

# ZOLLERN

Solid metals. Fine solutions.

Casting  
Cast Steel  
and Copper  
Casting  
Alloys



## **The ZOLLERN-Group**

With first-class products and customized solutions in the sectors drive technology, investment casting, sand casting and forging as well as steel profiles we are one of the leading manufacturers – worldwide.

As one of the oldest family-run businesses in Germany we are proud to look back on an impressive 300-year history during which we have merged tradition with innovation. Our main focus is on excellent quality and service.

Welcome to the world of ZOLLERN, where experience and progress go hand in hand to offer our customers the best solutions and products for their requirements in various industrial sectors.

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# Sand casting

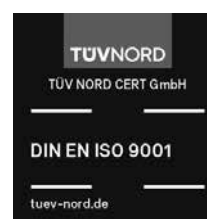
## Superior quality casting



In Lauchenthal, castings have been made from metallic materials since the founding of the company in 1708. Apart from iron and steel, a bronze foundry was added around 1890. Today the focus is on sand castings made of copper alloys and high alloy steels.

For manually or machine formed parts, resin-bonded sands are used. This ensures a good surface, narrow tolerances as well as high-quality material. We have a mold milling center at our disposal for the design of complex geometries without the need of a pattern. For special applications or requirements, the shell molding process or ceramic molds and ceramic cores are applied.

Copper alloy castings are possible up to a supplied weight of 8,000 kg, steel up to 2,500 kg. In addition to a milling center for the turning process at our premises, we work closely with a network of specialized processing partners for the pre- or finish-machining of the castings according to customers' drawings. In our own laboratory and material inspection department we can carry out every standard destructive and non-destructive tests and examinations.



For us, quality and delivery reliability are the prerequisites for success on the national and international market.

# Heat-resisting cast steel

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Thermal expansion between 20 and 300°C $\alpha$ (10-6 K-1)	Intended use/particular application examples	
				0.2% proof stress		Tensile strength Rm (MPa)				Percent elongation at failure A <sub>5</sub> (%)
				20°C	590°C					
G X 20 CrCoMoV 12 21	1.4912	-	Quenched and tempered	-	≥ 340	780-980	≥ 10	-	Heat-resisting castings resistant to pressurized hydrogen for the chemical industry; R <sub>p0.2</sub> at least 340 MPa at 500°C	
G X 22 CrMoV 12 1	1.4931	EN 10213	QT	≥ 540	≥ 340	740-880	≥ 15	≥ 27	11.5	Turbine construction; components that are exposed to rapid temperature changes (temperature shock)
G X 23 CrMoV 12-1		EN 10293								
G X 15 CrNiCo 21 20 20	1.4957	WL 1.4957	Cast state	-	≥ 250	650-850	≥ 10	-	15.8	Aerospace; turbines/air blades, combustion chambers, valves; up to approx. 730°C; for further data, see supplement 1 to 1.4957; non-scaling up to approx. 980°C; high-temperature; stainless
	1.4971	ASTM A567	Or annealed							
GS 16 CrMo 4	1.7242	-	Quenched and tempered	≥ 345	-	540-690	≥ 15	-	-	For castings up to max. 530°C application temperature can also be used as case-hardening steel
GS 17 CrMo 55 G 17 CrMo 5-5	1.7357	EN 10213	QT	≥ 315	≥ 180	490-690	≥ 20	≥ 27	13.4	Turbine construction, pressure vessels, steam boiler construction
		EN 10293								
GS 17 CrMoV 5 11 G 17 CrMoV 5-10	1.7706	EN 10213	QT	≥ 440	≥ 300	590-780	≥ 15	≥ 27	13.4	

