

Small Hydro solutions from one single source





**Voith – Innovation
with experience**



The application of renewable energies for eco-friendly power generation is a key concern of worldwide energy-political strategies. In this context, small hydropower plants are gaining more and more importance. With our experience and know-how we can help you to unlock the potential that lies in the development of this form of energy generation economically and, at the same time, with minimum impact on the environment.

Voith Hydro in St. Georgen

The location in St. Georgen was founded in 1928 under the name Kössler in Lower Austria as a repair workshop for machines and generators. Shortly afterwards, the company began to build its own turbines and controllers for small hydroelectric power plants and to expand its worldwide market position. Since 2008, Kössler is a wholly owned subsidiary of Voith. Today the company is part of the small hydro division and operates under the name Voith.

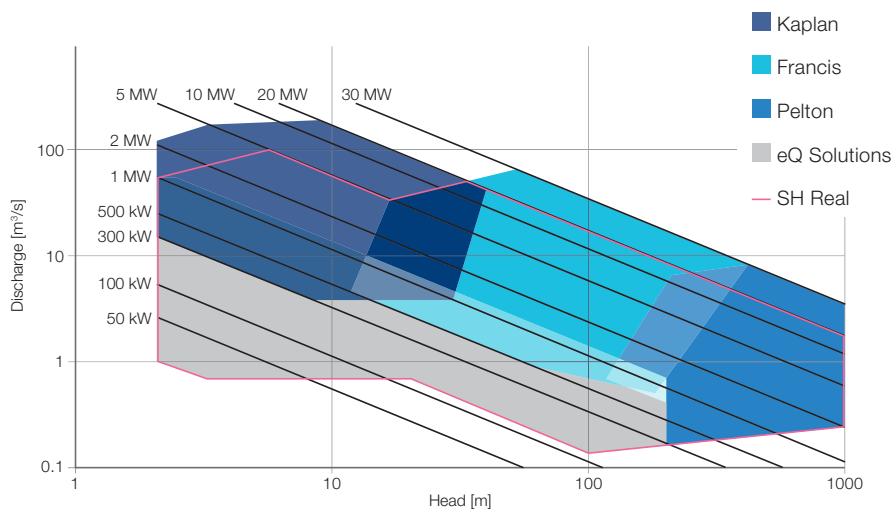
The competence center for small hydro complements the portfolio in the range up to 15 MW and combines turbine and model development, design and manufacturing expertise and comprehensive services for small hydropower plants under one roof. The company has more than 90 years of experience in this field.

Our corporate philosophy

Investment in research and development are the foundations of the success of our company – now and in the future. Our activities are firmly oriented on the existing and future requirements of our customers.

Flexibility when dealing with individual customer demands, on-schedule delivery and services across the entire service life of any power plant equipped by Voith are our highest priority. Therefore, we make an active contribution to eco-friendly generation from hydropower.

Application range Voith Small Hydro



Competence in Small Hydro

We develop solutions that allow for high economy in the generation of electricity from hydropower for our customers.

Everything from one single source

Our innovative, standardized concepts ensure the highest possible degree of economy of the delivered plants. Our optimum price-performance ratio results from the application of state-of-the-art technologies and our targeted orientation on the specific requirements of the operators of small hydropower plants:

- Clearly defined scope of delivery
- High availability
- Trouble-free operation
- Low operating costs
- Fast pay-back period

Our range of products and services:

- Standardized turbine concepts up to individual solutions
- Economical, constructive solutions with high operating safety
- Integrated designs with optimized interfaces
- Solutions that keep construction costs at the lowest possible level
- Concepts with high efficiencies and corresponding performance guarantees
- Maximum reliability due to strict quality controls
- Eco-compliant solutions
- Pre-assembly and therefore short erection times
- Competent commissioning of all systems
- Training of operating and service personnel
- After sales service

Our solutions combine all requirements on:

- Maximum safety and high availability
- Long service life and continuous further development
- Proven solutions and innovative technology
- Clear standards and maximum flexibility



Research and development

The name Voith has always been synonymous with comprehensive research and development activities in the small hydro market.

The Voith research and development department has been developing solutions for hydropower for more than 100 years as a pioneering institution in this particular field.

The solutions and expert know-how of this research laboratory are available to all units as “Central Technology” within a global network.

Since 1908, the Brunnenmühle has been Voith’s worldwide research and development center for hydropower. The Brunnenmühle applies the highest standards to all model tests carried out on its premises. It is considered a guarantor for the development of state-of-the-art research and development tools and processes – not just for large turbines but also for small hydro.



