

# Actuators and control systems for turbomachinery

## Products, services and engineering





# General information about Voith

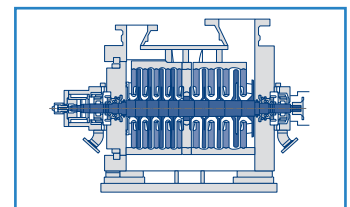
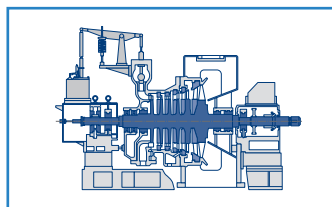
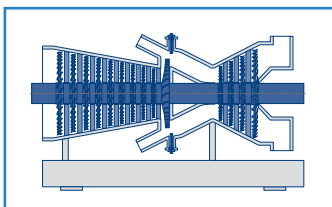
The Voith Group is a global technology company. With its broad portfolio of systems, products, services and digital applications, Voith sets standards in the markets of energy, oil & gas, paper, raw materials and transport & automotive. Founded in 1867, the company today has more than 20 000 employees, sales of Euro 4.2 billion and locations in over 60 countries worldwide and is thus one of the larger family-owned companies in Europe.

You benefit from the experience we have accumulated in turbomachinery for the last 40 years. Globally, 1 200 customers place their trust in this. More than 30 000 steam turbines using our actuators and control systems are driving generators, compressors and other driven machines. In addition, there are 950 gas turbines equipped with Voith valve assemblies.

# Produce safely and efficiently. Product portfolio

Gas turbines, steam turbines and compressors achieve exceptional efficiency and operational reliability when using actuators, protection equipment and control systems from Voith. With our products, virtually all turbine and compressor control systems can be achieved – from simple, non-redundant systems to redundant ones with high availability.

## Products for turbomachinery controls



### Control actuators

I/H converters

Way valves

Servo motors

### Safety actuators

Trip blocks

Trip actuators

Overspeed protection

### Controllers / Governors

Standard controllers

Customized controllers

# Actuators

No matter what type of valve actuation you may be planning, we have a cost-efficient and functional solution. That applies both to new systems and to the modernization of existing systems.

We design the actuator solutions in line with your requirements for safety and availability. For example, we offer redundant products for high-availability process units or certified products for potentially explosive atmospheres. In addition, most of our actuators are SIL certified and thus comply with the international standard for operational safety.

## Advantages and benefits

- + Our actuators reduce the complexity of your overall control system
- + The result is increased reliability and availability of your plant
- + This helps you to run a trouble-free and profitable operation
- + The outstanding control speed and precision of the actuators provide stable processes that ensure high quality for your products

## Three different product groups for actuating control valves



| Product         | I/H converters  | Way valves   | Servo motors   |
|-----------------|---|--|--|
|                 | <div style="border: 1px solid blue; padding: 5px; width: fit-content; margin: 0 auto;">Current-to-pressure converter</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Pilot valve</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Hydraulic cylinder</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Control valve</div> | <div style="border: 1px solid blue; padding: 5px; width: fit-content; margin: 0 auto;">Servo valve with position controller</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Hydraulic cylinder</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Control valve</div> | <div style="border: 1px solid blue; padding: 5px; width: fit-content; margin: 0 auto;">Linear actuator</div> <div style="text-align: center;">↓</div> <div style="border: 1px solid gray; padding: 5px; width: fit-content; margin: 0 auto;">Control valve</div> |
| Function        |   |  |  |
| Valve actuation | <b>Complex</b>  | <b>Less complex</b>  | <b>Simple</b>  |

Voith product   
 Provided by the customer

# I/H converters and I/H converter modules

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## I/H converter



An I/H converter is a current-to-pressure converter. It regulates the pilot valve of a hydraulic cylinder that actuates the control valve. The hydraulic pressure  $p$  is the control variable. The position of the piston rod is generally fed back mechanically to the pilot valve. This is a simple, reliable and cost-effective solution.