# Stainless and acid-resistant steels, ferritic/austenitic

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Thermal expansion between 20 and 300°C $\alpha$ (10-6 K-1)	Intended use/particular application examples	
				0.2% Proof stress R <sub>p0.2</sub>		Tensile strength Rm (MPa)				Percent elongation at failure A <sub>5</sub> (%)
G X 4 CrNi 26-7	1.4347	EN 10283	Solution heat treated and quenched	≥ 420	≥ 590	≥ 20	≥ 30	14.5	Parts that require toughness with higher proof stress compared to austenitic steels with partially identical or better corrosion resistance, suitable filler material 1.4462, pump housing	
G X 2 CrNiMoN 26-7-4	1.4469 J93404	EN 10213	Solution heat treated and quenched	≥ 480	≥ 650	≥ 22	≥ 50		For heavy exposure to corrosion, sea or brackish water, operating temperature up to 300°C	
		EN 10283 ASTM A 995								
G X 2 CrNiMoN 22-5-3	1.4470 J92205	SEW 400 EN 10283 ASTM A 995	Solution heat treated and quenched	≥ 420	≥ 600	≥ 20	≥ 30	13	Chemical and petro-chemical industry, high resistance to stress-crack corrosion in media containing chlorine; similar to 1.4462	
G X 2 CrNiMoCuN 25-6-3-3	1.4517	EN 10283	Solution heat treated and quenched	≥ 480	≥ 650	≥ 22	≥ 50	14.9	Chemical and petro-chemical industry, flue gas desulfurization; resistant to non-oxidizing acids, e.g. sulphuric acid	
	1.4468									

# Stainless and acid-resistant steels, ferritic/martensitic

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Annealing hardness (HB)	Intended use/particular application examples
				0.2% Proof stress R <sub>P0.2</sub>	Tensile strength R <sub>m</sub> (MPa)	Percent elongation at failure A <sub>5</sub> (%)			
G X 8 CrNi 13	1.4008	DIN 17445	QT	≥ 440	≥ 570	≥ 15	≥ 27	170-240	Resistant to humidity, water, steam; pump parts, running wheels, running wheel blades; suitable welding filler 1.4009
G X 7 CrNiMo 12-1		EN 10283							
G X 20 Cr 14	1.4027	DIN 17445 SEW 410	Quenched and tempered	≥ 440	590-790	≥ 12	-	170-240	For parts that must be resistant to humidity, steam, water and frequent handling. Suitable welding filler 1.4009
X 46 Cr 13	1.4034	DIN 17440	Quenched and tempered	-	-	-	-	(55 HRC)	Heat-treatable cast steel for cutting tools, measuring tools, wear parts
G X 22 CrNi 17	1.4059	DIN 17445 SEW 410	Quenched and tempered	≥ 590	780-980	≥ 4	-	230-300	Corrosion-resistant, heat-treatable cast steel, e.g. for tow bars
X 14 CrMoS 17	1.4104	DIN 17440 SEW 310	Quenched and tempered	≥ 550	750-950	-	-	225-275	As 1.4016. For castings that require elaborate, mechanical finishing. Welding not recommendable
G X 35 CrMo 17	1.4122	DIN 17442	Annealed or quenched and tempered	≥ 500	750-850	≥ 10	-	220-280	Parts for optical devices, medical instruments and measuring devices
		SEW 400							
G X 5 CrNi 13 4	1.4313	DIN 17445	QT1	≥ 550	≥ 760	≥ 15	≥ 50	240-300	Water turbines and pump parts, suitable filler material 1.4351
G X 4 CrNi 13-4		EN 10283	QT2	≥ 830	≥ 900	≥ 12	≥ 35	280-350	
			QT3	≥ 500	≥ 700	≥ 16	≥ 50		
G X 5 CrNiMo 16 5 1	1.4405	SEW 410	Quenched and tempered	≥ 540	760-960	≥ 15	≥ 60	-	For parts with increased corrosion resistance compared to 1.4313; suitable welding filler 1.4405
		EN 10283							
17/4 PH			1.4549.4	≥ 830	≥ 900	≥ 8		≥ 30 HRC	Precipitation-hardened, stainless cast steel of high strength; aeronautical material
0.04C 16Cr 4Ni 3Cu	1.4549	WL 1.4549	1.4549.5	≥ 900	≥ 1030	≥ 6		≥ 34 HRC	
			1.4549.6	≥ 1100	≥ 1240	≥ 6		≥ 40 HRC	
G X 4 CrNiCuNb 16-4	1.4525	EN 10283	QT1	≥ 750	≥ 900	≥ 12	≥ 20		
			QT2	≥ 1000	≥ 1100	≥ 5			