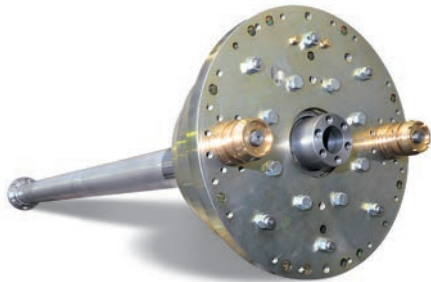
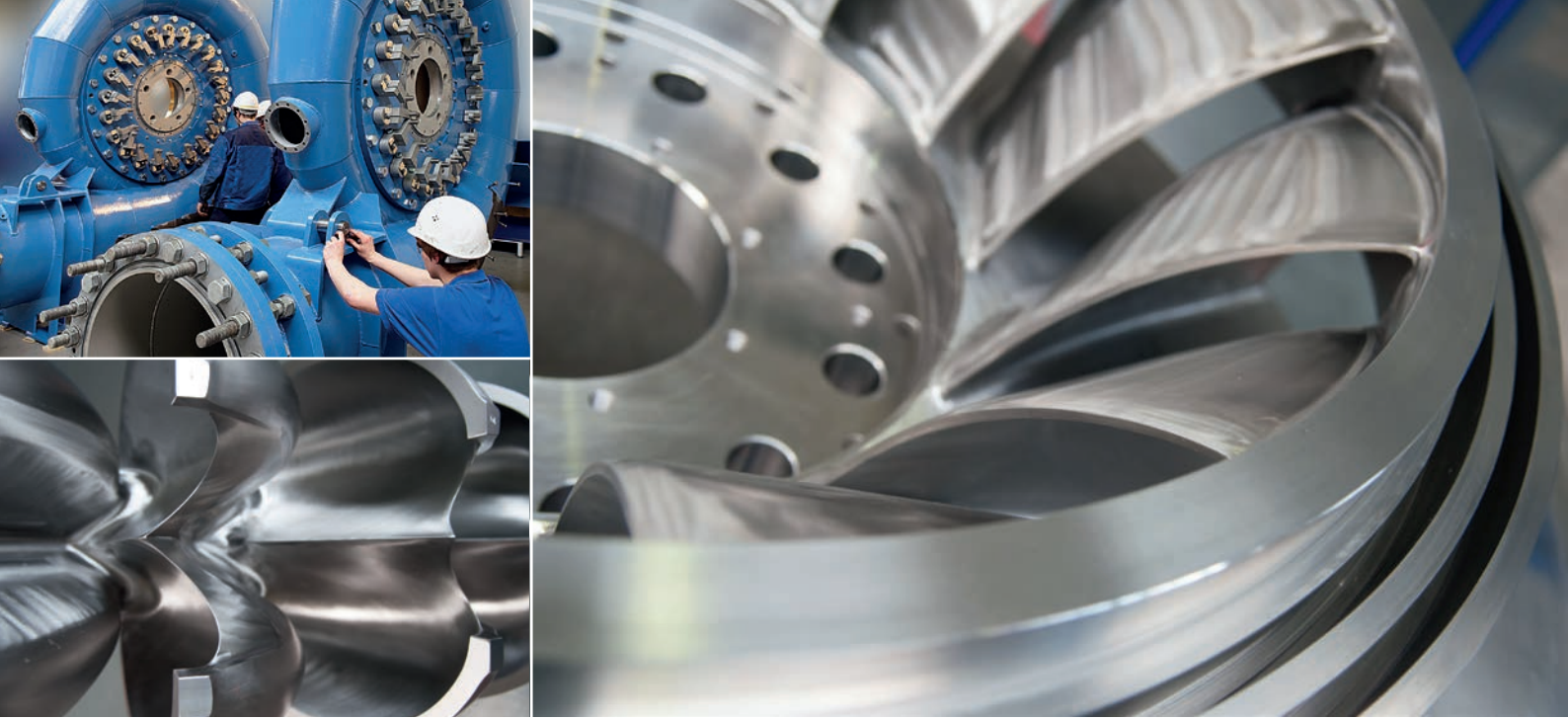


First-class production quality

The long-standing experience and high craftsmanship of our employees ensures that we always meet our own strict quality standards and those of our customers. The Voith team is firmly committed to innovative development technologies and high-end, precise production with outstanding results.

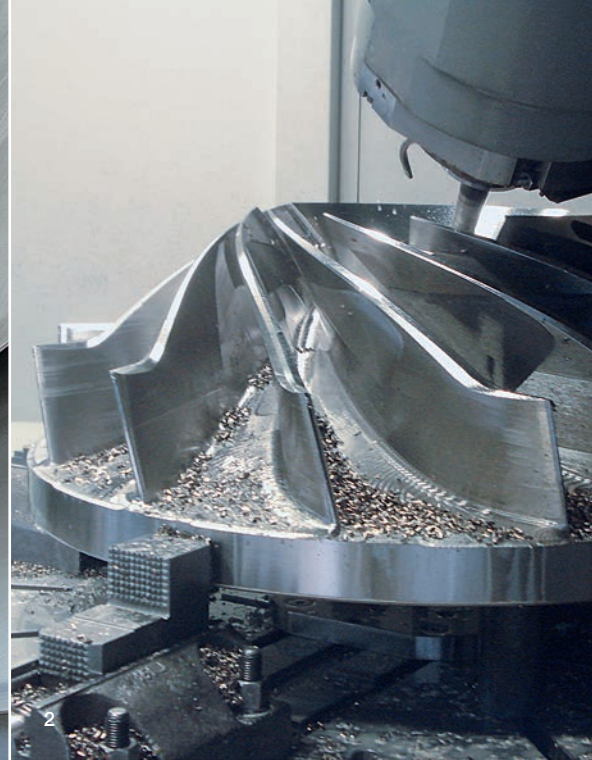
Our design engineers use the latest analytic tools, 3-D CAD systems and CAM products. More than half of our thoroughly skilled employees work in the production and service area. With their expertise and long-standing experience, they ensure the exact implementation of all developed concepts – from the selection of the best materials and precise production with

