



# Hydropower Plant Solutions

Supporting  
sustainable  
renewable energy

For Welding **Professionals**

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# Our company

Welding Alloys provides welding consumables, automated welding equipment and wear protection services for hardfacing, cladding, joining and repair. These services are delivered either in our workshops or directly on site. We also supply wear plates, pipes and components.

Since 1966, customers worldwide have chosen Welding Alloys for supply they can count on and technical expertise, helping to improve the reliability and performance of their equipment. Built on long-term partnerships and a commitment to continuous improvement, we invest in research and development to deliver welding wires, welding machines and engineered wear solutions that address real industrial challenges, today and for the long run.

Our R&D and technical teams are closely involved in customer projects, applying practical experience and up-to-date engineering methods to solve demanding

wear issues. Through collaboration with universities, standards bodies and industry groups, we stay aligned with the latest developments and bring effective solutions to the field. With teams operating globally, we support customers in a wide range of environments.

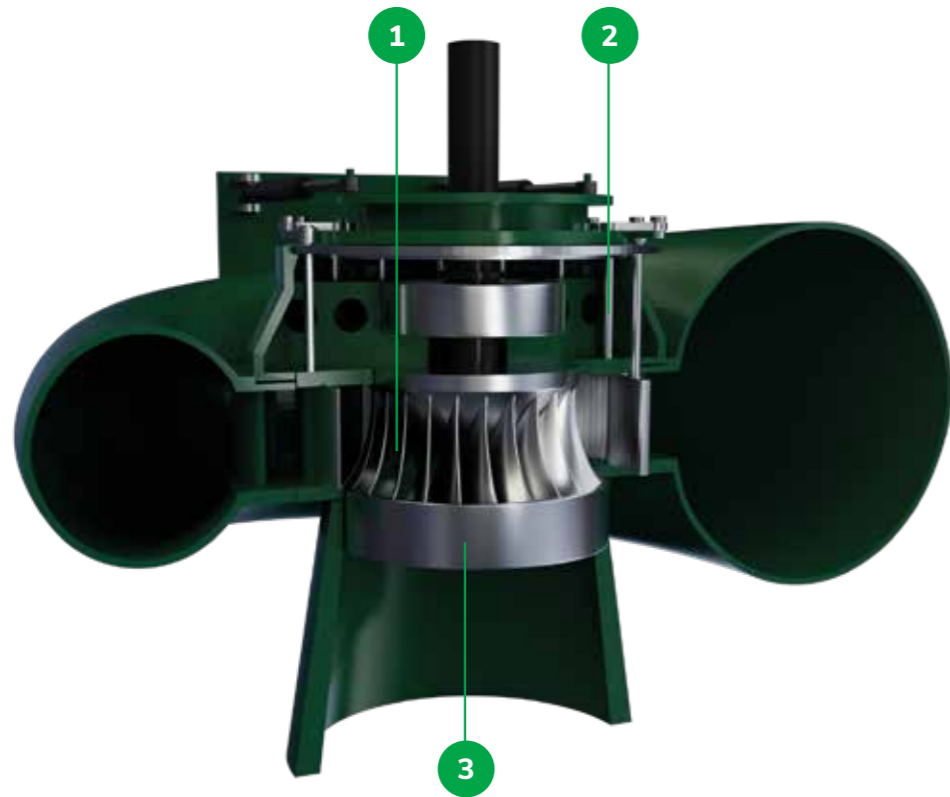
Welding Alloys is a member of the United Nations Global Compact and supports its principles on the environment, labour, human rights and anti-corruption. We design welding wires that produce lower fume emissions and manufacture many of our products using processes that reduce waste.

By extending component life through repair and maintenance, our services help lower energy use and carbon emissions over the lifecycle of industrial equipment. We continue to refine our products and processes to improve safety, efficiency and environmental performance.