# Stainless and acid-resistant cast steel, austenitic

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Annealing hardness (HB)	Intended use/particular application examples
				0.2% Proof stress Rp0.2	Tensile strength Rm (MPa)	Percent elongation at failure Ag (%)			
X 8 CrNiS 18 9	1.4305	DIN 17440	Solution heat treated and quenched	≥ 175	440-640	≥ 20	-	130-200	As 1.4308. For castings with extensive mechanical machining, primarily thread cutting; welding not recommendable
		EN 10088							
G X 2 CrNiN 18 9	1.4306	SEW 410	AT	≥ 205	≥ 440	≥ 30	≥ 80	130-200	Fittings and parts for pumps, centrifuges, etc.; suitable welding filler 1.4302, 1.4551, 1.4316; food processing industry, dairies, beverage industry; similar to 1.4309 and 304 L
X 2 CrNi 19 11		EN 10088							
G X 2 CrNi 19-11	1.4308	EN 10283	AT	≥ 175	≥ 440	≥ 30	≥ 60	130-200	Frequently used »V2A« quality; similar forging quality to 1.4301 and 304; fittings, pumps, food processing industry, dairies
G X 6 CrNi 18 9		DIN 17445							
G X 5 CrNi 19 10	1.4401	DIN 17440	Solution heat treated and quenched	≥ 185	440-640	≥ 20	≥ 60	130-200	Castings with identical corrosion resistance and forging quality, but lower strength; as a casting material standardised under 1.4408; similar to 316 L
X 5 CrNi 19-10									
G X 2 CrNiMoN 18 10	1.4404	SEW 410	Solution heat treated and quenched	≥ 205	440-640	≥ 30	≥ 80	130-200	Castings for which resistance to intergranular corrosion is paramount. After welding, no renewed heat treatment required; suitable welding filler 1.4430, 1.4576; similar to 1.4409 and 316 L
		X 2 CrNiMo 17 12 2							
G X 2 CrNiMo 19 11 2	1.4409	EN 10283	Solution heat treated and quenched	≥ 195	440-640	≥ 30	≥ 80	130-200	Similar to 316 L; castings with increased resistance to intergranular corrosion after welding without further processing
G X 6 CrNiMo 18 10	1.4408	DIN 17445	AT	≥ 185	≥ 440	≥ 20	≥ 60	130-200	Castings for the pulp, textile and chemical industry; fittings, pumps; suitable welding filler 1.4403
G X 5 CrNiMo 19-11-2		EN 10283							
X 2 CrNiMoN17 13 5	1.4446	DIN 17445	AT	≥ 210	≥ 490	≥ 20	≥ 50	130-200	Good intergranular corrosion resistance, resistant in high chlorine concentrations and temperatures, good pitting resistance, chemical industry
G X 2 CrNiMoN 17-13-4		EN 10283							
X 2 CrNiMo 18 14 3	1.4435 S31603 CF3M	DIN 17440 MR 0175 ASTM A 743	Solution heat treated and quenched	≥ 200	500-700	≥ 30	≥ 50	≤ 215	Material in accordance with NACE MR 0175. Similar to 1.4439, 316 L
		X 1 NiCrMoCuN 25 20 5	1.4539	SEW 400	Solution heat treated and quenched	-220	-	(≥ 35)	(80)
G X 1NiCrMoCuN 25 20 5	1.4538	SEW 400	Solution heat treated and quenched	≥ 185	≥ 450	≥ 30	≥ 60	130-200	Good resistance to pitting and stress-crack corrosion; full austenite; especially suitable for use in sea water; similar to 1.4584/1.4529
G X 5 CrNiNb 18 9	1.4552	DIN 17445	AT	≥ 175	≥ 440	≥ 20	≥ 35	130-200	Castings in the food processing, film, photo, paint, soap, paper, textile and saltpetre industries; suitable welding filler 1.4551
G X 5 CrNiNb 19-11		EN 10283							
G X 5 CrNiMoNb 18 10	1.4581	DIN 17445	AT	≥ 185	≥ 440	≥ 20	≥ 35	130-200	As 1.4552; suitable welding filler 1.4576
G X 5 CrNiMoNb 19-11-2		EN 10283							



