FROM HIDDEN DEPTHS COMES UNEXPECTED POWER

PRECISION ALLOYS

ISABELLENHÜTTE

Innovation by Tradition

ISABELLENHÜTTE HEUSLER GMBH & CO. KG

Our company is one of the world's leading manufacturers of electrical resistance and thermoelectric alloys for temperature measurement and a well known manufacturer of passive components for the automotive, electrical and electronics industries. Precision measurement systems from Isabellenhütte set the industry benchmark for current, voltage and temperature measurement in cars and trucks, hybrid and electric vehicles, as well as in industrial and renewable energy generating systems.

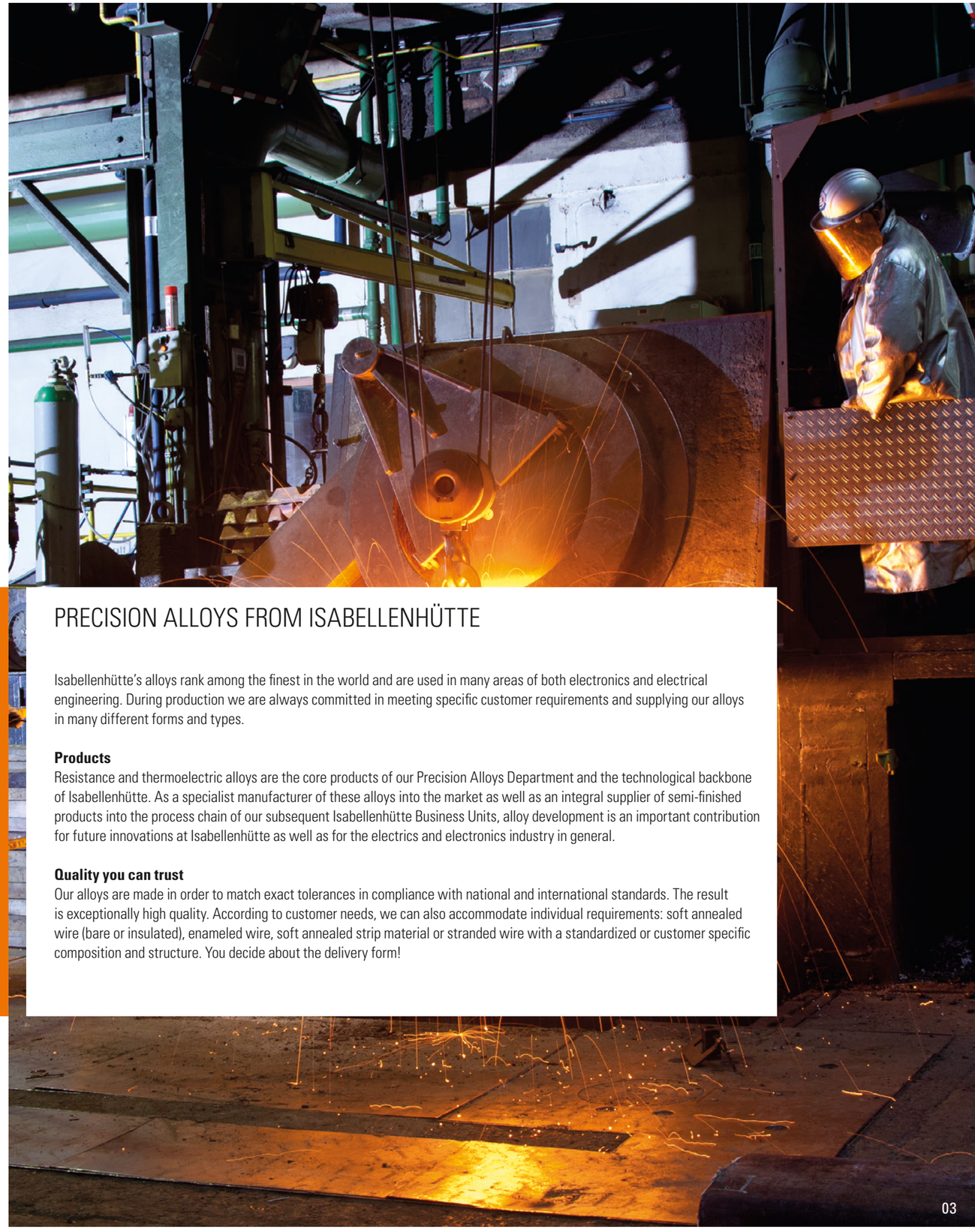
As a globally renowned specialist and technology leader, our innovative products consistently redefine the state of the art while showcasing Isabellenhütte's technical and innovative capabilities. Our success is driven by the continuous development of innovative products, new technologies and sophisticated manufacturing processes. In addition, we concentrate on a wide range of production steps and proprietary technologies in-house. This ranges from the production of alloys as well as forming and separating to coating and stranding for both standard and customer-specific requirements.