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### Advantages and benefits

- + High productivity from high reliability;  
MTBF = 600 years
- + Stable processes thanks to first-class control characteristics
- + Less sensitive to contaminated pilot oil

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## I/H converter module



An I/H converter module is a completely redundant system with two I/H converters connected in parallel (hot redundancy). Electronic fault detection is integrated. In the event of a I/H converter failing, the function is ensured by a hydraulic maximum selection.

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### Advantages and benefits

- + Very well suited to high-availability systems;  
MTBF = 20 000 years
- + An I/H converter can be replaced during operation
- + Simple upgrade from non-redundant systems

# Way valves and way valve modules

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## Way valve



A way valve is a servo valve with an integrated position controller. The way valve directly regulates the hydraulic cylinder that actuates the control valve. The control variable is the stroke  $s$  of the piston rod. The position of the rod is fed back electrically to the integrated position controller. 3/3 and 4/3 way valve options are available for single-acting and double-acting cylinders. This solution for directly controlling hydraulic cylinders is reliable and has a good price/performance ratio.

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### Advantages and benefits

- + High productivity from high reliability;  
MTBF = 180 years
- + Very good process quality due to excellent control speed and precise positioning
- + Less sensitive to contaminated pilot oil

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## Tandem way valve



A tandem way valve is a way valve with two control magnets. These control magnets are connected in series and form a redundant unit (warm redundancy). If one control magnet malfunctions, the other takes over the control task. The switching logic is located in the distributed control system (DCS) and monitors the control magnets.

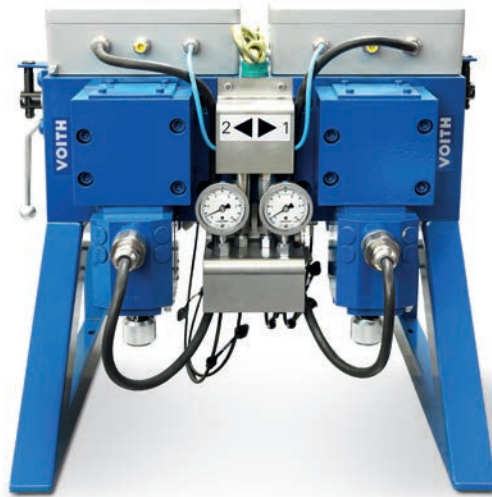
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### Advantages and benefits

- + High productivity from very high reliability;  
MTBF = 360 years
- + Higher operational reliability due to two control magnets connected in series
- + Very simple upgrade from non-redundant systems

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## Way valve module



A way valve module is a completely redundant system with two way valves connected in parallel (hot redundancy). Electronic fault detection is integrated. A hydraulic Max. Module ensures functionality.