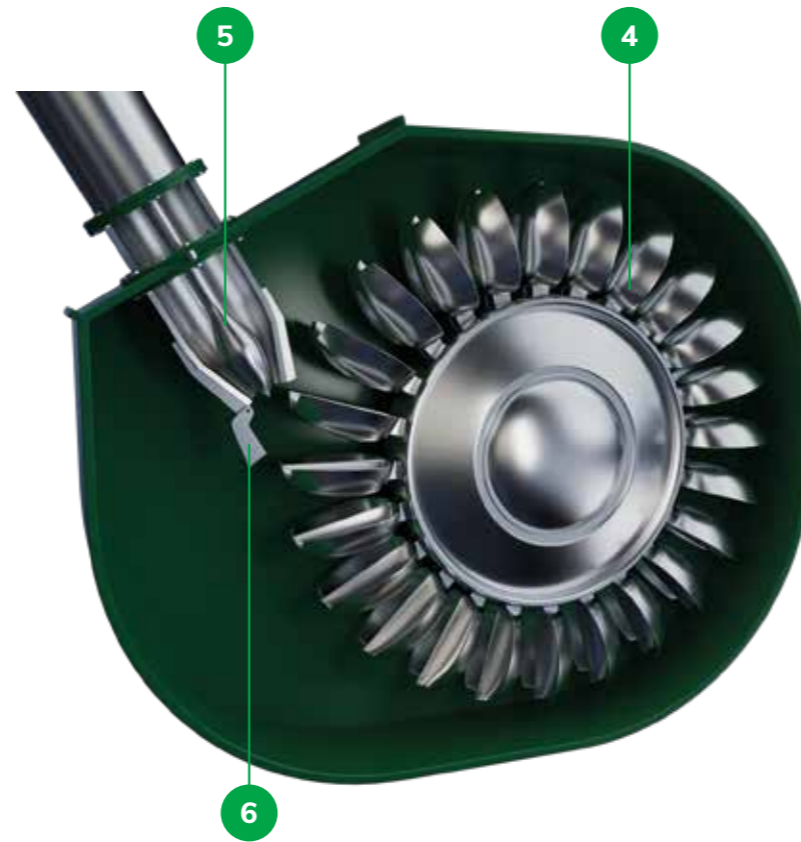


# Applications

Solutions for the specific needs of each turbine



Francis turbine



Pelton turbine



Kaplan turbine



**1. Francis blade**  
CHROMECORE soft martensitic wires ensure reliable joining and repair of CA6NM Francis blades, offering stable weldability and strong resistance to cavitation for long-term performance.



**2. Shaft**  
Wire arc spray rebuilding restores worn shafts to their original dimensions and provides a durable, corrosion-resistant surface, improving reliability and preventing premature component failure.



**3. Lower lip**  
CHROMECORE consumables effectively rebuild the lower lip area, restoring the original profile and providing enhanced erosion resistance in high-flow zones of the Francis turbine.



**4. Pelton bucket**  
CHROMECORE soft martensitic wires or CAVITALLOY provide robust repair solutions for Pelton buckets exposed to high-velocity water impact, ensuring extended service life.



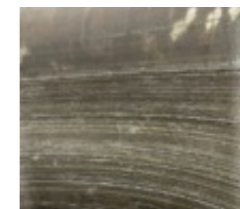
**5. Needle injector**  
STELLOY cobalt hardfacing delivers exceptional protection for needle injectors, with superior resistance to pressure, cavitation and turbulence in demanding Pelton turbine conditions.



**6. Deflector**  
HARDFACE AP-G work-hardening alloy or CAVITALLOY protect Pelton deflectors against severe erosion, pressure peaks and cavitation, ensuring stable flow control and reliable operation during load variations.



**7. Kaplan blade**  
CAVITALLOY preventive hardfacing improves the durability of Kaplan blades by increasing resistance to cavitation and erosion, helping maintain blade geometry and reducing maintenance intervals.



**8. Discharge ring**  
TETRA 309L-G or CAVITALLOY cladding enhances discharge ring longevity by reducing cavitation and corrosion wear, offering a stable and durable protective layer for continuous operation.