Innovation by Tradition

All of our alloys are made from pure nonferrous materials, e.g. Cu, Ni, Mn, Si, Cr, Al, Sn and Co.

Typical applications:

Compensation leads	Circuit breakers
Strain gauges	Signal lines
Level sensors	Seat heaters
Floor heating systems	Plug connectors
Coiled filaments	Tank container heating systems
Hard solders	Thermocouples
Heating cables	Thermoelectric leads
Heated hoses	Airfoil de-icers
Mineral-insulated wires	Resistors
Quick cups	Resistance thermometers
Rail heating systems	Ignition and lighting systems



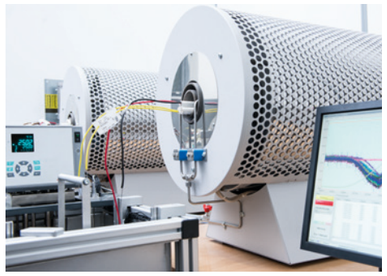
PRECISION ALLOYS FROM ISABELLENHÜTTE

Isabellenhütte's alloys rank among the finest in the world and are used in many areas of both electronics and electrical engineering. During production we are always committed in meeting specific customer requirements and supplying our alloys in many different forms and types.

Products
Resistance and thermoelectric alloys are the core products of our Precision Alloys Department and the technological backbone of Isabellenhütte. As a specialist manufacturer of these alloys into the market as well as an integral supplier of semi-finished products into the process chain of our subsequent Isabellenhütte Business Units, alloy development is an important contribution for future innovations at Isabellenhütte as well as for the electrics and electronics industry in general.

Quality you can trust
Our alloys are made in order to match exact tolerances in compliance with national and international standards. The result is exceptionally high quality. According to customer needs, we can also accommodate individual requirements: soft annealed wire (bare or insulated), enameled wire, soft annealed strip material or stranded wire with a standardized or customer specific composition and structure. You decide about the delivery form!

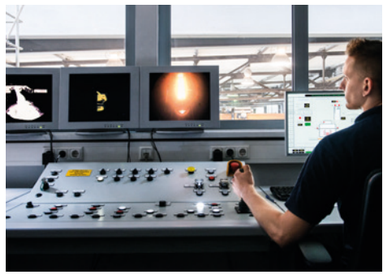

Alloy development


Temperature measurement


Current measurement


Signal and current transmission


Joining technology


Heat generation

ALLOY DEVELOPMENT //

OUR PILOT PLANT ENABLES THE PRODUCTION OF SMALL QUANTITIES

We have been manufacturing innovative electronic non-ferrous copper/nickel based alloys for decades. Besides copper/nickel alloys, we are also able to melt customer specific alloys and alloy compositions in our pilot plant (sample furnace). Sample quantities and batch weights between 100 g and 20 kg are possible.