CNC machines of the latest generation to internal quality control and professional on-site assembly. Our customers are able to personally monitor the progress of their orders directly at our plant.



Voith is certified in the principles of the quality management system ISO 9001:2000. Specially trained and audited employees are responsible for ongoing quality assurance.

All products are controlled on the basis of strict quality standards – which can always be expanded in accordance with customer requests. The consistent adherence to the quality regulations of the latest EN, DIN and IEC norms is a matter of course for us.



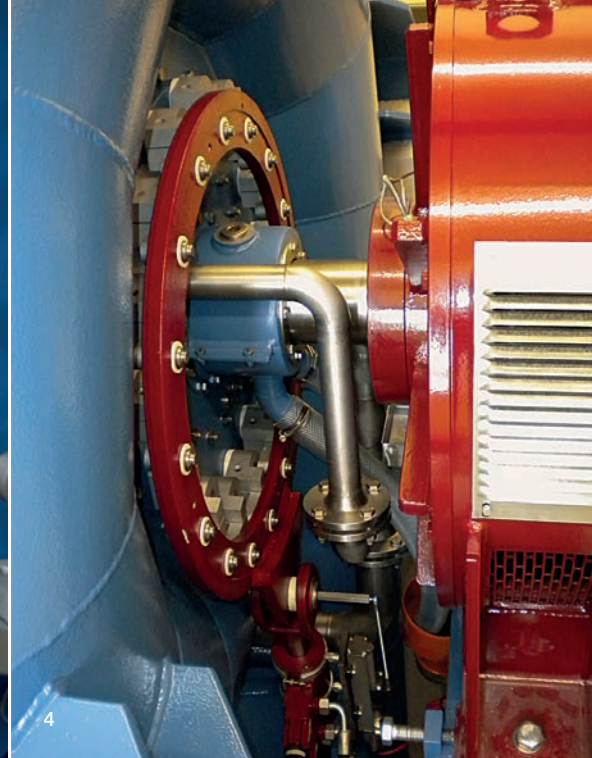
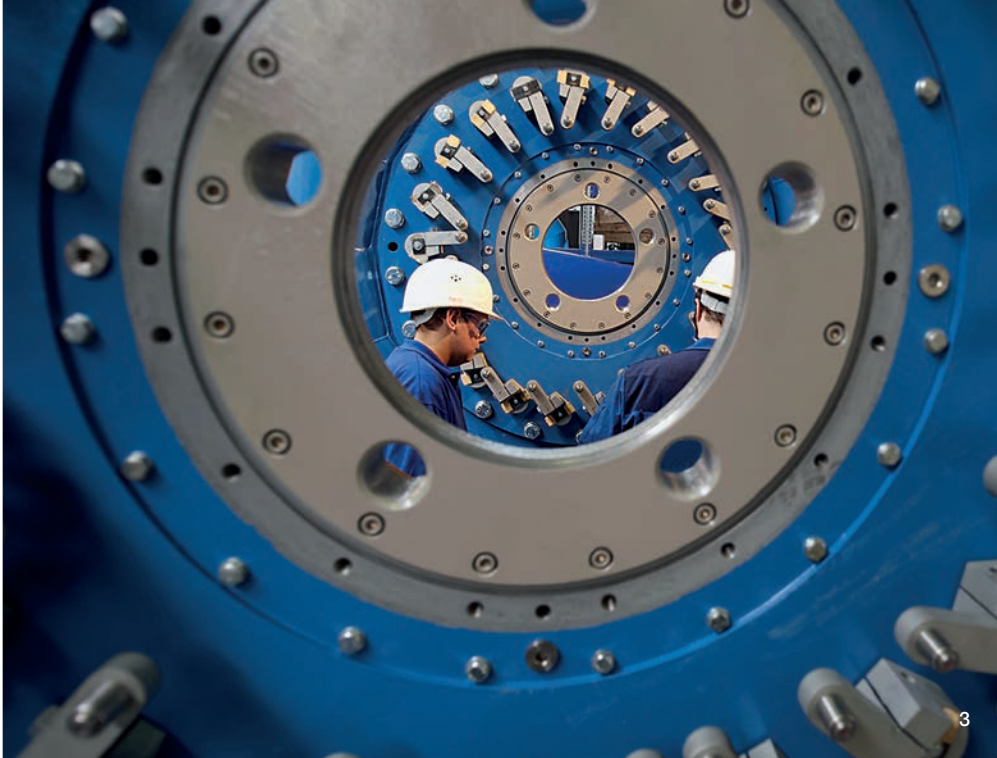
Francis turbines

Reliable turbine for low to medium heads.