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### Advantages and benefits

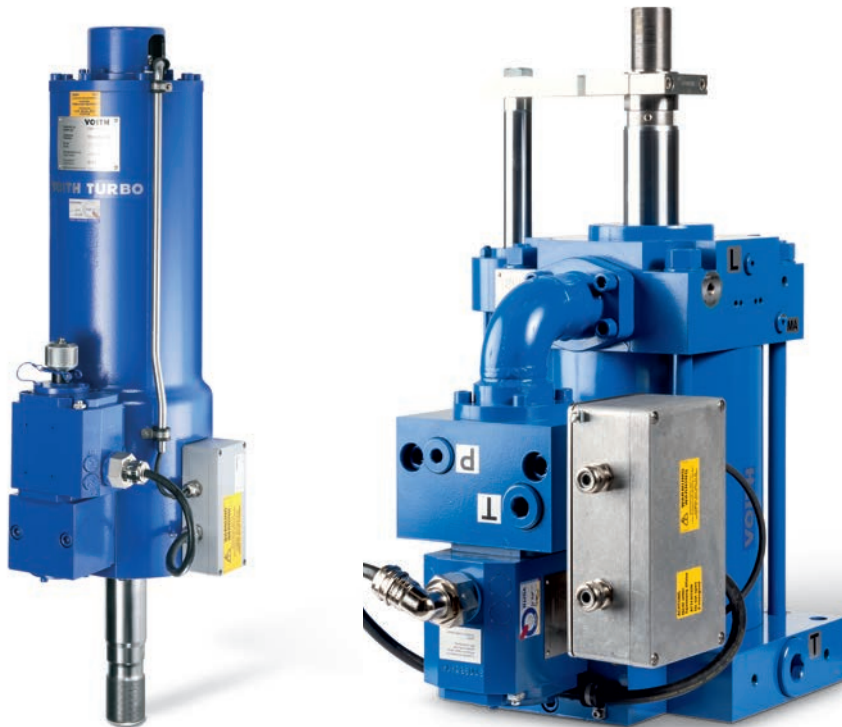
- + Very well suited to high-availability systems;  
MTBF = 8 800 years
- + A way valve can be replaced during operation
- + Simple upgrade from non-redundant systems



# Servo motors

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## Control servo motor



A control servo motor is a linear, electrohydraulic actuator. It is mounted to the control valve and actuates it directly. The control variable is the stroke  $s$  of the piston rod. The rod position feedback is integrated into the servo motor. Control servo motors are available with single-acting or double-acting cylinders. Various components of the servo motors may have redundant design.

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### Advantages and benefits

- + Complete, cost-optimized drive solution with a high force density
  - + Drive with only a few interfaces
  - + Simple system integration and quick commissioning; also ideal for retrofitting
  - + Very quick, precise and stable control using matched components
  - + Less sensitive to contaminated pilot oil
  - + Integrated fail-safe function
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## SelCon self-contained linear actuator



A SelCon self-contained actuator is a linear, electrohydraulic drive without external oil supply. It is mounted to the control valve and actuates it directly. The control variable is the stroke of the piston rod. The rod position feedback is integrated into the drive. The self-contained hydraulic system is also integrated into the drive.

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### Advantages and benefits

- + **Compact, cost-effective drive solution with a high force density**
  - + **Only electrical interfaces present**
  - + **Simple system integration and quick commissioning; also ideal for retrofitting**
  - + **Very good dynamics and control loop performance with position control via a servo pump**
  - + **Integrated fail-safe function**
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## EMA electromechanical actuator



The EMA electromechanical actuator is a linear and oil-free actuator. It is mounted to the control valve and actuates it directly. The control variable is the stroke  $s$  of the actuator spindle. The spindle position feedback is integrated into the drive.

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### Advantages and benefits

- + **Compact, cost-effective drive solution with a medium force density**
- + **Only electrical interfaces present**
- + **Simple system integration and quick commissioning; also ideal for retrofitting**
- + **Very quick, precise and stable control**
- + **No costs for oil management**
- + **Integrated fail-safe function**