We are your experienced partner for the production of even the smallest quantities for development processes, feasibility and proof of concept studies, prototype production or special applications and offer the following services:

- Melting of sample batches of up to 20 kg in atmosphere or vacuum
- Casting geometry, generally as ingot or bar
- Further mechanical hot or cold processing to wire, strip material or flat wire
- Wafering (sliced or polished and separated chips)
- Heat treatment up to 1,100 °C in air, vacuum or inert atmosphere

Analytics Facilities

- Characterization of material features (electrical, mechanical and microstructural)
- Extensive laboratory analytical equipment, e.g.:
  - SEM-EDX
  - ICP-OES and RFA elemental analysis
  - Oxygen, Nitrogen and Hydrogen elemental analysis
  - X-ray analysis

TEMPERATURE MEASUREMENT //

OPTIMISATION OF PRECISE TEMPERATURE MEASUREMENT

Thermocouples, which are mainly used in the industry and medical engineering, use the so-called Seebeck effect. Two different electrical conductors (legs) are connected to a circuit. If the junctions of the two different conductors have two different temperature levels, a thermoelectric voltage is generated. This voltage can be converted for temperature measurement purposes.

Our broad range of thermoelectric alloys comprises the types K, J, T, E, L and U. Furthermore, we produce alloys for compensation leads for the types B, C, D, R and S.

Type K is the thermocouple which is most frequently used. For this type we recommend our **ISATHERM® PLUS** as the positive leg and our **ISATHERM® MINUS** as the negative leg. Beside this Type N (Nicrosil-Nisil) becomes more and more significant. Since the standards and requirements of the industry are becoming more and more complex, we are optimising the common types up to one half or one third of class 1 (according to IEC 60584).

Thermoelectric alloys at a glance:

- Alloys for thermocouples, thermoelectric leads and compensation leads
- Temperature range from -40°C to +1,200°C
- Compliance with all common international standards
- With respect to precision, tolerance values that account for one third of class 1 in the IEC 60584 tolerance classes and a half of Special Tolerance in ASTM 230 are also permitted
- Special requirements with regard to thermoelectric voltage and dimensional tolerances or special thermoelectric voltages, e.g. for mineral-insulated wires, can also be fulfilled

CURRENT MEASUREMENT //

BEST POSSIBLE RESISTANCE MATERIALS

Sustained stability is extremely important for a sensor. That is why resistance materials have to be corrosion-proof and have to experience metallurgical changes in structure and state.

Our alloys **MANGANIN®, ZERANIN®, ISAOHM®** and **NOVENTIN®** are homogenous solid-solution alloys and meet these requirements optimally because they are annealed and stabilised in the primary thermodynamic state. These alloys guarantee stability values in the ppm range per annum.

MANGANIN®

- Copper-manganese-nickel alloy
- Medium specific resistance
- Very low TCR and low thermoelectric EMF

ZERANIN®

- Copper-manganese-tin alloy
- Low-ohmic alternative to **MANGANIN®**
- Improved TCR compared to **MANGANIN®**

ISAOHM®

- Nickel, chrome and additives from aluminium, silicon, manganese and iron
- High specific resistance
- Low TCR

NOVENTIN®

- Copper-manganese-nickel alloys
- Closes the gap of the specific resistance between **MANGANIN®** and **ISAOHM®**
- TCR ±10 ppm/K

SIGNAL AND CURRENT TRANSMISSION //

ISA-CON® WIRES FOR HIGH ELECTRICAL CONDUCTIVITY

Copper is frequently used as an electrical conductor. It has a number of disadvantages, including low tensile strength, low mechanical hardness and limited bending strength. Therefore, materials of a higher quality are required for the optimisation of conductor cross sections. The materials we use for **ISA-CON®** wires are characterised by the absorption of very high strain loads without any plastic deformation, as well as by high alternating loads at current-conducting contacts. Particularly noteworthy also is the high electrical conductivity, together with mechanically optimised features.