# Heat-resistant cast steel

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Annealing hardness (HB)	Intended use/particular application examples
				0.2% Proof stress Rp0.2	Tensile strength Rm (MPa)	Percent elongation at failure A <sub>5</sub> (%)			
G X 40 CrSi 13	1.4729	DIN 17465	annealed	-	490-750	≥ 4	-	200-300	For parts subject to minimal stress in industrial furnace construction up to 850°C
		EN 10295							
G X 25 CrNiSi 18 9	1.4825	DIN 17465	Cast state or annealed	≥ 230	≥ 450	≥ 15	-	130-200	For parts subject to minimal stress in industrial furnace construction up to 900°C
		EN 10295							
G X 15 CrNiSi 25 20	1.4840	SEW 595	Cast state or annealed	205	440-640	15	-	≤ 230	For parts in furnace and apparatus construction up to 1,100°C in oxidizing atmospheres
G X 40 CrNiSi 25 20	1.4848	SEW 595	Cast state or annealed	≥ 220	≥ 450	≥ 8	-	150-220	
		EN 10295							
G X 40 NiCrSi 38 18	1.4865	DIN 17465	Cast state or annealed	≥ 220	≥ 420	≥ 8	-	150-220	For parts in industrial furnace construction with high temperature fluctuation resistance
		EN 10295							

# Special materials, non-magnetisable

Designation	Material no.	Standard	Typical heat treatment state	Mechanical and technological characteristics			Notched-bar impact work (ISO-V) (J)	Annealing hardness (HB)	Intended use/particular application examples
				0.2% Proof stress Rp0.2	Tensile strength Rm (MPa)	Percent elongation at failure A <sub>5</sub> (%)			
G X2 CrNiMoN 18 14	1.3952	SEW 395	Solution heat treated and quenched	≥ 240	490-690	≥ 30	≥ 80	130-200	Non-magnetic casting material (VG 81236); resistant to intergranular corrosion; can be welded
		WL 1.3952							
G X12 CrNi 18 11	1.3955	SEW 395	Solution heat treated and quenched	≥ 195	440-590	≥ 20	≥ 80	150-190	Non-magnetic casting material (VG 81236), can be welded
		WL 1.3955							
G X2 CrNiMnMoN Nb 21 16 5 3	1.3964	SEW 395	Solution heat treated and quenched	≥ 315	570-800	≥ 20	≥ 65	130-200	Non-magnetic casting material (VG 81236); very good corrosion resistance; particularly resistant to intergranular corrosion; can be welded, subsequent heat treatment not required
		WL 1.3964							



# Copper-tin-zinc casting alloys

Zollern designation	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples	
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %			
RG 5	EN 1982 CC491K CuSn5Zn5Pb5-C DIN 1705 2.1096 G-CuSn5Zn5Pb5 USA ~ C83600 UK LG2 F U-E5Pb5Z5	GS	90	200	13	60 65	Thin-walled castings, water and steam fittings up to 225°C
		GZ	110	250	13		
RG 6	EN 1982 CC492K CuSn7Zn2Pb3-C DIN 1705 2.1093 G-CuZn6ZnNi UK ~ LG 4	GS	130	230	14	65 70	Suitable for pressure-tight parts due to additional Ni content fittings and pump housing up to 225°C
		GZ	130	260	12		
RG 7	EN 1982 CC493K CuSn7Zn4Pb7-C DIN 1705 2.1090 USA ~ C93200 F U-E7Z5Pb4	GS	120	230	15	60 70	Through higher Pb content good emergency running properties, sliding strips, sliding plates slide bearing shells or bushings up to 4kN/cm <sup>2</sup> maximum load, unhardened steel as shaft is an option
		GZ	120	260	12		

mechanical properties pursuant to EN 1982

GS = sand casting (values also for shell-mould casting) GZ = centrifugal casting

- Young's modulus ~ 90 - 105 kN/mm<sup>2</sup>
- Electric conductivity ~ 5-8 MS/m
- Density ~8.6-8.7 kg/dm<sup>3</sup>
- Thermal conductivity ~ 0.54-0.59 W/cm.K
- Thermal expansion coefficient ~ 17-18 . 10<sup>-6</sup>/K
- Permeability < 1.01 μr

All alloys are resistant against drinking water, sea water, oils, soap solutions, milk