Francis turbines are primarily used in run-of-river power stations and pumped storage power plants with medium flow volumes. They stand out with their optimum efficiency and high speed ranges.

Voith develops and produces Francis turbines as spiral turbines, which can be used both in horizontal and vertical designs.

The runner is often installed directly to the generator shaft, which results in optimum compactness and low maintenance requirements.



- 1 Francis runner – latest design
- 2 CNC-controlled production
- 3 Works assembly
- 4 Installed plant

Francis turbine



Technical information

Types	Spiral turbines for medium to large heads. Designed as horizontal or vertical shaft spiral case turbines.
Output	up to 15 MW
Heads	up to 250 m
Runner diameter	up to 2.5 m



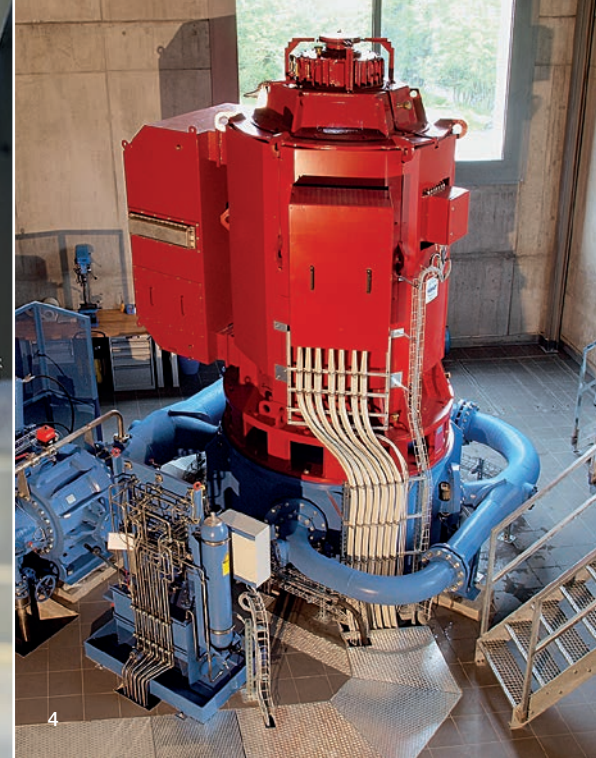
Pelton turbines

The ideal turbine type for large heads.

Pelton turbines are mainly used for applications with large heads and low water volumes. This turbine type can achieve optimum efficiencies even with fluctuating water supplies, since the number of nozzles can be individually adapted.

Pelton turbine buckets are frequently subjected to load changes and abrasion. In order to achieve maximum robustness of the runner buckets, we use specially milled Pelton runners and complex production methods, for example hard coating.

Be it horizontal or vertical design, one or up to six nozzles, internal or external control, Voith develops, designs and produces the Pelton turbine that is most suited to individual requirements – and ideally complies with the existing operating conditions.



- 1 Pelton runner
- 2 Horizontal Pelton turbine
- 3 CNC-controlled production
- 4 Installed multi-nozzle Pelton turbine

Pelton turbine



Technical Information

Types	Horizontal or vertical construction with one to six nozzles
Output	up to 15 MW
Heads	up to 1 200 m
Runner diameter	up to 2.5 m



Kaplan turbines

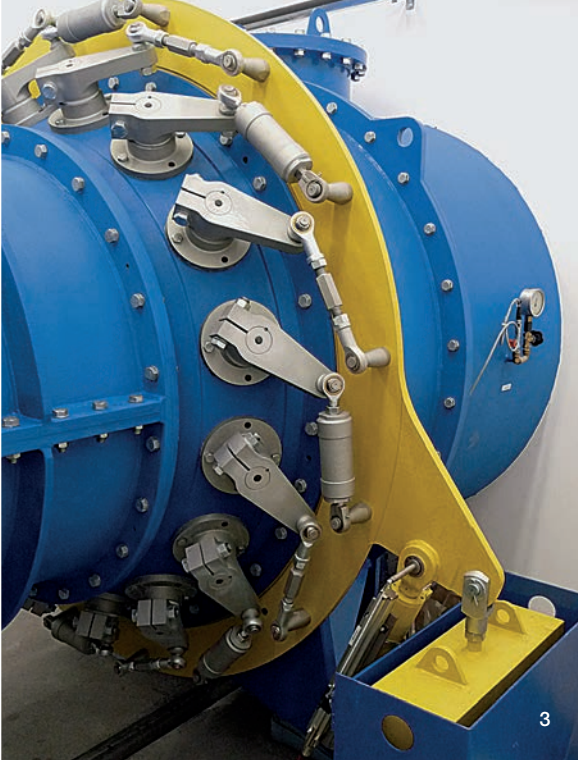
The optimum turbine for low-pressure applications with high water volumes.