**9. Guide vane wicket gate**  
Wire arc spray coatings rebuild worn guide vane and wicket gate surfaces, improving protection against metal-to-metal wear and corrosion while restoring correct operating clearances.



**Valves**  
STELLOY cobalt alloys provide a durable hardfacing solution for hydropower valves exposed to pressure, turbulence and metal-to-metal contact.



Francis turbine manufacturing using CHROME CORE M 410NiMo-G

# Welding consumables

Welding Alloys manufactures advanced cored wires designed for hydropower applications, offering strong resistance to mechanical loading, cavitation and erosion. With extensive experience providing solutions to the industry, our consumables are produced with strict control of chemical composition and diffusible hydrogen (<4 ml/100g) to ensure consistent mechanical properties.

Our consumables are designed for the repair and rebuilding of hydropower equipment, supporting longer service life and reliable operation. The range offers excellent weldability across several product families:

### Soft martensitic stainless steels

Our CHROME CORE wires with 13% Cr, 4% Ni and Mo (410NiMo) are designed for joining or rebuilding CA6NM base materials. The range also includes an over-alloyed

version with 16% Cr, 5% Ni and 1% Mo for improved pitting corrosion resistance. These wires are available as metal-cored, basic-slag or rutile-slag options depending on the application.

### Austenitic stainless steels

Our TETRA wire with 23% Cr and 12% Ni (309L) is designed for buffer layers, heterogeneous joining or corrosion-resistant cladding. Using cored wires in these applications provides higher deposition rates with lower heat input, helping to control the HAZ.

### Hardfacing solutions

For surface protection, we offer CAVITALLOY, a work-hardening cored wire providing maximum cavitation and erosion resistance along with cobalt based STELLOY cored wires for severe wear conditions.

Product	CHROME CORE M	CHROME CORE V TETRA V	CHROME CORE B	CAVITALLOY STELLOY
Welding process	GMAW	FCAW-G	FCAW-G	GMAW
Wire type	Metal cored	Flux cored	Flux cored	Metal cored
Slag	No slag	Fast freezing rutile slag	Basic slag	No slag
Shielding gas	M12: Ar + 0.5 - 5% CO <sub>2</sub>	M21: Ar + 15 - 25% CO <sub>2</sub>	M12: Ar + 0.5 - 5% CO <sub>2</sub>	M12: Ar + 0.5 - 5% CO <sub>2</sub> I1: 100% Ar
Welding positions				

\*Out of position welding also possible using short circuit or pulsed arc modes of transfer