# Safety

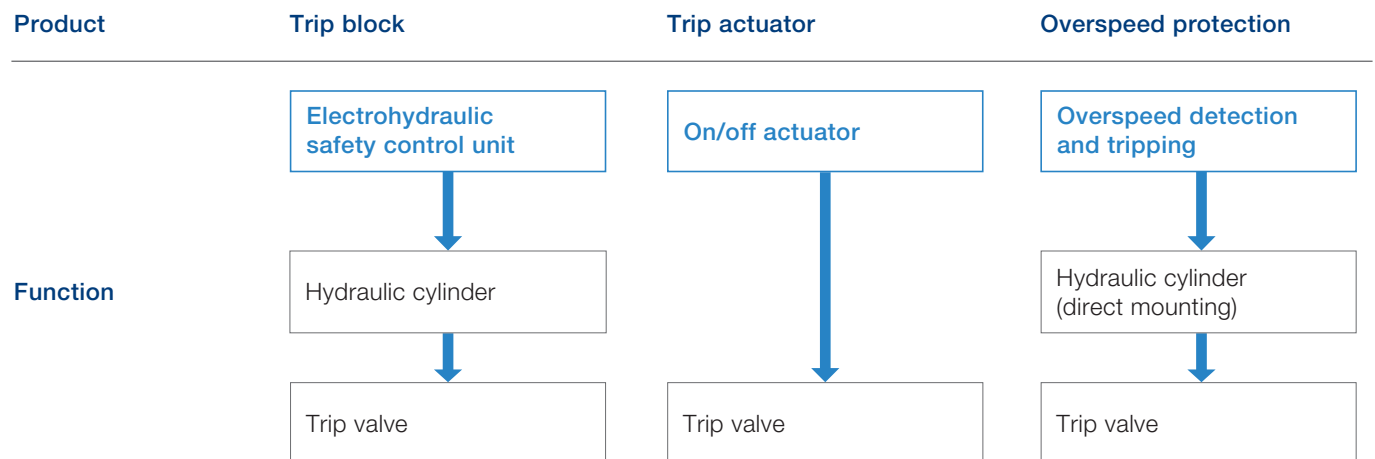
Avoiding overspeed is the primary task for the protection equipment of turbomachinery. For these protection systems, we offer a range of actuators to increase the operational reliability of your plant.

The design of the products is compact and modular. This allows nearly all standard safety concepts for turbine control systems to be implemented in a cost-effective way. As an option, the products are available in explosion-proof design.

## Advantages and benefits

- + In the event of a trip, your turbine safely shuts down via our actuators in the shortest possible time
- + You avoid immediate and consequential damage resulting from turbine overspeed

## Three product groups for actuating trip valves

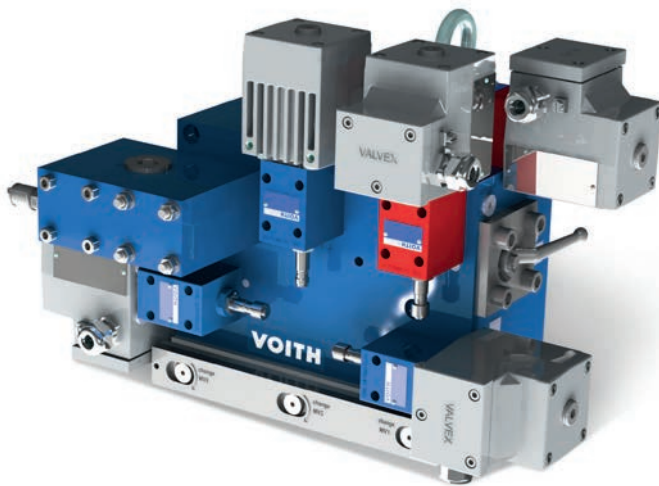


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# Actuators for protection systems

