ŽOLLERN

Solid metals. Fine solutions.

Forging

Pure copper and copper 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.

Contents Page

Forging
Superior quality forging

ZOLLERN has been active in the area of non-cutting metal forming of copper and copper alloys through forging for more than 100 years. In the meantime, the transformation from purely manual production of the past to industrial production been consummated. Today, forgings and semi-finished products are manufactured through the use of forging hammers, a hydraulic forging press with 1,600 t compressive force, a stretching machine, as well as with a ring-rolling mill. The required ingoing material is largely produced in-house.

Equipped with highly modern CNC machines, our machining workshops manufacture pre-processed or finished single or volume production parts from forgings or semi-finished products according to customer drawings.

In the laboratory and materials inspection, all standard destructive and non-destructive tests and examinations are available. Production is certified according to DIN EN ISO 9001 : 2015. For us, quality and delivery reliability are the prerequisites for success on the national and international market.

Copper-aluminium wrought alloys (EN materials)

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
CuAl8Fe	**EN 12420** CW303G CuAl8Fe3 EN 1653 DIN 17665 2.0932 CuAl8Fe3	> 80 ≤ 80	180	460	30	110	The toughness decreases with increasing Al content. Hardness, toughness, the very good cavitation and erosion resistance, abrasion and wear resistance increase with Al content. Selection of the alloy occurs predominantly according to the required strength properties.
EBw	**EN 1653** CW304G CuAl9Ni3Fe2 DIN 17665 2.0971 UK ~ CA103 F ~ U-A9NFe	≤ 100	180	490	20	≥ 125 HV	Good corrosion resistance compared to neutral and acidic aqueous media, alloyed with nickel also resistant against sea water and brine solutions good temperature resistance with low and increased temperatures, good resistance against scaling
AMB1	**EN 12420** CW306G CuAl10Fe3Mn2 DIN 17665 2.0936 UK CA103 F ~ U-A10Fe	> 80 ≤ 80	200 250	560 590	12 10	120 125	Fittings and hydraulic parts such as valve seats and plugs, guides, spindles, piston rods, axis, shafts, flanges, screws, spindle and pressure nuts, sliding strips and blocks, highly stressed bearings, cages for cage-type bearings, rotor bars, rotor wedge, shrink rings, pressure ladles, hinged blocks, worm, cog tooth and bevel wheels, bearing bushing, toggle bearings, plate floors for condensers, heat exchangers, parts for plastic forms and food processing industry, ship drive shafts, pump and agitator shafts
EBz	**EN 12420** CW307G CuAl10Ni5Fe4 1653, AD2000 W6/2 DIN 17665 2.0966 USA ~ C63000 GB CA104 F ~ U-A10	> 80 ≤ 80	330 360	700 720	15 12	170 175	AMB1 is predominantly used as bearing material.
EBh	**EN 12420** CW308G CuAl11Fe6Ni6 DIN 17665 2.0978 (CuAl11Fe6Ni5) F ~ U-A11	> 80 ≤ 80	410 410	740 740	4 4	210 210	EBz is the alloy most often used for the applications specified above, as the material is a good combination of very high strength and good toughness, usable for sliding velocities of < 1 m/s and compressive loads per unit area up to approx. 20 KN/cm², good oil lubrication necessary
VB	VB - higher strength (non-standardised)	> 80 ≤ 80	480 500	800 800	4 4	215 215	
EBz EBz-Oe EBh	Forged parts with heat treatment, up to 100 mm thickness with higher strength (EBz-Oe, higher alloyed than EBz=CW307G)	EBz EBz-Oe EBh	390 440 ~ 700	740 740 ~ 920	14 12 2 - 6	200 205 ~ 280	EBw has better weldability properties than materials with less elongation EBh: compressive loads per unit area up to approx. 25 KN/cm²

forged round and flat rods, rings, bushings wall thickness > 80 mm und ≤ 80 mm
mechanical properties pursuant to EN 12420:1999, also for forged bars.