## Welding consumables for hydropower applications

Product	Standard diameters [mm]	Slag	EN ISO ASME / AWS standards	Typical chemical composition (%)						Typical mechanical properties				Description and applications
				C	Mn	Si	Cr	Ni	Other	Rp0.2% [Mpa]	Rm [Mpa]	A5 [%]	CVN [J]	
<b>SOFT MARTENSITIC STAINLESS STEELS</b>														
CHROMECORE M 410NiMo-G	1.2 - 1.6	No slag	ISO 17633-A T 13 4 M M12 1 AWS A5.22 EC410NiMo*	0.02	0.9	0.7	12.5	4.5	Mo: 0.5	720	860	18	-20 °C: 55	Soft martensitic deposit of CrNi steel, type 410NiMo. Good ductility, toughness, excellent resistance to cavitation and to stress corrosion cracking. Low amount of diffusible hydrogen guaranteed (<4 ml/100 g). A post-weld heat treatment at 580 °C to 620 °C is recommended to obtain a soft martensite structure. Joining and rebuilding of stainless martensitic and martensitic-ferritic steel base metals. *Classified EC410: Out of AWS standard regarding Mn > 0.6 and Si > 0.5.
CHROMECORE B 13 4-G	1.2 - 1.6	Basic slag	ISO 17633-A T 13 4 B M12 2 AWS A5.22 E410NiMoT0-4	0.02	0.5	0.3	12.0	4.5	Mo: 0.5	690	830	18	-20 °C: 110	
CHROMECORE V 410NiMo-G	1.2 - 1.6	Fast freezing rutile slag	ISO 17633-A T 13 4 P M21 1 AWS A5.22 E410NiMoT1-4	0.03	0.4	0.3	12.0	4.5	Mo: 0.5	670	830	19	-20 °C: 42	
CHROMECORE B 16 5 1-G	1.2 - 1.6	Basic slag	ISO 17633-A T Z 16 5 1 B M12 1 AWS A5.22 *	0.03	1.0	0.4	15.5	4.5	Mo: 0.9	670	860	17	-20 °C: 60	
CHROMECORE M 17 6-G	1.2 - 1.6	No slag	ISO 17633-A T Z 17 6 M M12 1 AWS A5.22 *	0.02	0.6	0.4	17.0	5.5	Mo: 0.9	650	850	15	+20 °C: 30	
<b>AUSTENITIC STAINLESS STEELS</b>														
TETRA V 309L-G	1.2 - 1.6	Fast freezing rutile slag	ISO 17633-A T 23 12 L P M21 1 AWS A5.22 E309LT1-4	0.03	1.4	0.7	23.5	13.0	-	460	580	35	-60 °C: 40	Austenitic deposit of highly alloyed CrNi steel, type 309L. Service temperatures range from -60 °C to +400 °C. Joining of steels with similar and dissimilar base metal compositions. To be used as a buffer layer if cladding with 308L. We also offer 309LNb, which can be used as a buffer layer when cladding 347, and 309LMo for cladding 316L.
<b>HARDFACING &amp; CLADDING</b>														
CAVITALLOY	1.3	No slag	EN 14700 T Z Fe 17	0.20	9.5	1.3	19.0		Co: 10.5 Mo: 0.25 N: 0.3	As welded: 240 HB Work hardened: 50 HRC			Austenitic deposit of highly alloyed CrCoMn steel strengthened with nitrogen. Superior cavitation resistance, comparable to Co-base alloys. Exposed to cavitation, a phase transformation occurs and the deposit hardens. The microstructure becomes martensite and forms a hard surface layer. Demonstrates high resistance to cavitation, corrosion and erosion.	
STELLOY 21-G	1.2 - 1.6	No slag	EN 14700 T Co1 AWS A5.21 ERCCoCr-E	0.35	1.0	1.0	28.0	3.2	Mo: 5.5 Fe: 3.0 Co: Bal.	As welded: 33 HRC Work hardened: 47 HRC			Low carbon cobalt base. Low cracking tendency. Ideal choice for resistance to multiple combinations of stress, such as corrosion and cavitation. Maintains a good level of hardness at high temperatures. Can be work hardened and polished. Low coefficient of friction. A special version is also available for GTAW, plasma and laser processes.	


# CHROMECORE variants by slag type

Each variant of the three CHROMECORE wires highlighted in the table is formulated with a different slag system to suit specific welding conditions, from controlled flat welding to challenging out-of-position task.

Slag behaviour has a direct impact on weld quality, ease of cleaning and properties. By offering options with metal cored, basic slag or fast-freezing rutile slag, these wires give welders the flexibility to choose the most suitable solution for the job, helping to avoid inclusions, improve productivity and achieve consistent results.

Flux cored wire with basic slag (CHROMECORE B 13 4-G) is generally not recommended for positional welding due to the increased risk of slag entrapment. While it can be used in these positions, it requires a carefully controlled and stringent welding procedure to ensure acceptable results.

Product	CHROMECORE M 410NiMo-G	CHROMECORE B 13 4-G	CHROMECORE V 410NiMo-G
Slag type	Metal cored: No slag	Basic slag: Isolated slag islands	Fast freezing rutile slag: easy to remove
Benefits	High yield strength, clean deposit	Best impact toughness	Designed for out of position welding

Flat welding position / PB:			
As welded			
After brushing			
Vertical up welding position / PF:			
As welded			
After brushing			

# Engineered wear services

Welding Alloys provides engineered wear services for hydropower equipment, either on-site or in our workshops. Our teams understand the operating conditions of runners, guide vanes, turbine housings and other plant components, and support customers from inspection through to final machining.