ISA-CON®

- Electrical conductivity of up to 90 % IACS
- Mechanical strength of up to 1,400 MPa
- The characteristics of the materials remain even during a long use and in high temperatures

JOINING TECHNOLOGY //

ISA-BRAZE® – THE HIGH TEMPERATURE SOLDER FOR ALL COMMON MATERIALS

During soldering a metallic workpiece is combined with a melted metal (solder). There is a difference between soft soldering and brazing. During soft soldering, the liquidus temperature is below +450°C; during brazing, it is above. If the temperature rises to more than +900°C, it is called high-temperature soldering, the flux-free soldering under the exclusion of air.

ISA-BRAZE® is a brazing alloy which is ideally suitable for the use as a high temperature solder. With this alloy, all common materials, particularly hard metals, can be soldered.

ISA-BRAZE®

- No additional fluxes necessary
- Superb surface quality
- No adjustment work necessary

HEAT GENERATION //

HEAT CONDUCTOR ALLOYS

For a long time, heat losses of an electrical conductor supplied with current have been used for electrical trace heating – in the industry as well as in the automotive sector.

For this purpose we have developed heat conductor alloys, consisting of copper-based alloys or nickel-based alloys, depending on the temperature range. Both can be easily processed and are corrosion-proof.

Our alloys are characterised by narrow tolerances and the very good long-term stability of the electrical features, as well as by their conductivity and the temperature coefficient of the specific electrical resistance. The highest application temperature in air of our alloys is +1,200°C. Our broad portfolio offers the optimum solution for each heat generation application.