Based on the Francis turbine, Victor Kaplan designed the Kaplan turbine between 1910 and 1913, with Voith using it for the first time in 1922. It is primarily installed in plants with low heads and larger water volumes. This turbine type can also be applied as a run-of-river power station.

Since the guide vane and the runner can be controlled separately, Kaplan turbines are able to utilize even strongly

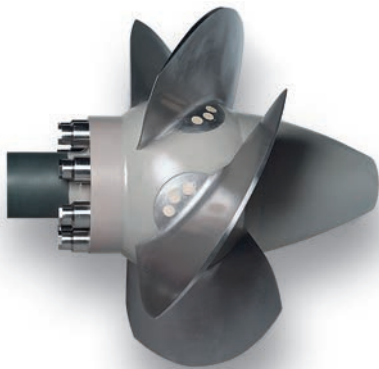
fluctuating water supplies. This control technology ensures very high efficiencies.

Voith supplies Kaplan turbines in vertical design in concrete with a steel spiral or as horizontal bulb turbines in a wide variety of shapes with three, four, five or six blades. The drive to the generator occurs preferably via a direct connection or, in certain cases, via flat belts or gearboxes.



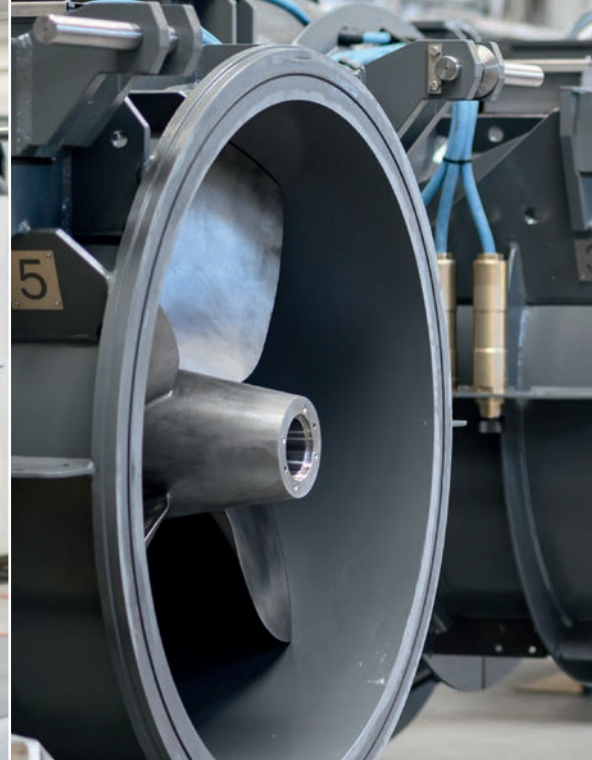
- 1 Kaplan runner
- 2 Dynamic balancing
- 3 Bulb turbine
- 4 Assembly

Kaplan turbine



Technical Information

Types	Bulb turbines, vertical Kaplan turbines and Kaplan spiral turbines
Output	up to 5 MW
Heads	up to 35 m
Runner diameter	up to 3 m



StreamDiver

Innovative turbine technology setting new economical and ecological standards.

All over the world there are run-of-river schemes with low heads whose high energetic potential could thus far not be utilized. The StreamDiver ideally meets the demands for economy and ecology needed by these plants.

The innovative technical concept of the StreamDiver ensures minimum maintenance and service work. As it can be directly installed into a weir system, its installation can even render conventional power station structures unnecessary. Construction technology and peripheral equipment can thus be reduced to an absolute minimum.

The StreamDiver is a compact turbine with an output of up to 800 kW per unit, which can be used for modular extensions as a minimum-flow turbine or as an alternative to existing small hydro plants.

Apart from economical aspects, the development of the StreamDiver focuses strongly on ecological considerations. The bearings of this new development are water-lubricated. As a result, the compact turbine can be operated without any oil or grease.

