

# ZOLLERN

Solid metals. Fine solutions.

Sand Casting and Forging

Hydroelectric  
turbines



# Individual cast components. For hydroelectric turbines.

ZOLLERN makes running wheels and blades from special aluminium bronzes as well as stainless and acid resistant steels. The sand moulds required for the casting process are manufactured cost effectively using a model, or without a model using a printed core.

## **ZOLLERN steel and aluminium-bronze alloys for turbine components**

- Francis running wheels
- Turgo running wheels
- Kaplan turbine blades
- Guide blades and hub bodies

## **Custom design**

- Design freedom
- Rapid adaptation to new requirements
- Production using 3D data supplied
- Quality management
- Maximum 8000 kg part weight for aluminium bronze
- Maximum 2000 kg part weight for cast steel (high alloy)

## **Tested quality**

### Non-destructive testing

- Ultrasonic testing
- Dye penetration testing
- Magnetic surface testing
- Electric conductivity
- X-ray testing

### Destructive testing

- Tensile testing
- Hardness testing
- Notched-bar impact testing

Francis  
running  
wheel



Francis  
running  
wheel



Turgo  
running  
wheels



Kaplan  
blade



Kaplan  
blade



# High quality turbine parts. For micro-hydro systems.

## **ZOLLERN supplies turbine manufacturers and operators of hydroelectric installations with**

- turbine parts for micro-hydro generating stations up to 50 MW, small hydro/compact hydro,
- sand cast parts in steel or aluminium bronze, rough cast or preprocessed,
- hydraulic contours ready ground and machine finished on request.

# Cost-effective renovation. Francis running wheels.

Worn Francis running wheels are quickly and cost-effectively reconditioned and repaired at ZOLLERN. Hydraulic contours can be optimised. The existing running wheel is scanned either on site or at ZOLLERN, the data is then worked up. Versions of the parts are rapidly produced by combining different processes and using an existing pattern.

## **Features and advantages**

- Renovation of worn running wheels
- Optimisation of performance, improved performance
- Minimisation/elimination of cavitation
- Long service life of renovated running wheels
- Rapid execution and supply
- Amortisation of costs over a short period
- Can also be used for Kaplan turbines

# Copper-aluminium casting alloys

ZOLLERN Brand	Standards	Minimum values from the tensile specimen			Min. hardness HB 10/1000	
		R <sub>p0.2</sub> N/mm <sup>2</sup>	R <sub>m</sub> N/mm <sup>2</sup>	A <sub>5</sub> %		
EBG 9	EN 1982 CC332G CuAl10Ni3Fe2-C DIN 1714 2.0970 G-CuAl9Ni	GS	180	500	18	100
		GZ	220	550	20	120
EBG	EN 1982 CC333G CuAl10Fe5Ni5-C DIN 1714 2.0975 G-CuAl10Ni USA ~ C95500, ~ C95800 UK ~ AB2 F U-A10N	GS	250	600	13	140
		GZ	280	650	13	150
VBG	EN 1982 CC334G CuAl11Fe6Ni6-C DIN 1714 2.0980 G-CuAl11Ni USA ~ C95500	GS	320	680	5	170
		GZ	380	750	5	185
MEBG	WL 2.0968 G-CuAl9Ni7	GS	230	490	10	125
		GZ	290	490	7	130
AMB3	DIN 1714 2.0962 G-CuAl8Mn	GS	180	440	18	105
		GZ	200	500	18	105

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 exp. coefficient ~ 14-18 . 10<sup>-6</sup>/K
- Permeability < 1.01 to < 1.9 μ<sub>r</sub>

# 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)	Annealing hardness (HB)
				0.2 yield strength R <sub>p0.2</sub>	Tensile strength R <sub>m</sub> (MPa)	Elong. at fracture A <sub>5</sub> (%)		
G X 5 CrNi 13 4	1.4313*	DIN 17445	QT1	≥ 550	≥ 760	≥ 15	≥ 50	240-300
	1.4317*	EN 10283	QT2	≥ 830	≥ 900	≥ 12	≥ 35	280-350
G X 4 CrNi 13-4			QT3	≥ 500	≥ 700	≥ 16	≥ 50	

\*Used for water turbines and pump parts, suitable filler material for welding 1.4351



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