- Young's modulus ~ 100 - 125 kN/mm²
- Electric conductivity ~ 4-6 MS/m
- Density ~ 7.6 kg/dm³
- Thermal conductivity ~ 0.38-0.63 W/cm.K
- Thermal expansion coefficient ~ 16 . 10^{-6}/K
- Permeability < 1.9 μ_r

Copper-aluminium wrought alloys

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
MEBz	**WL 2.0967** CuAl9Ni7	> 80 25-80	260 300	570 620	15 15	140 150	Applications, properties see page 4 Both alloys are implemented if non-magnetic material is required, predominantly in shipbuilding and marine technology. MEBz, AMB 2 permeability < 1.03
AMB 2	**WL 2.0958** CuAl8Mn	> 80 25-80	220 240	540 540	23 20	120 130	
SMBm	**DIN 17665** 2.0960 CuAl9Mn2 DIN 17678 forged	> 80 ≤ 80	200 210	490 510	25 22	110 120	Applications, properties see page 4 with 0.88 W/cm.K higher thermal conductivity, for inlets to cool in injection tools but also suitable as bearing material, due to the low hardness, better adaptability, counterpart material not required to be hardened steel
SMBh	(no EN standards available) SMBh forged, higher values	> 80 ≤ 80	200 200	540 570	15 14	120 130	
TZB 28 TZB 32 TZB 36	non-standardised alloys, Al > 13% also for sand cast parts		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

forged round and flat rods, rings, bushings wall thickness > 80 mm und ≤ 80 mm
mechanical properties pursuant to DIN 17678, also for forged bars.

Forged parts deliverable also in alloys C61400, C62300, C62400, C63000, C63020 and C63200 pursuant to ASTM B150.

Copper-aluminium wrought alloys (foreign standards)

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		inch	$Rp_{0,2}$ $^{*}Rp_{0,5}$ N/mm² KSI	Rm N/mm² KSI	A %	HB 10/1000	
C61400	CuAl8Fe3 ASTM B171	M10 <= 2" M10 > 2"	195 28 180 26	485 70 450 65	35 35		
C62300	CuAl9Fe4Ni1 ASTM B150	O20	*205 30	515 75	20		The toughness decreases with increasing Al content. Hardness, toughness, the very good cavitation and erosion resistance, abrasion and wear resistance increase with Al content. Selection of the alloy occurs predominantly according to the required strength properties.
C63200	CuAl9Ni4Fe3Mn1 ASTM B150	O20 TQ50 <= 3" TQ50 3" - 5" TQ50 > 5"	*275 40 *345 50 *310 45 *275 40	620 90 620 90 620 90 620 90	15 15 15 15		Good corrosion resistance compared to neutral and acidic aqueous media, alloyed with nickel also resistant against sea water and brine solutions good temperature resistance with low and increased temperatures, good resistance against scaling
C63000	CuAl10Ni5Fe4Mn1 ASTM B150	O20 <= 4" O20 > 4" TQ50	*295 42,5 *275 40 *345 50	585 85 550 80 690 100	10 12 10		Fittings and hydraulic parts such as valve seats and plugs, guides, spindles, piston rods, axis, shafts, flanges, screws, spindle and pressure nuts, sliding strips and blocks, highly stressed bearings, cages for cage-type bearings, rotor bars, rotor wedge, shrink rings, pressure ladles, hinged blocks, worm, cog tooth and bevel wheels, bearing bushing, toggle bearings, plate floors for condensers, heat exchangers, parts for plastic forms and food processing industry, ship drive shafts, pump and agitator shafts
	81,5Cu 10,0Al 4,8Ni 3,0Fe AMS 4640	TQ50 2" - 3" TQ50 > 3"	*379 55 *345 50	724 105 689 100	10 10	187 - 241 187 - 241	
	CuAl10Ni5Fe4 NFL 14705		320	690	13	180	
EBz	CuAl10Ni5Fe4 STF 22-55 B004		330	650	12	170	

Copper-aluminium wrought alloys (foreign standards)