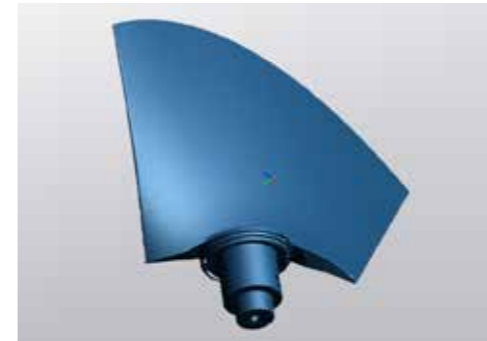
With years of experience working across hydropower facilities, we understand how plant components wear, distort or deteriorate over time, and what is required

to return them to working condition. Our teams perform welding, joining, rebuilding and machining operations, restoring correct profiles, surface finishes and clearances. This allows turbine parts, gates, vanes and associated equipment to be returned to a service-ready state.

By working closely with OEMs and hydropower operators, we help extend the service life of critical components and support efficient, reliable plant operation.



On-site welding repair



3D-scan model of a Kaplan turbine blade.

Advanced 3D scanning captures precise blade geometry, allowing accurate assessment of wear, distortion and profile deviation. This digital data improves repair planning, ensures correct surface restoration and supports quality control before and after machining or repair/hardfacing.



Pelton turbine bucket hardfacing.

Welding restoration of turbines to increase resistance to erosion from high-velocity water jets. The protective deposit ensures durability, stable performance and extended service intervals under severe operating conditions.



Machining on site.

On-site machining restores critical surfaces and dimensions after welding or hardfacing operations. This ensures correct clearances, smooth finishes and proper alignment of components, enabling reliable operation without costly dismantling or transport.



Wear-resistant liners for penstocks.

Wear-resistant linings are applied to penstocks to protect against abrasion and particle-laden flow. These linings reduce material loss, stabilise internal surfaces and help maintain long-term efficiency by limiting hydraulic roughness and preventing premature failures.



Wire arc spray coating on a wicket gate

Wire arc spray deposits a uniform, wear-resistant layer on wicket gate surfaces exposed to metal-to-metal friction and corrosion. The coating rebuilds worn areas, improves sealing and offers a cost-effective, low-heat process suitable for large components.



HVOF coating on turbine drive shaft

HVOF thermal spraying produces a dense, highly adhesive coating that protects turbine drive shafts from abrasion, corrosion and fretting. The resulting surface delivers excellent hardness, low porosity and long-term reliability in high-load, high-moisture environments.

# Quality & innovation

Welding Alloys has many years of experience in the design and manufacture of flux and metal cored welding wires, supported by R&D teams located across several global sites. Our consumables are developed for demanding operating environments, including those typically found in hydropower plants.



Since 1966, innovation has been central to Welding Alloys. Our R&D teams focus on the development of wires suited to evolving manufacturing and repair techniques, including processes such as wire laser additive manufacturing, possible in hydropower applications. This ongoing work ensures our consumables keep pace with the operational needs of the industry.



We maintain full control over design, development and manufacturing. All wires are produced on our own equipment at Welding Alloys facilities worldwide, with laboratory testing and quality checks carried out throughout the process.