Advantages of the StreamDiver

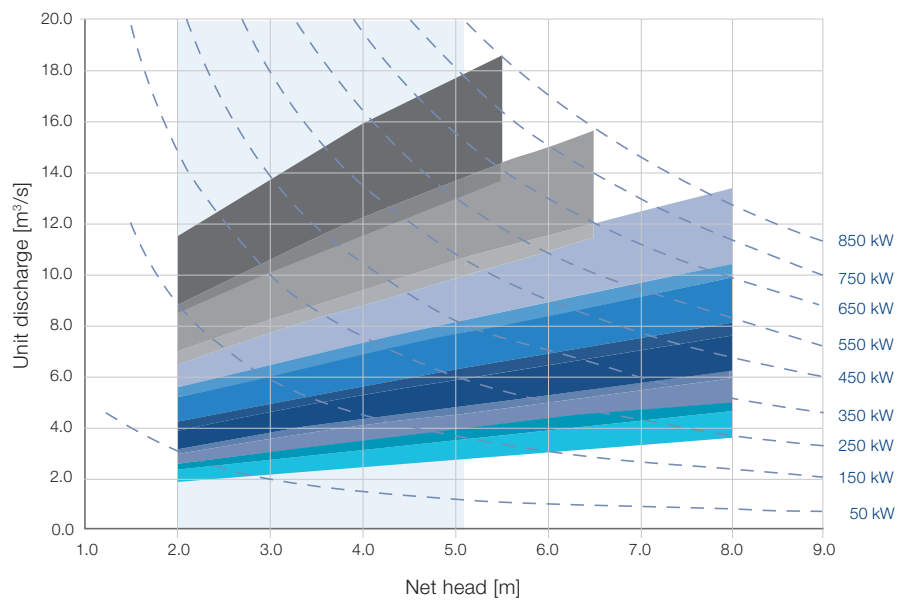
- + **Particularly economical solution due to minimum operating and maintenance costs**
 - + **Ideally suited for low heads**
 - + **Easy integration in existing weir systems or transverse structures**
 - + **Ecologically advantageous due to water-lubricated bearings and therefore oil and grease-free operation**
 - + **Fish-friendly runner contours**
 - + **Low structural requirements and universal applicability**
-



StreamDiver



Application areas of the StreamDiver modules



StreamDiver modules

- | | | | |
|-----------------|------------|------------|-----------|
| ■ SD 16.95 (XL) | ■ SD 13.10 | ■ SD 10.15 | ■ SD 7.90 |
| ■ SD 14.90 (XL) | ■ SD 11.55 | ■ SD 8.95 | |

eQ-Solutions

Standardized turbine solutions for economical applications in the lower output range.

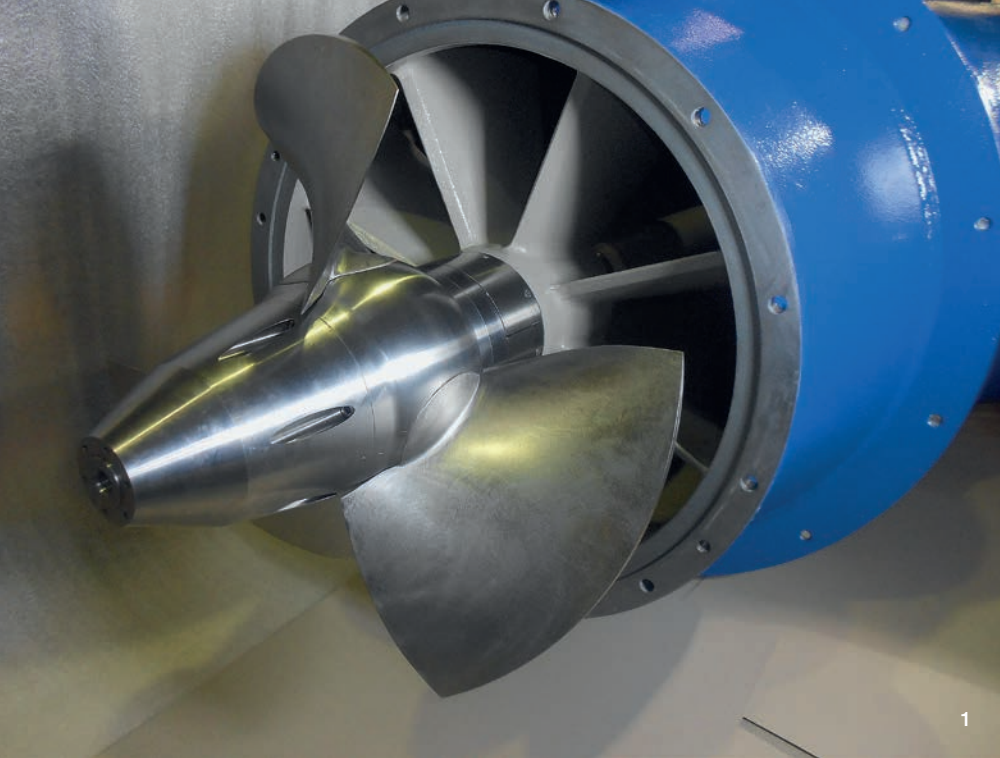
eQ-Solutions stand for compact Francis, Pelton and Kaplan turbine solutions in the output range of up to 1200 kW. Standardized solutions are supplied in proven Voith quality with a view to material selection, production and operating safety for man and machine – with a strong focus on essential functions and equipment. Owing to their technically mature design, the construction of these turbines can be deliberately kept uncomplicated and compact.

This concept opens up totally new application opportunities, where small turbines had so far been regarded as unsuitable for economical reasons.

The applied turbine hydraulics are identical with those used for larger plants. For this reason, we can guarantee outstanding performance data and high investment security. All components and production stages are of course subject to our strict quality control.

Wherever possible, the turbines, generators and auxiliary units are pre-assembled in our workshop. This results in short delivery times and minimal on-site assembly requirements. Experienced customers may even install the systems themselves.