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$Rp_{0,2}$ N/mm²	Rm N/mm²	A %	HB 10/1000	
EBz-HF	CuAl10Ni5Fe4 BS2B23	<= 80 > 80	370 320	650 650	12 12	179 - 255 179 - 255	
EBZ - DGS (EBz)	CuAl9Ni5Fe4 DEF STAN 02-833	25 - 100 >100	295 245	635 620	17 15		The toughness decreases with increasing Al content. Hardness, toughness, the very good cavitation and erosion resistance, abrasion and wear resistance increase with Al content. Selection of the alloy occurs predominantly according to the required strength properties.
EBz-GAM	CuAl9Ni5Fe4 GAM 11	<= 50 50 - 80 > 80	270 250 250	650 650 610	16 16 18	160 155 152	Good corrosion resistance compared to neutral and acidic aqueous media, alloyed with nickel also resistant against sea water and brine solutions good temperature resistance with low and increased temperatures, good resistance against scaling
EBw	CuAl9Ni3Fe2 GAM 11STF 22-55 B003		180	500	25	115	Fittings and hydraulic parts such as valve seats and plugs, guides, spindles, piston rods, axis, shafts, flanges, screws, spindle and pressure nuts, sliding strips and blocks, highly stressed bearings, cages for cage-type bearings, rotor bars, rotor wedge, shrink rings, pressure ladles, hinged blocks, worm, cog tooth and bevel wheels, bearing bushing, toggle bearings, plate floors for condensers, heat exchangers, parts for plastic forms and food processing industry, ship drive shafts, pump and agitator shafts
C6191 B	CuAl10Fe4Ni2Mn1 JIS H 3250		-	685	15	170	
EBh	CuAl11Ni5Fe5 NFL 14706 STF 22-55 B009		390	740	8	190	

Copper-nickel wrought alloys

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
NB 1	**WL 2.1504** CuNi14Al3Fe1 (Values for thickness > 80 mm* and rings* non-standardised) F ~ U-N14A2	50-80 15-50 Rings* > 80*	590 640 570 540	780 780 760 740	10 10 10 10	225 230 210 220	Non-magnetic material - permeability < 1.01, very high strength, corrosion and sea water resistant, hardly any growth in sea water, erosion resistant, abrasion-proof, for highly stressed parts, also with simultaneous exposure to corrosion, such as screws, bolts, nuts and connection pieces with sea water contact, fitting parts such as spindles, seat rings and hydraulic parts, toothed gear and bevel wheels, inserts and cores in plastic injection moulding (thermal conductivity 0.71 W/cm.K), tension rod in industrial furnaces (high strength up to 400°C), retaining ring for electric motors
NB 10	**EN 12420** CW352H CuNi10Fe1Mn EN 1653 / AD2000 W6/2 DIN 17664 2.0872 USA C70600 UK CN102 F ~ U-N10Fe1Mn	≤ 300	100	280	25	70 70-100 100	Very good corrosion resistance against sea water, brackish and harbour water as well as chloride-containing aqueous solutions, no risk of stress-crack corrosion, high toughness, also in low temperatures, permitted calculated flow velocity NB 10 - 3.2 m/s and NB30 - 4.5 m/s
NB 30	**EN 12420** CW354H CuNi30Mn1Fe EN 1653 / AD2000 W6/2 DIN 17664 2.0882 USA C71500 UK CN107 F ~ U-N30Mn1Fe	≤ 300	120	340	25	90 80-110 110	Plates and floors for condensers and heat exchangers, pipeline parts and other building components for power plants, refineries, desalination plants, chemical and petrochemical industry, ships, offshore plants

forged round and flat rods, rings, bushings wall thickness ≤ 300 mm
mechanical properties pursuant to EN 12420:1999, also for forged bars.