# Copper-zinc casting alloys

Zollern designation	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples	
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %			
BZG	Non-standardised bearing casting material better sliding properties (Si, Pb) ~ CuZn37Mn2Al2Ni1SiPb-C composition similar to CW713R	GS	200	450	10	~ 150	Preferred for sliding-stressed parts, up to 10 m/s sliding velocity, average compressive loads per unit area spindle and pressure nuts, bearing and guide bushings, bearing rings, worm wheel rims cast or pro- duced from centrifugal casting
		GZ					
PB	EN 1982 CC765S CuZn35Mn2Al1Fe1-C DIN 1709 2.0592 G-CuZn34Al1 USA ~ C86500 UK HTB1	GS	170	450	20	110 120	Moderate sliding properties, tough pressure nuts for rolling mills and spindle presses with higher additional Ni content also for ship superstructures, on-board table- ware, propeller hubs and blades
		GZ	200	500	18		
ZB37	EN 1982 CC764S CuZn34Mn3Al2Fe-C DIN 1709 2.0596 G-CuZn34Al2 USA ~ C86200 F U-Z36N3	GS	250	600	15	140 150	Statically stressed construction parts, valve and control units, bevel only with good lubrication for bearing, guide rings, sliding blocks, pressure and adjustment nuts with low sliding velocities, low emergency running properties
		GZ	260	620	14		
ZB 80	EN 1982 CC761S CuZn16Si4-C DIN 1709 G-CuZn15Si4 USA C87500	GS	230	400	10	100 130	Very good casting capability, good sea water resistance, low permeability < 1.01, suitable for pressure-tight, thin-walled parts such as sea water pump housings and fittings, water tanks, heat exchanger parts, also parts for mechanical engi- neering, the electronics industry and precision engineering
		GZ	300	500	8		
ABG	EN 1982 CC762S CuZn25Al5Mn4Fe3-C DIN 1709 2.0598 G-CuZn25Al5 USA ~ C86300 GB HTB3 F ~ U-Z19A6	GS	450	750	8	180 190	Bearing material with high stress capability, only for low sliding velocities, moderate sliding proper- ties, bearing bushings in construction machines, such as excavator arms, slow-running worm wheel rims, slide and guide rails
		GZ	480	750	5		

mechanical properties pursuant to EN 1982

GS = sand casting (values also for shell-mould casting) GZ = centrifugal casting

- Young's modulus ~ 90 - 110 kN/mm<sup>2</sup>
- Electric conductivity ~ 3-8 MS/m
- Density ~8.1-8.3 kg/dm<sup>3</sup>
- Thermal conductivity ~ 0.42 W/cm.K
- Thermal expansion coefficient ~ 18-19 . 10<sup>-6</sup>/K
- Permeability < 1.03 μr



# Copper-nickel casting alloys

Zollern designation	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %		
GN 10	EN 1982 CC380H CuNi10Fe1Mn1-C	GS	120	280	20	Very good resistance against sea water, brackish water, chloride-containing wastewater, brine solutions for power plants, refineries, desalination plants, chemical industry, drilling platforms, petroleum production fittings, valve parts, oil and water cooling tanks
	DIN 17658 2.0815 G-CuNi10	GZ	100	280	25	
	USA C96200					
	F U-N10Fe1M					
GN 30	EN 1982 CC383H CuNi30Fe1Mn1NbSi-C	GS	230	440	18	
	DIN 17658 2.0835 G-CuNi30					
	USA C96400					
	F U-N30M1Fe					

mechanical properties pursuant to EN 1982

GS = sand casting (values also for shell-mould casting) GZ = centrifugal casting

- Young's modulus ~ 120 - 145 kN/mm<sup>2</sup>
- Electric conductivity ~ 2-6 MS/m
- Density ~ 8.9 kg/dm<sup>3</sup>
- Thermal conductivity ~ 0.30-0.60 W/cm.K
- Thermal expansion coefficient ~ 15-16 · 10<sup>-6</sup>/K
- Permeability < 2 μ<sub>r</sub>

# Copper casting materials

Zollern designation	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %		
CCG	EN 1982 CC140C CuCr1-C	GS	200	300	10	Electric conductivity ≥ 45 MS/m thermal conductivity ~ 3.14 W/cm.K As WKG, but higher wear resistance also for welding guns, electrode holders, clamping jaws for resistance welding equipment
	DIN 17665 2.1292 G-CuCr F35					
	USA ~ C81500					
	UK CCI-WP					
	F U-Cr0.8Zr					

mechanical properties pursuant to EN 1982

GS = sand casting (values also for shell-mould casting)