## Trip blocks



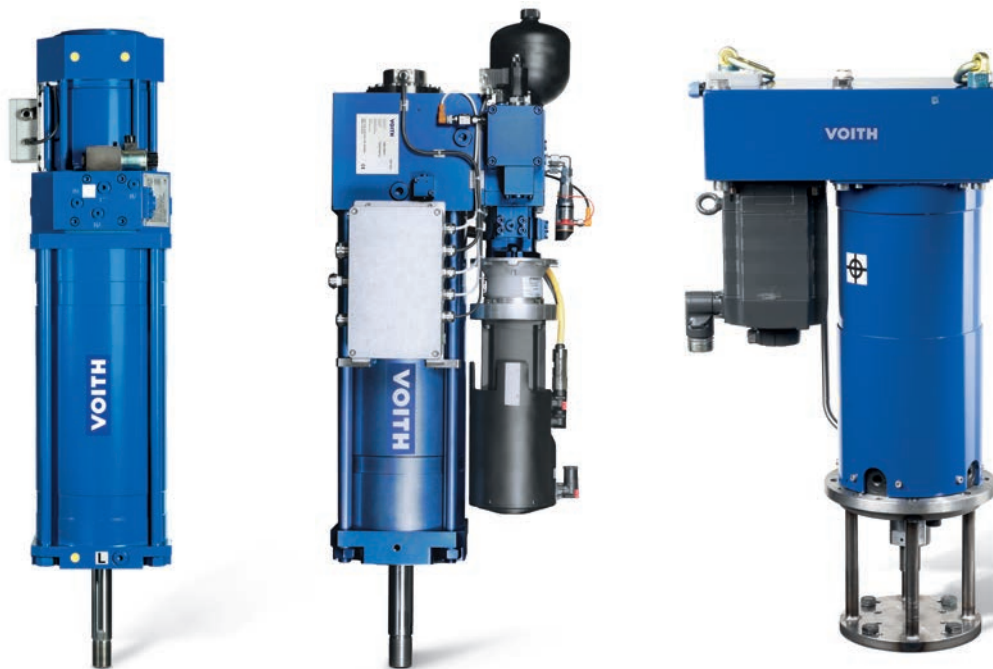
A trip block is an electrohydraulic safety control unit. It directly regulates the hydraulic cylinder that actuates the trip valve. The structure is triple modular redundant with a 2-out-of-3 voting (2oo3). A high flow rate allows very short trip times. All the solenoid valves can be isolated from the hydraulic system.

### Advantages and benefits

- + Very well suited to high-availability systems;  
MTBF = 100 000 years
- + Excellent safety and availability through triple modular redundancy and 2-out-of-3 voting (2oo3)
- + Less sensitive to contaminated pilot oil
- + Diagnostics for the trip valve using a partial-stroke testing function

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## Trip actuators



A trip actuator is a linear on/off actuator, which is mounted to the trip valve and actuates it directly. The drive solution is compact and forms a complete unit. We offer three different trip actuators: electrohydraulic, self-contained electrohydraulic and electromechanical drives.

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### Advantages and benefits

- + Simple system integration and quick commissioning; also ideal for retrofitting
- + Diagnostics for the trip valve using a partial-stroke testing function
- + Integrated fail-safe function



# Controllers

Voith control systems are suitable for all steam turbines used to drive generators, compressors, pumps and other mechanically driven machines.

The control systems are available in two designs:

1. Standard controllers that are “pre-engineered” with standard software
2. Customized controllers with adapted software, widely differing functionality and optional redundancy

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## Advantages and benefits

- + Your turbine or compressor operates safely, reliably and efficiently with our controllers
- + You ensure the productivity of your plant and the quality of the produced products
- + Your turbine or compressor operates very efficiently with proven and multiple tested software algorithms. Our engineers are continually refining these algorithms and adapting them to the current state of the art

- 1 TurCon DTc in quality control
- 2 TurCon DTe-R2 final test
- 3 TurCon DTm in service







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# Control systems

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## TurCon DTm/DTc standard controllers



Standard controllers have a modular design with industry-proven hardware. The software is “pre-engineered” and the operation of the user interface is intuitive. After connection and configuration, the standard controllers are ready for operation. Integration into a distributed control system (DCS) is easy with various communication interfaces. A 7” TFT LCD control panel with touchscreen interface is used for operation.

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### Advantages and benefits

- + **Very flexible controller – suited to steam turbines of all power classes**
- + **Simple, fast and cost-effective system integration; ideal for new plants and for retrofitting**
- + **Convenient and modern HMI**

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## TurCon DTe-R2-CC customized controller



Customized controllers are designed with standard industrial-proven hardware. The hardware is fault-tolerant with a redundancy that is scalable over wide ranges. The software is based on proven algorithms for turbomachinery control. The functionality is scalable to almost any degree desired. The controllers optionally offer teleservice for remote maintenance, data analysis and system optimization.