- Young's modulus ~ 120 - 160 kN/mm²
- Electric conductivity ~ 4-6 MS/m
- Density ~ 8.9 (NB1 ~ 8.5) kg/dm³
- Thermal conductivity ~ 0.30-0.50 (NB1 ~ 0.71) W/cm.K
- Thermal expansion coefficient ~ 16-17 . 10^{-6}/K
- Permeability < 1.5 (NB1 < 1.01) μ_r

Copper-Zinc Wrought Alloys (Special Brass)

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
StBm	DIN 17660 2.0561 CuZn40Al1 (ZOLLERN supplies lead-free)	> 80 ≤ 80	155 165	410 440	22 20	90 100	Resistant against weather influences, not against sea water, good sliding properties in medium stress range for average sliding velocities - max 10 m/s, StBm is lead-free, because of additional Si and Pb content, BZ 1 and BZ 2 have better sliding properties, BZ 2 has higher stress-bearing capacity than StBm and BZ 1 Sliding and guiding properties, mounting, tube and bottom plates, pressure ladles, pressure nut, bushings in mechanical engineering, in particular BZ 2 for worm wheels, bearing bushings and spindle nuts
BZ 1	**EN 12420** CW718R CuZn39Mn1AlPbSi DIN 17660 2.0561 CuZn40Al1 UK CZ114 F ~ U-Z36N3	> 80 ≤ 80	150 180	410 440	15 15	90 110	
BZ 2	**EN 12420** CW713R CuZn37Mn3Al2PbSi DIN 17660 2.0550 CuZn40Al2	> 80 ≤ 80	180 230	470 510	16 12	125 140	
ZB 68	**forged - Zollern values****, non-standardised, CW708R CuZn31Si DIN 17660 2 .0490 USA C69800	> 80** ≤ 80**	160 180	370 390	22 20	80 80	Properties and applications similar to StBm, high low-temperature toughness, therefore versatile implementation ability in low-temperature technology, also for hydraulic parts
CuZn39Sn1	**EN 1653(*)** CW719R CuZn39Sn1 DIN 17660 2.0530 CuZn39Sn USA C46400 (Naval Brass)	≤ 120 ≤ 75	100 120	320 340	30 30	80 HV 85 HV	Good sliding properties and good resistance against wear and stress-crack corrosion, average strength, good sea water resistance, tube plate for condensers and heat exchangers, fittings, screws, nuts, rivets for boats

forged round and flat rods, rings, bushings wall thickness > 80 mm und ≤ 80 mm mechanical properties pursuant to EN 12420:1999, also for forged bars.

- Young's modulus ~ 85 - 110 kN/mm²
- Electric conductivity ~ 6-10 MS/m
- Density ~8.1-8.4 kg/dm³
- Thermal conductivity ~ 0.63-0.84 W/cm.K
- Thermal expansion coefficient ~ 19 . 10^{-6}/K
- Permeability < 1.03 μ_r

Copper wrought alloys with high conductivity

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
SE-Cu	**EN 13605*** CW021A Cu-HCP EN 12420(*) (copper H045), EN 13601 DIN 1787 SE-Cu USA C10300 UK C106 F Cu-c1	≤ 400(*)	40	200	35	45	Very high thermal conductivity and electric conductivity (>57, cold-formed >56 MS/m), oxygen-free, insensitive to hydrogen embrittlement, good weldability and solderability, SE-Cu does not oxidise on the surface as quickly as OF-Cu, at increased temperatures the creep characteristics of CuAg are better, it does not lose the higher strength generated by cold-forming as quickly due to the higher recrystallisation temperature (~ 320°C compared to pure copper ~ 150°C)
		≤ 125**	160	220	18	65	
		≤ 125**	200	250	12	70	
CuAg	**EN 13605*** CW016A CuAg0,10P EN 12420(*) (copper H045), EN 13601 DIN 17666 CuAg0,1P USA C10700						Short-circuit rings and rods for electric motors and generators, power rails and other circuit parts, continuous casting and other permanent moulds, cooling plates and other cooling elements, cooled combustion chambers for jet propulsion
OF-Cu	**EN 13601** CW009A Cu-OFE EN 12420(*) (copper H045) DIN 1787 OF-Cu USA C10100 UK OFHC F Cu-c2	≤ 400(*)	40	200	35	45	As SE-Cu, but with higher conductivity (>58,6; cold-formed >57 MS/m), free of deoxidant and virtually free of elements volatile in a vacuum, copper content at least 99.99%. The residual resistance ratio constitutes at least 400
		≤ 125**	160	220	18	65	
		≤ 125**	200	250	12	70	Predominantly for applications in vacuum, low-temperature and high-frequency technology, sockets and anodes for tubes, also parts with glass-metal connections, parts for linear and cyclone accelerators, beam stoppers in accelerator plants, microwave anodes, cooling elements and crucibles for vacuum processes