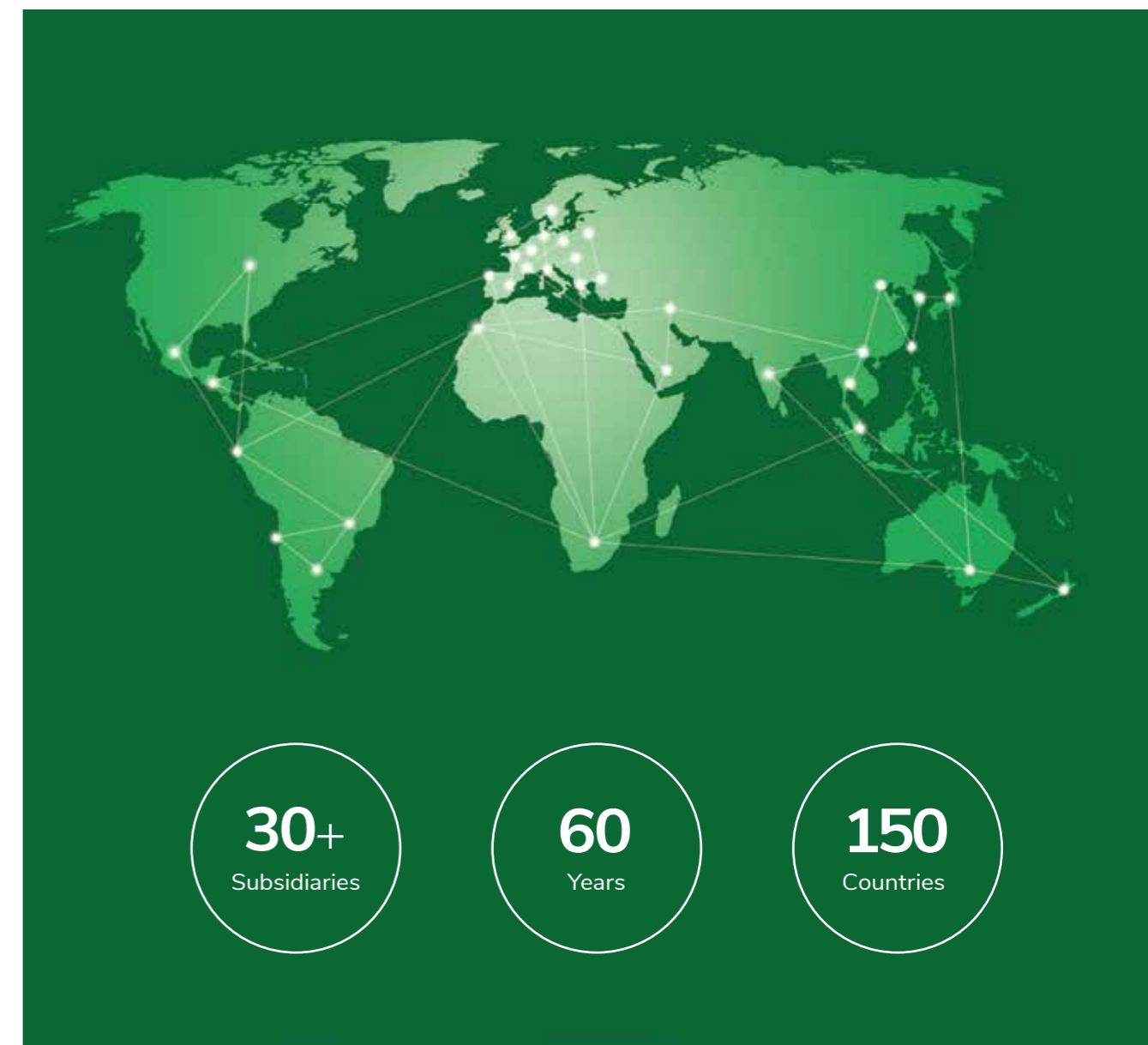
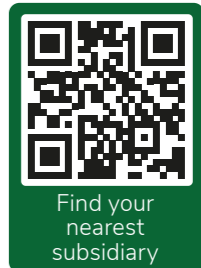
Our technical teams support customers across the hydropower industry and other sectors, providing consumables expertise and engineered services either on-site or in our workshops.



Watch the video

# Our global footprint

Our specialists and industry experts are active in 150 countries across the world and have an in-depth understanding of the operating conditions and customer requirements across a wide range of sectors.



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