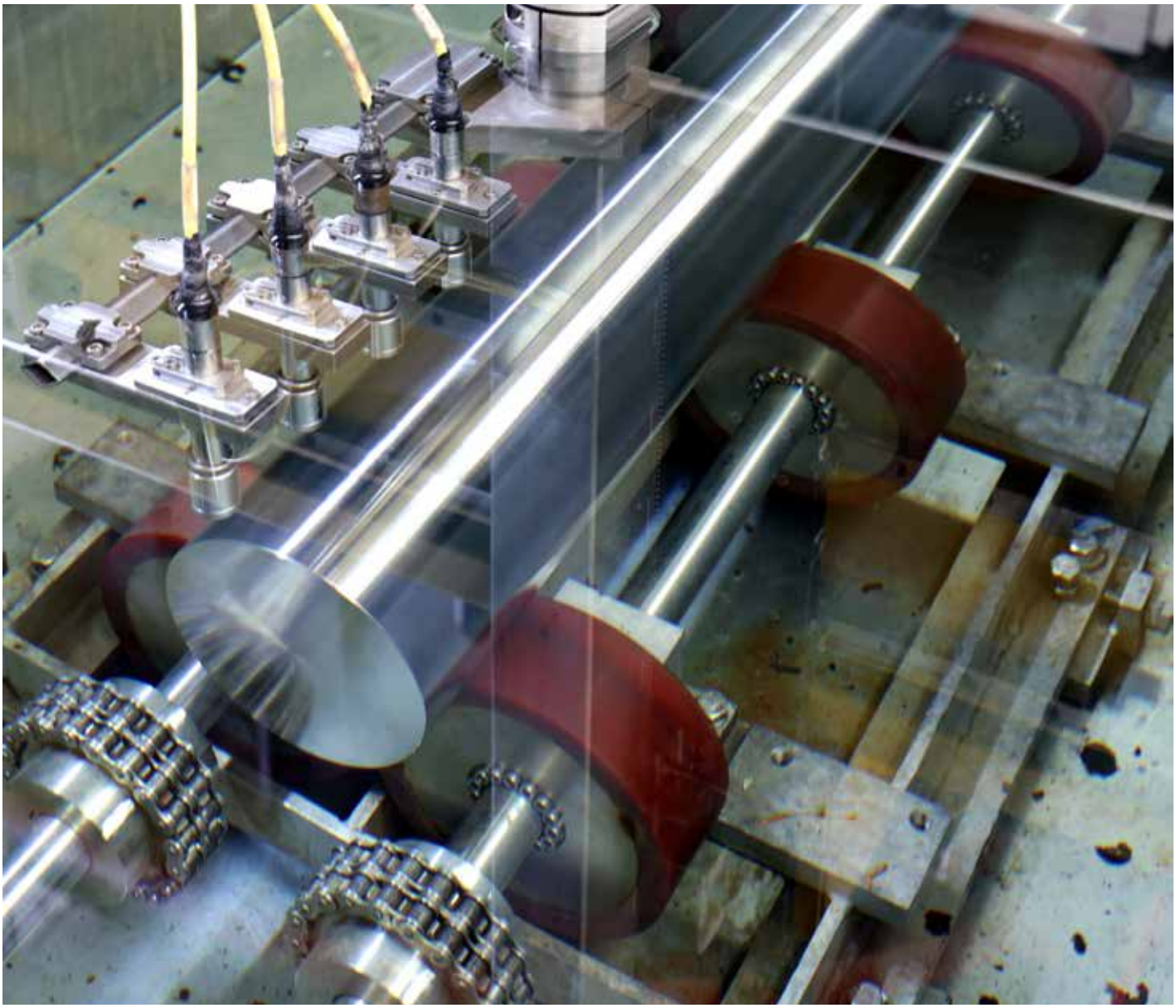
  Component length: max. 14.5 m

  Disc testing systems

  Component weight: max. 100 t

  Component height: max. 4.5 m

  Component diameter: max. 3.5 m
- US immersion facilities
- Dye penetrant testing
- Visual inspection (endoscopy of drill holes)
- Residual stress measurement (Siemens toroidal method)
- Hardness measurement
- Permeability measurement
- Optical emission spectroscopy
- Magnetic particle testing



LABORATORIES (SAARSTAHL AG)

Accreditation according to DIN EN ISO/IEC 17025:2018 (DAkkS Registration Number D-PL-11350-02-00)

Chemical laboratory

- Emission and X-ray fluorescence spectrometer (OES, RFA)
- C/S/N/O/H - combustion analyzers
- Inductively coupled plasma spectrometer (ICP)
- Atomic absorption spectrometer (F-AAS, graphite furnace-AAS)

Technical laboratory

- Universal testing machines up to 1,000 KN and temperatures from -70 °C to 800 °C
- Impact hammer & Pellini drop hammer
- Test stands for creep rupture and creep tests
- Metallographic investigations
- Scanning electron microscopes with WDX & EDX
- Microprobe
- Image analysis systems for quantitative metallography
- Permeability & coercivity measurements