forged round and flat rods, rings, bushings wall thickness ≤ 400 mm

mechanical properties soft condition (H045; R200, F20) pursuant to EN 12420:1999, also for forged bars.

** higher strength through work hardening up to 125 mm thickness (R220, F22 and R250, F25) - non-standardised, Zollern values.

- Young's modulus ~ 100 - 130 kN/mm²
- Electric conductivity > 56 MS/m, depending on strength
- Density ~ 8.9 kg/dm³
- Thermal conductivity ~ 3.77-3.94 W/cm.K
- Thermal expansion coefficient ~ 16.5-17.0. 10^{-6}/K
- Permeability < 1.01 μ_r

Low-alloy copper wrought alloys

Zollern designation	Standards	Thick-ness	Minimum values from the tensile specimen			Min. hardness	Intended use/ particular application examples
		mm	$R_{p0.2}$ N/mm²	Rm N/mm²	A_5 %	HB 10/1000	
CCZr	**EN 12420** CW106C CuCr1Zr DIN 17666 2.1293 CuCrZr USA C18150 UK CC102 F ~ U-Cr0.8Zr	≤ 250	270	360	15	110	Very good combination of high electric (> 43 MS/m), thermal conductivity (~ 3.35 W/cm.K) and strength, is also, compared to copper, implemented with higher temperatures Short-circuit rings and bars for electric motors and generators, contact rails and bolts, switch parts, roller and spot welding electrodes as well as other parts for welding equipment, highly stressed parts in accelerator plants, continuous casting and other permanent moulds for cast iron and cast steel, also for non-ferrous metals, casting wheels for wire manufacture
NSB	**EN 12420** ~CW111C (mit Mn) CuNi2Si DIN 17666:1983 2.0855 CuNi2Si USA ~ C64700 F U-N3S	> 80 ≤ 80	320 340	470 490	12 12	140 150	As CCZr, higher strength but lower conductivity (11-16 MS/m and ~ 1.51 W/cm.K) and more wear-resistant for grinding and short-circuit rings, rotor bars, connection pieces in the electronics industry and in overhead-line construction as well as other electrical circuit parts subject to mechanical stress, also available with at least 2011s/m
NSB-CrZr	non-standardised, Zollern values *Rings, flat and round rods	≤ 120*	440	540	15	150	Similar to NSB, but with Cr+Zr ~ 0.3% for better creep rupture strength Application as NSB, higher electric conductivity (> 19.0 MS/m)
NSB 4	forged non-standardised, Zollern values CW112C CuNi3Si DIN 17666:1983 2.0857 USA ~ C64700	> 80 ≤ 80	500 540	600 690	8 8	160 180	similar to NSB, but with higher strength, lower toughness, electric conductivity 16.5-22.0 MS/m, thermal conductivity 1.8 W/cm.K Mould inserts and injection nozzles in plastic injecti-on moulds, circuit parts subject to mechanical stress, copper back-up bar for resistance welding machines, pressure casting pistons

forged round and flat bars, rings, bushings

mechanical properties pursuant to EN 12420:1999 (CuCr1Zr and CuNi2Si), also for forged bars.