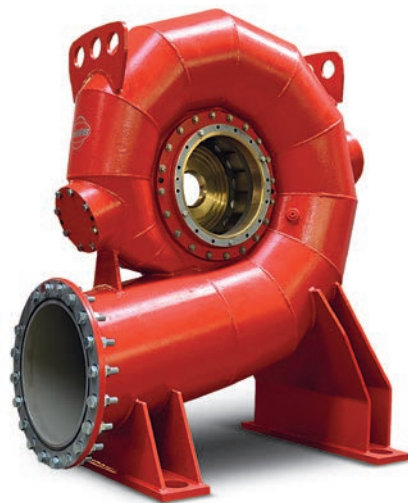
eQ-Solutions: Developed for economical applications in the lower output segment. And produced with the quality for which Voith has been renowned for decades.



Advantages of eQ-Solutions

- + Standardized series
- + Concentration on essential functions
- + Proven high quality, production and safety standards
- + Shorter delivery times
- + Low assembly requirements
- + Guaranteed performance values due to the application of proven turbine hydraulics

Francis compact turbine





Turn-key hydropower stations

**Turn-key solutions for electro-mechanical equipment:
Voith develops, plans and manufactures the entire
product range for small hydropower plants.**

A successful project requires more than first-class technical equipment. On-time and cost-efficient project implementation can only work through optimum cooperation of all parties concerned. And this applies to every single interface of the project.

This is why Voith offers turn-key solutions for its customers. We supply you right from the start with initial concepts, developments, design, production, quality control and project management up to assembly and commissioning – everything from one single source.

Thanks to decades of experience, we always find the appropriate complete solution even for specialized tasks, and we implement this solution professionally – up to the handover of the turn-key plant. And afterwards we accompany you all the way with our services.



As far as generators and electrical engineering are concerned, we closely cooperate with reliable companies whose product portfolio provides an ideal supplement to our complete solutions and who have proven themselves as competent project partners on numerous occasions.

Range of turn-key solutions

- Support during the concept phase
 - Development, design, production and assembly of electro-mechanical systems including accessories
 - Quality assurance and works control
 - Complete project management
 - HyService: Service, maintenance and upgrades
-

HyCon Digital Turbine Governor

Today's technology meets long-term experience. Our tailor-made solutions help you to control the process. The proven control philosophy applied in HyCon turbine governor.

The ability to control a hydropower unit and the quality of the electric power it provides largely depends upon the performance of the turbine governing system. Voith has been developing and manufacturing the core components of turbine governor systems for more than 120 years. Over 18 500 complete turbine governors have been delivered and installed worldwide by Voith.

The HyCon Digital Turbine Governor is designed as an integral part of our HyCon control system family. Our digital governors combine leading-edge technology with concepts that have proven their reliability and performance under all operating conditions over many years.

By using the best hardware and software available, it offers the highest availability. Because of its modular and flexible design, the governor can be customized to satisfy the requirements of every type of turbine. Governors are designed to meet the high level of safety standards embedded in all Voith products.

The HyCon Digital Turbine Governor has included all control modes required for any type of turbine. Governors have been successfully implemented in a vast number of hydropower plants of every type and size all over the world.

Remarkable features of the HyCon Digital Turbine Governor

- All operation modes available
 - Meets and surpasses all relevant international standards
 - Advanced control concepts
 - Open communication standards
 - Parameter access and change without engineering tools
 - Independent local operation
 - Wide range of redundancy concepts
 - Hardware and software diagnosis in the PLC controller
 - Flexible remote access solutions
-

Automation laboratory,
Brazil



Main functions

The HyCon Digital Turbine Governors offer a wide extent of control modes to operate any kind of turbine in a safe and dynamic manner:

- Speed control
- Power control
- Water level control
- Flow control
- Pump control

Furthermore, our extensive process know-how as a turbine manufacturer enables us to supply:

- Optimized functions for surge control
- Multi-needle control for Pelton turbines
- Optional cam curve optimization module for Kaplan turbines
- Optional Kaplan blade movement optimization

The system is designed for fully automatic operation. However, the operator can get detailed information about the status of turbine and governor via local and remote operator stations. This ensures safe and efficient operation and monitoring.

Other features

- Primary and secondary control
- Quick step response
- Advanced stability for reference action of the control loop
- Advanced stability for disturbance action of the control loop

Software

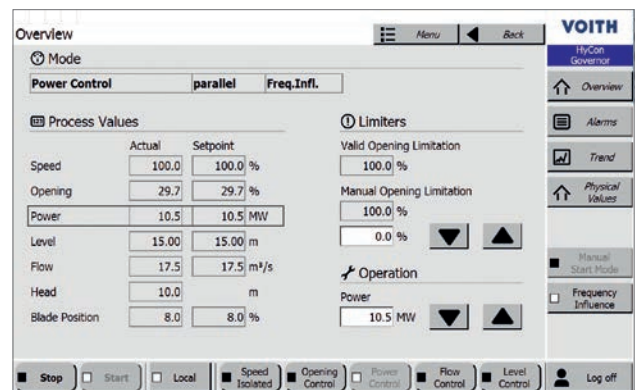
The HyCon Digital Turbine Governor software is based on well-known SIMATIC standards like TIA Portal, Step7 and WinCC flexible.