Alloy name	Short form acc. to DIN	Material number acc. to DIN	Specific electr. resistance at +20°C	IACS	Conductivity	Temperature coefficient of the electrical resistance				Thermo-electric EMF
			[µΩcm]	[%]	[S/m]	Standard TCR [ppm/K]	ISA standard TCR [ppm/K][1]	ISA special TCR o.d. [ppm/K]	Footnote	[µV/K]
ISAOHM®	NiCr20AlSi	2.4872	132	1.31	0.76	±50	±10	±3	5)	+1
ISA®-CHROM 60	NiCr6015	2.4867	111	1.55	0.90	+100 to +200	+110 to +170		5)	+1
ISA®-CHROM 80	NiCr8020	2.4869	108	1.60	0.93	+50 to +150	+60 to +120		5)	+4
ISA®-CHROM 30	NiCr3020	1.4860	104	1.66	0.96	+300 to +400	+300 to +400		5)	-3
CENTANIN®			100	1.72	1.00		±50		7)	+3
NICROSIL			98	1.76	1.02		approx. +100			+10
NOVENTIN®	CuMnNi25-10		90	1.92	1.11		±50	±10	7)	±0.3
ISATHERM® PLUS	NiCr10	2.4870	72	2.39	1.39		approx. +270		7)	+20
ISA®-SIL			52	3.32	1.92		-80 to +40		7)	-28
ISA® MINUS			51	3.38	1.96		-80 to +40		7)	-30
ISA®-NICKEL	NiCu30Fe	2.4360	49	3.52	2.04	+400 to +600			5)	-33
ISOTAN®	CuNi44	2.0842	49	3.52	2.04	-80 to +40	±20	±10	5)	-40
ISA-BRAZE® 980	B-Cu87MnCo		44	3.92	2.27		±50		6)	-0.6
ISA-BRAZE® 970 Si	B-Cu86MnNi(Si)		44	3.92	2.27		±50		6)	-0.6
ISA-BRAZE® 970	B-Cu86MnNi		43	4.01	2.33		±50		6)	-0.6
MANGANIN®	CuMn12Ni	2.1362	43	4.01	2.33	±50	±10		6)	stand.: -0.6 special: ±0.2
NICKELIN W	CuNi30Mn	2.0890	40	4.31	2.50	+80 to +190	+80 to +190		5)	-25
NISIL			34	5.07	2.94		approx. +1,100		7)	-18
RESISTHERM[2]	NiFe30		33	5.22	3.03	+3,200 to +4,000	+3,000 to +3,500		4)	-27
ISA-ZIN	CuNi23Mn	2.0881	30	5.75	3.33	+180	+150 to +210		5)	-30
ZERANIN® 30[2]	CuMn7Sn		29	5.95	3.45		±10	±3	7)	-1
ISATHERM® MINUS		2.4122	27	6.39	3.70		approx. +1,200		7)	-21
ALLOY 127[2]	CuNi15		21	8.21	4.76		approx. +300		7)	-29
NiFe28	NiFe28		21	8.21	4.76		approx. +4,500		4)	o.d.
ALLOY 90	CuNi10	2.0811	15	11.5	6.67	+400 to +500	+350 to +400		5)	-25
ISA® 13	CuMn3	2.1356	12.5	13.8	8.00	+280 to +380	+280 to +380		5)	+1
S-COPPER		2.1356	12.5	13.8	8.00		+280 to +380		7)	+4
IRON		1.000	12	14.4	8.33		approx. +5,000		4)	+10
A-COPPER 11			12	14.4	8.33		approx. +500		7)	-7
ALLOY 60	CuNi6	2.0807	10	17.2	10.00	+500 to +900	+500 to +900		5)	-20
NICKEL 99.2	Ni99.2	2.4066	9	19.2	11.10		+4,700 to +5,800		4)	-23
PURE NICKEL	Ni99.6	2.4060	8	21.6	12.50		+5,300 to +6,400		4)	-23
SPECIAL NICKEL	Ni99.4Fe	2.4062	8	21.6	12.50		+6,100 to +6,260		4)	-23
SUPER PURE NICKEL	Ni99.98		7	24.6	14.30		approx. +6,600		4)	-23
ALLOY 30	CuNi2	2.0802	5	34.5	19.80	+1,100 to +1,600	+1,100 to +1,600		5)	-15
A-COPPER 2.5[2]	CuNi1		2.5	69	40.00		approx. +3,000		5)	-6.4
E-COPPER	Cu-ETP	2.0060	1.7	100	58.80		approx. +4,300		4)	0
ISA-CON® 1000+	Cu Ag 7 Zr	o.d.	o.d.							
ISA-CON® 450	CuCr 1.0		≤2.22	≥80	≥46		approx. +3,000		4)	±1.0
ISA-CON® 414	CuCr 0.3		≤2.03	≥85	≥49		approx. +3,000		4)	±1.0