- Young's modulus ~ 100 kN/mm<sup>2</sup>
- Density ~ 8.9 kg/dm<sup>3</sup>
- Thermal expansion coefficient ~ 17 · 10<sup>-6</sup>/K
- Permeability < 1.01 μ<sub>r</sub>

# Copper-aluminium casting alloys (standardised)

Zollern designation	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples	
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %			
AB 9	EN 1982 CC330G CuAl9-C	GS GZ	120 160	340 450	15 15	80 100	Low permeability < 1.01 also resistant against diluted sulphuric acid, castings for the chemical and food industry, such as screw conveyors, feed-in trays, mixing arms, pickling racks and hooks
TUBG	EN 1982 CC331G CuAl10Fe2-C DIN 1714 2.0940 G-CuAl10Fe USA ~ C95200 UK AB1 F ~ U-A10Fe	GS GZ	180 200	500 550	18 18	100 130	Low temperature dependency of the properties between -200 und +200°C, good corrosion resist. paddle wheels, pump wheels, fittings, bevel wheel sea water applications if Al < 8.2+0.5Ni (%)
EBG 9	EN 1982 CC332G CuAl10Ni3Fe2-C DIN 1714 2.0970 G-CuAl9Ni	GS GZ	180 220	500 550	18 20	100 120	Sea water resistant copper-aluminium bronze, no risk of stress-crack corrosion, as bearing material for parts subject to high stress and slower sliding velocities < 1 m/s good lubrication required
EBG	EN 1982 CC333G CuAl10Fe5Ni5-C DIN 1714 2.0975 G-CuAl10Ni USA ~ C95500, ~ C95800 UK ~ AB2 F U-A10N	GS GZ	250 280	600 650	13 13	140 150	good weldability, also with composite constructions, with increasing aluminium content greater wear-resistance and cavitation resistance, but also less elongation
VBG	EN 1982 CC334G CuAl11Fe6Ni6-C DIN 1714 2.0980 G-CuAl11Ni USA ~ C95500	GS GZ	320 380	680 750	5 5	170 185	running wheels, pump housing and blades, ship propellers, ship superstructures, on-board tableware, turbine wheels, superheated steam fittings, engine components, stirrers, pickling hooks, mixing arms for the chemical industry, heat exchangers, worm wheels, toggle bearings, sliding and pressure parts, wear parts
MEBG	WL 2.0968 G-CuAl9Ni7 ZOLLERN centrifugal casting	GS GZ	230 230	510 550	8 10	130 140	EBG 9 - very good weldability EBG - most often implemented, very good combination of strength and toughness MEBG, AMB3 for special requirements in shipbuilding low permeability < 1.02 or < 1.05
AMB3	DIN 1714 2.0962 G-CuAl8Mn	GS GZ	180 200	440 500	18 18	105 105	VBG - highest wear resistance and stress capability

mechanical properties pursuant to EN 1982 or WL 2.0968 and DIN 1724 - 2.0962

GS = sand casting (values also for shell-mould casting) GZ = centrifugal casting

- Young's modulus ~ 90 - 125 kN/mm<sup>2</sup>
- Electric conductivity ~ 2-9 MS/m
- Density ~7.5-7.6 kg/dm<sup>3</sup>
- Thermal conductivity ~ 0.34-1.13 W/cm.K
- Thermal expansion coefficient ~ 14-18 . 10<sup>-6</sup>/K
- Permeability < 1.01 to < 1.9 μ<sub>r</sub>