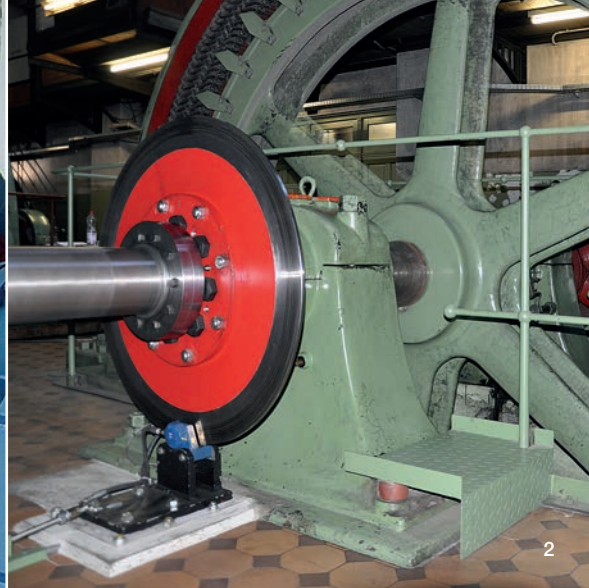
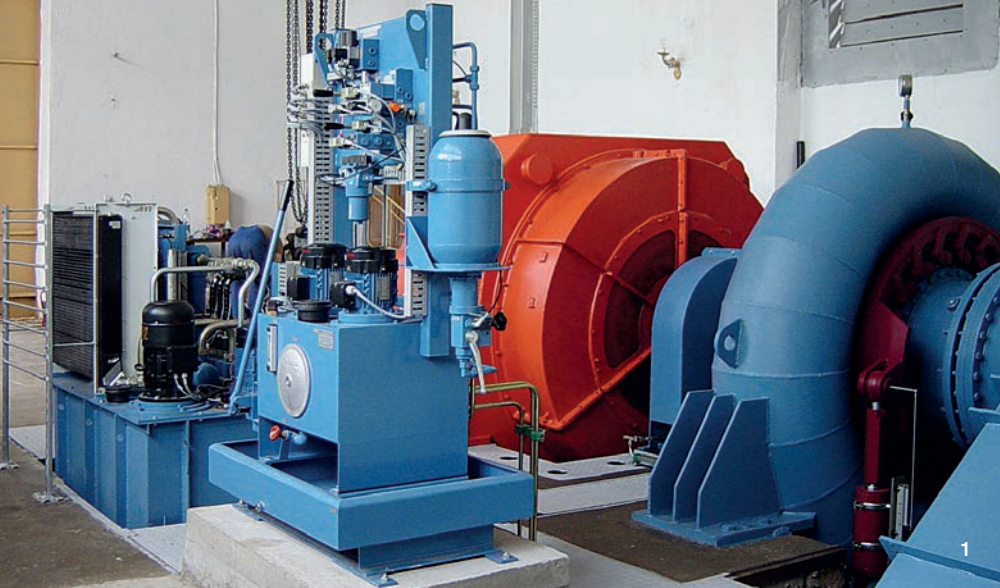
We offer:

- Modular and flexible systems
- Graphic user interface
- Easy and efficient parameterization
- Extensive diagnostic functions for fast and optimal maintenance

It is also compatible with third-party control systems due to its open and flexible interfaces and can be integrated into both new and existing hydropower plants.

Independent local operation





Service, maintenance and upgrades HyService

For Voith, customer service does not end with the handover of the plant. We accompany you with our service specialists – across the entire life cycle of your power station.

HyService covers the full service of everyday operation, annual maintenance, provision of original spare parts and fast assistance in the event of failures. We know that standstill of a hydropower station means financial loss. Therefore, we react promptly, flexibly and efficiently whenever required in order to keep downtimes as low as possible.

The latest control systems from Voith allow remote diagnosis of your power station. For older plants we recommend retrofitting a remote maintenance module. If failures cannot be externally eliminated despite these facilities, our service technicians are quickly on site, in order to ensure that operation can be resumed as soon as possible.

Depending on their construction and operating conditions, power stations have life cycles spanning many decades. Therefore, Voith also offers individual service for general overhauls of older plants. A conversion to lubrication-free bearings, the restoration of the original hydraulic contours and special coatings, for example, can significantly increase life cycles and efficiencies.

A performance and efficiency analysis by Voith will point out existing potentials and improvement possibilities.



- 1 Automation of Francis spiral turbine
- 2 Power station modernization
- 3 Spare runner

We are regularly informed about the latest developments in the field of hydropower. And of course we utilize this expertise also for small hydropower plants.

Voith service offers comprehensive solutions from maintenance in current operation to emergency services and upgrades. With our range of services, we ensure productivity for your small hydropower plant.

Historic display instruments



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Inspiring Technology
for Generations