Materials list

Super alloys and special materials

Material no.	WDL (DIN)	AIR (AFNOR)	AMS (UNS)	DTD (BS)	Designation
Bearing steels					
1.2581.02	X20WCr10-3	E-Z20WC10			RBD
1.3552	80MoCrV42-16	E-80DCV40	6491		M50
1.3590			6278 K91231		M50NIL
Stainless steels					
1.4006	X12Cr13	Z10C13 / Z13C13	S41000	410S21	
1.4057	X17CrNi16-2	Z15CN16-02	S43100	431S29	
1.4301	X5CrNi18-10	Z7CN18-09	S30400	304S31	
1.4306	X2CrNi19-11	Z3CN19-11	S30403	304S11	
1.4404	X2CrNiMo17-12-2	Z3CND17-11-02	S31603	316S11	
1.4454			S21904		FXM-11
Duplex steels					
1.4410	X2CrNiMoN25-7-4	Z3CND25.07Az	S32750		F53
1.4462	X2CrNiMoN22-5-3	Z3CND22-05Az	S31803	318S13	F51
Precipitation-hardening steels (PH)					
1.4534	X3CrNiMoAl13-8-2	Z3CNDA13-08	5629 S13800		PH13-8Mo
1.4545	X5CrNiCu15-5	Z5CNU15	5659 S15500		15-5PH
1.4548	X5CrNiCuNb17-4-4	Z5CNU17	5622, 5643 S17400		17-4PH
1.4594	X5CrNiMoCuNb14-5		S45000	460S52	14-5PH
Soft martensitic steels					
1.4313	X3CrNiMo13-4		S41500		F6NM
1.4418	X4CrNiMo16-5-1	Z6CND16-05-01			
Creep-resistant steels					
1.4911	X8CrCoNiMo10-6	Z10CKD10		S152	FV535
1.4914			5616	S150	Greek Ascology
1.4939	X12CRNiMo12	Z12CNDV12	5719 S64152	S151	Jethete M152
1.4944 / 1.4980	X6NiCrTiMoV26-15	E-Z6NCT25	7532 S66286	HR51	A286
Maraging steels					
1.6354	X2NiCoMo18-9-5	E-Z2NKD18-9	6514, 6521		Grade 300
1.6356	X2NiCoMoTi18-12-4				Grade 350
1.6359	X2NiCoMo18-8-5	E-Z2NKD18	6512, 6520	5212, 5232	Grade 250
High-strength steels					
1.6747.06		35NCD16		2S146	
1.6944.01			6417, 6419 K44220	S155	300M
1.6944.02			6431 K24728		D6AC
Creep-resistant alloys					
2.4631/2.4952	NiCr20TiAl	NC20TA	N07080	HR1	80A
2.4632/2.4969	NiCr20Co18Ti	NCK20TA	N07090	HR2	90
2.4634	NiCr20Cr15MoAlTi	NK20CDA	N13021	HR3	105
2.4650	NiCr20Cr20MoTi	NCK20D	5886, 5872 N07263	HR10	C263

Super alloys and special materials

Material no.	WDL (DIN)	AIR (AFNOR)	AMS (UNS)	DTD (BS)	Designation
Creep-resistant alloys					
2.4654	NiCr20Co13Mo4Ti3Al	NC20K14	5704, 5706, 5708, 5709 N07001		Waspaloy
2.4663	NiCr23Co12Mo		N06617		617
2.4668	NiCr19Fe19Nb5Mo3	NC19FeNb	5662, 5663 N07750	HR8	718
2.4669	NiCr15Fe7TiAl	NC15FeTNbA	5669 N07750		X750
2.4816	NiCr15Fe	NC116FeT	5665 N06600		600
2.4856	NiCr22Mo9Nb	NC22DNb	5599, 5666 N06625	NA21	625
2.4973	NiCr19CoMo	NC20KDTA	5712, 5713 N07041		Rene 41
2.4989	NCoCr20Ni20W	KCN20DNbW	5765 R30816		S816
2.4819	NiMo16Cr16Fe6W4	NC17D	N10276		Alloy C-276
~2.4665	NiCr22Fe18Mo-9Co2W		N06001		Alloy X

Ingot formats

- **Vacuum induction melted electrode blocks (VIM)**
  In dimensions from ø 325 to 985mm and weights approx. 1.9 to 16 t
- **Electro-slag remelted ingots (ESR)**
  In dimensions from ø 460 to 2400mm and weights approx. 2.7 to 225 t
- **Vacuum remelted ingots (VAR)**
  In dimensions from ø 350 to 1275mm and weights approx. 1.4 to 28 t

Weight data in each case for iron-based materials.

Quality assurance: Certificates

The comprehensive and effective management of health and safety, environmental protection, energy efficiency and quality is of great importance for all stakeholders of Saarschmiede. Therefore, through our IMS we are committed to maintain and continuously improve the high standard in the areas mentioned. In this regard a special focus is on the outstanding quality of our products and the fulfillment of the different industry requirements.

Saarschmiede is certified according to:

- ISO 9001
- ISO 14001
- ISO 50001
- ISO 45001
- ABS Certificate of Forging Facility and Process Approval
- KTA 1401 and AVS D 100/50
- Material manufacturer in accordance with AD 2000 Guideline W 0, EN 764-5, Section 4.2 and KTA 3201.1
- Material manufacturer in accordance with Directive 2014/68/EU, Annex I, Section 4.3
- Lloyd's Register Forgings
- Lloyd's Register Steelmaking

You can obtain further information at
www.saarschmiede.com

Saarschmiede GmbH Freiformschmiede
Bismarckstraße 57–59
66333 Völklingen | Germany

Telephone + 49 (0) 6898 10 4310

saarschmiede
Freiformschmiede

Saarschmiede GmbH Freiformschmiede is a company of the Saarstahl Group.