# Copper-aluminium casting alloys (non-standardised)

Zollern designation	Notes		Minimum values from the tensile specimen			Min. hardness HB 10/1000	Intended use/ particular application examples
			R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %		
TZB 28 TZB 32 TZB 36	Al content > 13% Tensile specimen frequently not possible only hardness is guaranteed very brittle	GS	450- 600	500- 650	0.5- 1.5	260-300 300-340 340-380	Deep drawing tools for reshaping of titanium, Hastelloy and austenitic steel, low friction coefficient, no welding profile and straightening rolls, bending tools
SMBG	Sliding material, similar to forged material 2.0960	GS	140	440	11	105 110	For parts subject to sliding stress, oil lubrication required, worm wheels, sliding blocks, spindle nuts, guide rails, also suitable for refrigeration technology
		GZ	180	540	12		
AMBG	Sliding material, similar to forged material 2.0936 (CW306G)	GS	220	490	8	130 130	For parts subject to sliding stress, MoS lubrication required, worm wheels, sliding blocks, bushings, bearings subject to impact-type oscillating stresses also for higher temperatures such as roller conveyors of continuous casting plants, foundry machines
		GZ	250	590	12		

mechanical properties pursuant to EN 1982 or WL 2.0968 and DIN 1724 - 2.0962

GS = sand casting (values also for shell-mould casting) GZ = centrifugal casting

- Young's modulus ~ 105 - 115 kN/mm<sup>2</sup>
- Electric conductivity ~ 3-6 MS/m (SMBG, AMBG)
- Density ~ 7.6 kg/dm<sup>3</sup> TZB ~ 7.2 kg/dm<sup>3</sup>
- Thermal conductivity ~ 0.45 W/cm.K (SMBG, AMBG)
- Thermal expansion coefficient ~ 15-18 · 10<sup>-6</sup>/K (SMBG, AMBG)

For sand and shell-mould casting, the mechanical properties are determined from separately or integrally cast specimen rods, with centrifugal casting (only copper alloys), directly from the casting, in doing so, the specified values apply only for wall thicknesses up to 50 mm.

The information contained in this document are solely for general information purposes and all data is stated without warranty. It is non-binding and especially does not constitute a binding contract offer on our part. Our general terms and conditions apply for all our deliveries and services.

# ZOLLERN Group

## Product areas

### Metals and shaping

#### // Investment casting parts



- Turbine components
  - Vanes / Blades / Shrouds / Heat Shields
- Structural Castings
  - Gas Turbines / Aero / Engines Defense / Medical / Industrial Components
- Automotive
  - Turbine Wheels / Waste gates / Vanes / Pins / Planet carriers
- Implants
  - Knees (Femur, Tibia) / Hipps
- Alloys
  - Super alloys / Cobalt Chrome alloys

#### // Sand casting parts



- Sand casting
- Croningguss / Maskenguss
- Ceramic casting
- Continuous casting
- Centrifugal casting

#### // Forgings



- Forgings made of pure copper and copper alloys
- Semi-finished products, open die forged, flat bars, round bar
- Drop forged parts
- Rings, seamlessly rolled
- Bushings, seamlessly forged
- Individual pieces, small series, large series

#### // Special profiles and finished parts



- Special profiles, coils, bars
- Customer-specific finished parts
- Profile types hot-rolled, cold-rolled, cold-drawn, induction-hardened

## Drive technology and automation

### // Gearboxes



- Travel drives
- Slewing gearboxes
- Winch gearboxes
- Industrial gear units
- Gearboxes for tunnel boring machines
- Sugar mill gearboxes
- Electric drive systems
- Condition Monitoring and Predictive Maintenance

### // Winches



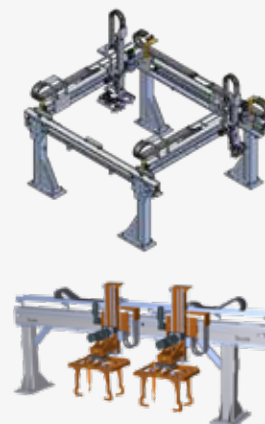
- Hoisting winches
- Free fall winches
- Pull winches
- Rescue boat winches
- Winch systems
- Winch gearboxes

### // Electric motors



- Torque motors kits
- Synchronous motor kits
- Synchronous motor modules

### // Automation, special systems



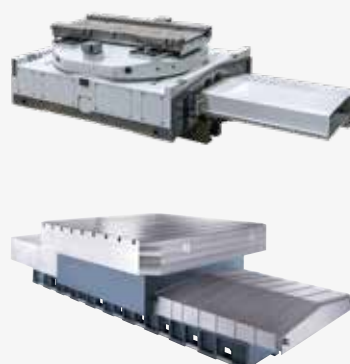
- Linear units, linear modules, gantry axes, portal units
- Telescoping axes
- Rotary modules, rotary tables
- Line gantries, area gantries
- Robot traverse axes, jig axes
- Storey lifter and lifting columns
- Fast conveyor
- Framing tenter handling / overhead systems
- Storage systems
- Complete systems with steel construction and control
- Special solutions
- Gripper