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### Advantages and benefits

- + **Adaptable control system with maximum reliability and availability**
- + **Suitable for all steam turbines, even those with special control functions or in system-critical applications**
- + **Compressor control can be integrated as an option**
- + **Control of motor-driven compressors is also possible**
- + **Communication interfaces to the control system for diagnostics, condition monitoring, etc.**
- + **Extensive fault detection and diagnostics**
- + **Redundant components can be exchanged during operation**



# Services and engineering for actuators and control systems

Our goal is to ensure that your production runs according to your expectations – reliably, efficiently and profitably.

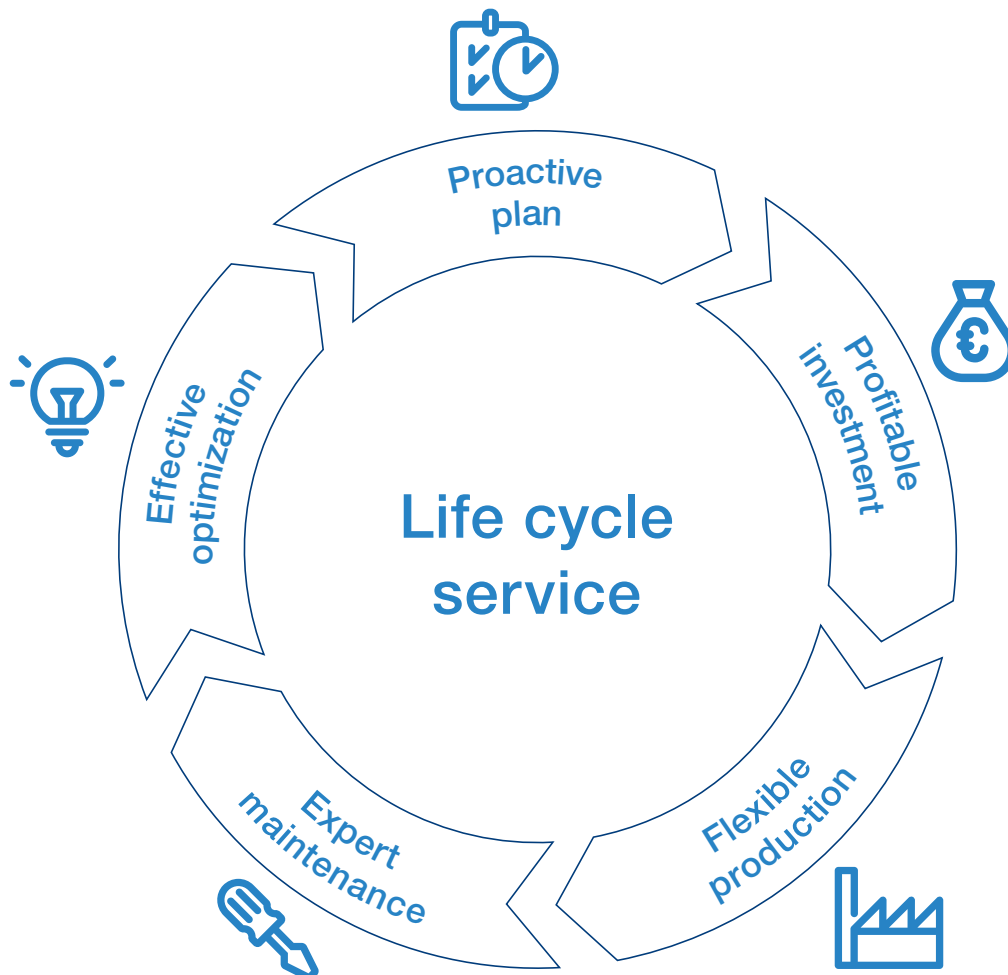
We are partners over the entire life cycle of your turbine or plant. This starts with the planning, continues during use and also includes the development of cost-effective concepts for operation, maintenance and repair.