Tensile strength reference value (soft)	Density at +20°C	Heat conductivity at +20°C	Highest application temperature in air[3]	Melting temperature	Format						Application examples				
					wire (round)		wire (flat)		Rod	Strip	Temperature measurement	Current measurement	Signal- and current transmission	Joining technology	Heat generation
[MPa]	[g/cm³]	[W/mK]	[°C]	[°C]	from [mm]	up to [mm]	from thickness [mm]	up to width [mm]							
1,000	8.00	14	250[8]	1,400	0.01	0.60	0.08	3.00		n		•			
600	8.20	13	1,150	1,390	0.01	1.00	0.05	3.30		n		•			•
650	8.30	15	1,200	1,400	0.01	1.00	0.05	3.30		n		•			•
600	7.90	13	1,050	1,390	0.05	1.00	0.05	3.30		n		•			•
540	7.80	n. i.	n. i.	900	1.50	8.00			•	n					•
650	8.50	13	1,260	1,394	0.10	6.00	0.10	3.00	•	•	•	N, NX			
550	8.10	12.5	140[8]	940	0.03	1.00	0.10	5.50	•	n		•			
610	8.70	19	1,260	1,430	0.08	12.00	0.05	4.00	•	•	•	K, KX, E, EX			
500	8.90	23	200	1,280	0.10	8.00	o.d.	o.d.	•	n	•	NC, CC			
500	8.90	23	200	1,280	0.10	8.00	o.d.	o.d.	•	n	•	KCA			
450	8.90	22	700	1,360	0.03	8.00							•	•	•
420	8.90	23	600	1,280	0.02	8.00	0.05	3.00	•	•	•	J, L, T, E, U, JX, LX, TX, UX, EX, KCB	•		•
	8.40	22		970		8.00	0.10	5.50	•	•				•	
	8.40	22		970		8.00	0.10	5.50	•	•				•	
390	8.40	22		970		8.00	0.10	5.00	•	•				•	
390	8.40	22	140[8]	960	0.02	8.00	0.10	5.50	•	•			•		•
400	8.80	25	500	1,180	0.02	8.00	o.d.	o.d.	•	•			•		•
650	8.55	23	1,260	1,341	0.10	12.00	0.10	3.00	•	•	•	N, NX			
600	8.50	25	800	1,400	0.02	0.25	o.d.	o.d.		n			•		•
350	8.90	33	500	1,150	0.04	8.00	0.05	3.00	•	•			•		•
370	8.50	34	140[8]	1,000	0.02	8.00	0.10	5.50	•	•			•		
600	8.60	30	1,260	1,400	0.08	12.00	0.05	4.00	•	•	•	K, KX			
310	8.90	45	400	1,130	0.05	8.00	0.10	8.00	•	•					•
o.d.	8.45	23	600	1,450	0.02	0.25	o.d.	o.d.	•	•			•		
290	8.90	59	400	1,100	0.05	8.00	0.10	8.00	•	•					•
290	8.80	84	200	1,050	0.05	8.00			•	•				•	•
290	8.80	84	200	1,050	0.05	8.00	0.10	8.00	•	n	•	BC			
370	7.80	81	760	1,496	0.12	4.75	0.05	4.00	•	•	•	J, L, JX, LX, KCA			
320	8.90	200	200	1,080	0.05	13.50	0.10	8.00	•	•	•	RCA, RCB, SCA, SCB			
250	8.90	92	300	1,095	0.05	8.00	0.10	8.00	•	•				•	•
450	8.90	69	700	1,440	0.05	5.00	0.10	6.00	•	•					•
450	8.90	69	700	1,440	0.05	5.00	0.10	6.00	•	•			•	•	•
450	8.90	70	250	1,440	0.03	1.00			•	n	•		•		
330	8.90	90	700	1,453	0.10	3.00	0.05	1.50	•	n					•
220	8.90	130	300	1,090	0.05	8.00	0.10	8.00	•	•				•	•
220	8.90	200	200	1,085	0.05	8.00	0.10	8.00	•	•					•
200	8.90	390	150	1,083	0.05	10.00	0.10	8.00	•	•	•	T, U, KCB, NC, SCB, SCA, RCB, RCA, TX, UX, BC	•		
													•		
>450 [9]	8.90	approx. 390		1,080		o.d.			n	n			•		
>414	8.90	approx. 390		1,080		<0.8			n	n			•		

[1] ppm/K = 10^{-6}/K
[2] not standardised
[3] higher application temperatures are possible non-oxidised atmospheres
[4] Tref. = +0°C/T = +100°C
[5] Tref. = +20°C/T = +105°C
[6] Tref. = +20°C/T = +50°C
[7] Tref. = +20°C/T = +60°C
[8] depending on the application
[9] e.g. hard, hardened
o. d. = on demand
n. i. = no information
n = not available

CONTACT

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Quality standards

DIN EN ISO 9001:2015

IATF 16949:2016

DIN EN ISO 14001/
DIN EN ISO 50001

RoHS 2011/65/EU

REACH 1907/2006

Authorised Economic Operator
(AEO)

AEO-F certificate
(Customs simplification,
security and safety)

European Space Agency (ESA)

Calibration Laboratory Accredited
by DIN EN ISO/IEC 17025:2005

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-K-19500-01-00

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