### // Hydrostatic systems



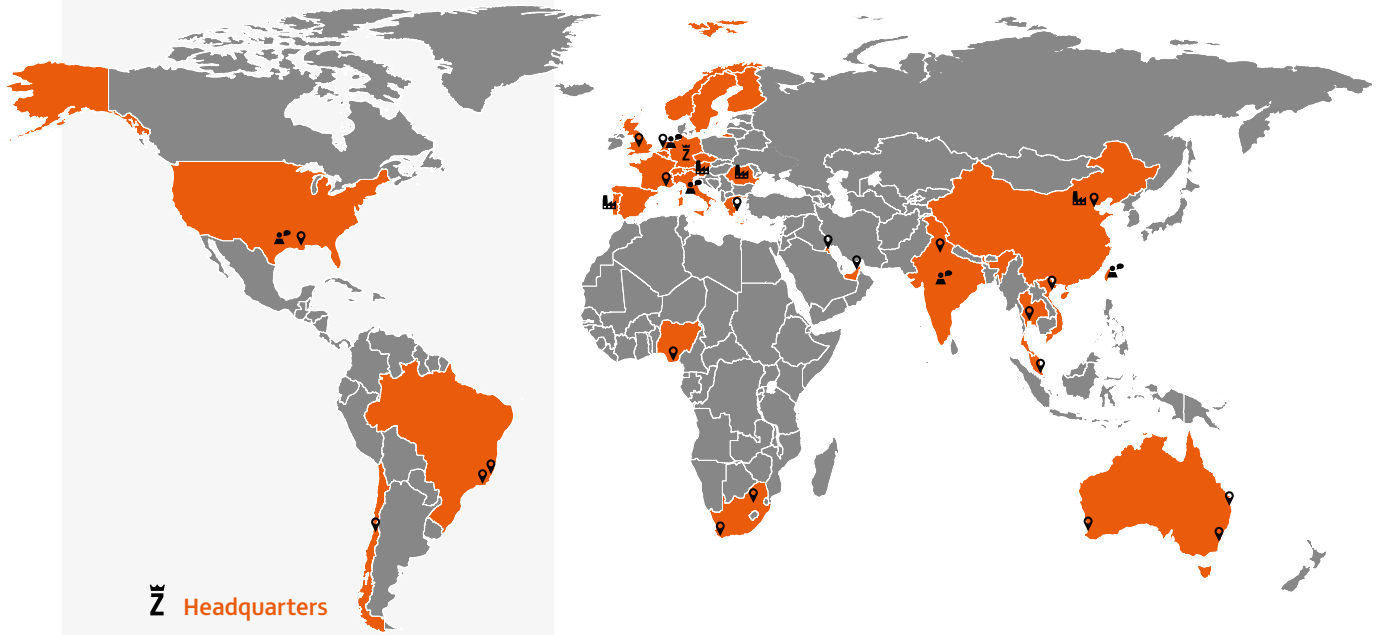
- Hydrostatic spindle units
- Hydrostatic rotary tables
- Aerostatic rotary tables
- Hydrostatic linear guides
- Hydrostatic center drive spindles
- Hydrostatic bearing components
- Hydrostatic special applications and test benches

### // Rotary tables systems



- Roller bearing rotary tables
- Hydrostatic rotary tables
- Automatic pallet changing systems and linear axes
- Swiveling tables
- After sales service for products of ZOLLERN, Rückle and Eimeldingen

# ZOLLERN



## Headquarters

## Subsidiaries

Italy and southern Europe  
Netherlands and Northern Europe  
USA  
India and Southeast Asia  
Taiwan, China

## Factories

Germany  
Portugal  
Romania  
Slovenia  
China

## Service partner

Australia  
Brazil  
Chile  
Greece  
Great Britain  
Kuwait  
Singapore  
South Africa  
Thailand  
Dubai  
USA  
Vietnam



ZOLLERN-worldwide



ZOLLERN-Products

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