Service from the manufacturer pays off because we know our products inside and out. The engineers and technicians of Voith's service network are available worldwide. Voith maintains service and sales facilities in all regions of the world.

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## Advantages and benefits

- + Our services allow you to ensure the productivity and efficiency of your system
  - + You profit from our product and technology know-how over the entire life cycle of your turbine or system
  - + Our service experts have a high level of competence in the industry. They develop customized service and engineering solutions that help you minimize operating costs and downtime
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## Retrofit and modernization

- Advice and support, for example:
  - Analysis of the installed technology
  - Demonstration of potential improvements
  - Designation of the new technology according to your requirements
  - Suggestions for products and systems with corresponding range and offers
- Disassembly of old components
- Assembly of new components
- Commissioning
- Production support during the start-up phase
- Training for operating and maintenance personnel

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### Advantages and benefits

- + Increasing the productivity of your system with customized solutions
  - + Improving process quality with precise control systems
  - + Increasing energy efficiency with advanced actuators and control systems
  - + Decreasing maintenance and repair costs with reliable, easy-to-service components
  - + Enhancing system availability with a secure supply of spare parts
  - + Expanding functionality and easy servicing with new technologies (for example, the Internet of Things [IoT] environment)
  - + Easy migration to a new technology by way of competent, complete service
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## Technical service and engineering

- Technical advice and engineering support, for example:
  - Answers to questions about products and their use
  - Help in troubleshooting the system
  - Performing failure modes and effects analysis (FMEA)
  - Involvement in optimizing the total cost of ownership (TCO)
  - Suggestions for increasing productivity and optimizing the process
  - Developing strategies for operation, maintenance and repair
- Inspection of the actuators and control systems (even for non-Voith products)
- Standardized product training and system-specific training
- Consulting via phone, e-mail or on site
- Remote and on-site diagnostics

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### Advantages and benefits

- + Increased machine and system availability resulting from optimized operation
  - + High productivity and product quality by using the best processes
  - + Low total cost of ownership (TCO) as a result of investment and operating costs that have been carefully considered
  - + Products used in the best possible way as a result of training by the manufacturer with first-hand expertise
  - + Cost and time savings as a result of competent and prompt advice
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## On-site maintenance, repair and overhaul

- Preventive maintenance and repair of the actuators and control systems:
  - On-site maintenance and inspection
  - On-site overhauling
  - On-site repairs
- Installing and commissioning
- Production support during the start-up phase
- Servicing the actuators and control systems of other manufacturers

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### Advantages and benefits

- + High system availability by providing maintenance and repair at the highest level
  - + Predictable maintenance costs and personnel schedule planning due to targeted preventive maintenance
  - + Maximum productivity due to consistent turbine performance
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## Maintenance, repair and overhaul with Voith

- Overhaul
- Repairs
- Maintenance
- Inspection
- Update the products with the latest technology

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### Advantages and benefits

- + A long lifetime and high availability of the products due to the highest level of maintenance and repair
  - + Maximum cost transparency from binding quotes and reports on the findings
  - + More effective and affordable service as a result of the manufacturer expertise
  - + Consideration of the maintenance time window due to flexible personnel schedule planning
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## Original Voith spare parts

- Faster and more reliable global shipment of stock spare and wear parts, even express delivery upon request
- Standard spare parts are stocked in our service branch offices worldwide
- Advice on identifying and selecting spare parts
- Spare parts are available for up to 20 years, after which replacement products are available
- Consulting on your spare parts management
- Preparation of spare part packages that match your Voith products precisely and that meet your operating conditions
- Continuous refinement of the original spare parts

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### Advantages and benefits

- + **Secure spare-part procurement using the manufacturer's expertise**
  - + **A long product lifetime due to perfectly matched spare parts**
  - + **High system availability due to secure spare-part supply**
  - + **Functionally reliable spare parts resulting from 100% final testing**
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