- Young's modulus ~ 120 - 130 kN/mm²
- Density ~8.8 kg/dm³
- Thermal expansion coefficient ~ 16-17 . 10^{-6}/K
- Permeability < 1.01 μ_r

Dimensions

(not always possible in combination)

// Round bar		
	Diameter	Ø 28 - 450 mm
	length	max. 12.000 mm
// Square		
	Lateral length	max. 400 mm
	length	max. 4.000 mm
// Rectangle		
	Width	max. 1.100 mm
	Height	min. 20 mm
	length	max. 12.000 mm
// Bush		
	Outer diameter	max. 550 mm
	Wall thickness	min. 35 mm
	length	max. 1.500 mm
// Ring		
	Outer diameter	1.600 mm On request up to Ø 2.500 mm
	Height	max. 750 mm
	Weight	max. 3.000 kg
// Disc		
	Outer diameter	max. 1.600 mm
	Weight	max. 3.000 kg
// Drop forged part		
		max. 20 kg

Production overview

- Foundry
- Drop forging
- Testing & analysis
- Heat treatment
- Hydraulic forging press
- Mechanical properties testing
- NDT - PT, UT, VT
- Ring mill
- Mechanical machining

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

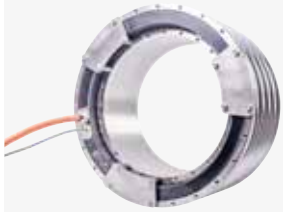
// Gearboxes

- 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

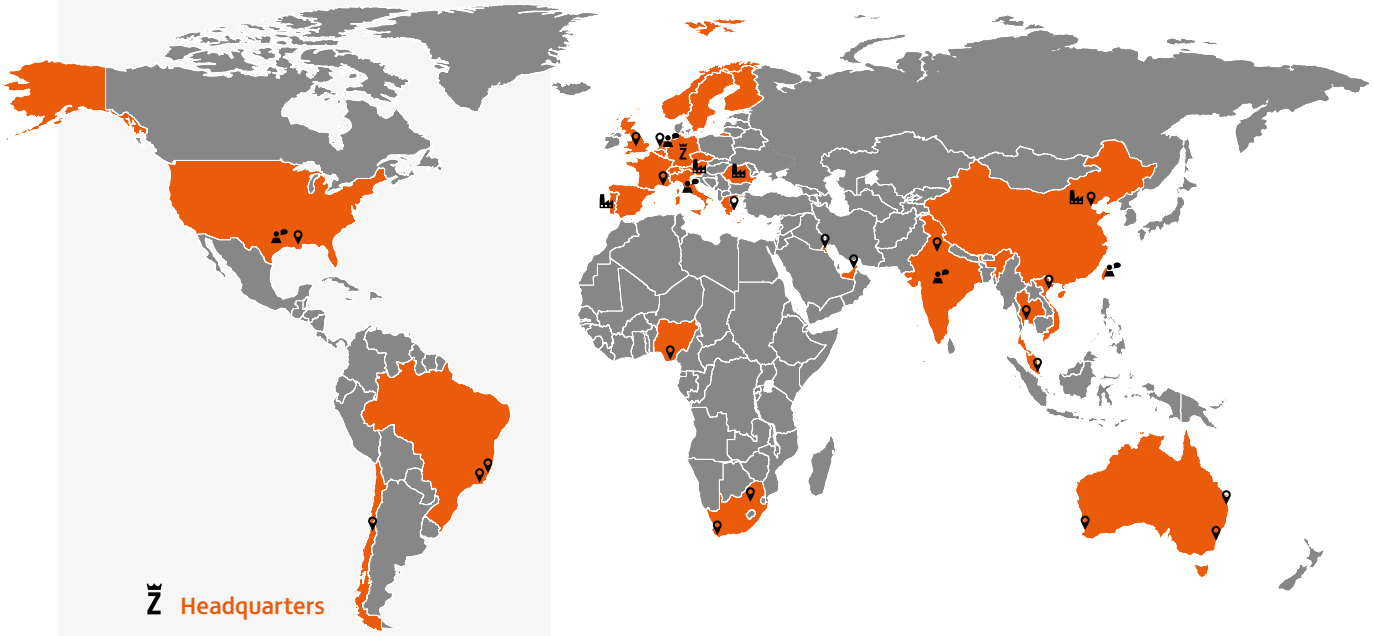
// Hydrostatic systems

- 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

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