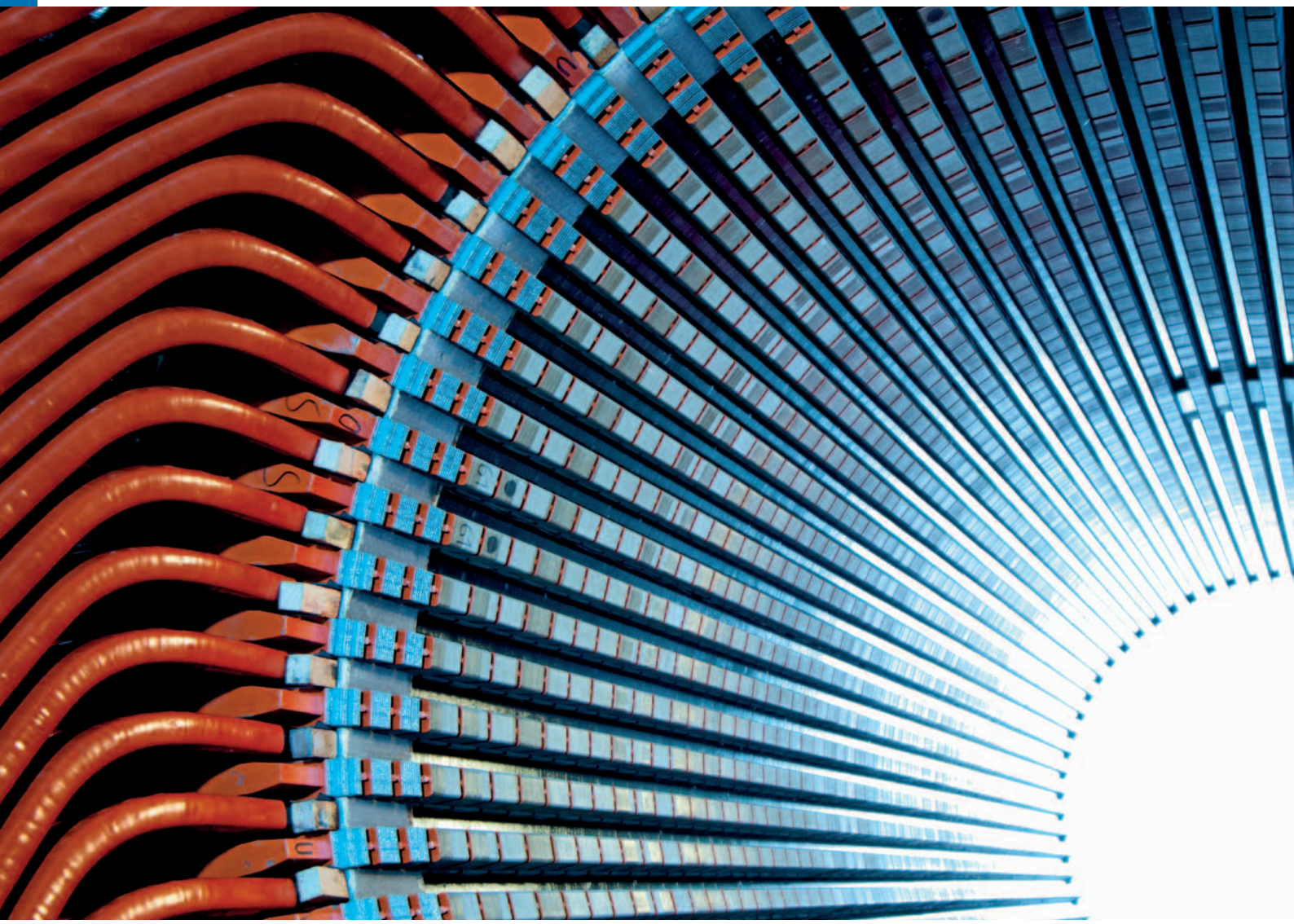
ANDRITZ Hydro

Turbo generators

Best quality for thermal power plants



ANDRITZ HYDRO

Turbo generators

International technology Group ANDRITZ is a globally leading supplier of plants, equipment, and services for hydropower stations, the pulp and paper industry, the metalworking and steel industries, and solid/liquid separation in the municipal and industrial sectors.

ANDRITZ HYDRO supplies electromechanical equipment for hydropower stations, holds a top position in the growing hydropower plant service, refurbishment, and upgrade market and supplies turbo generators for thermal power stations.

The success of ANDRITZ turbo generators, as part of ANDRITZ HYDRO, is derived from over 120 years of experience in engineering and manufacturing of electrical equipment. In 1892 the “Pichlerwerke” was founded in Weiz, Austria. In 1922 the company name was changed into “ELIN”. Since 2006 we are globally acting as ANDRITZ HYDRO.

Located in the green heart of Austria, in Weiz, the development, design and manufacturing of turbo generators started in the 1950s. Since then our product range developed and covers currently turbo generators up to 350 MVA.

Our goal is to deliver turbo generators with newest technological standards, providing flexibility to changing grid conditions and delivering highest possible efficiency. Until today more than 1,100 turbo generators with a total output of over 110,000 MVA were manufactured by ANDRITZ HYDRO.

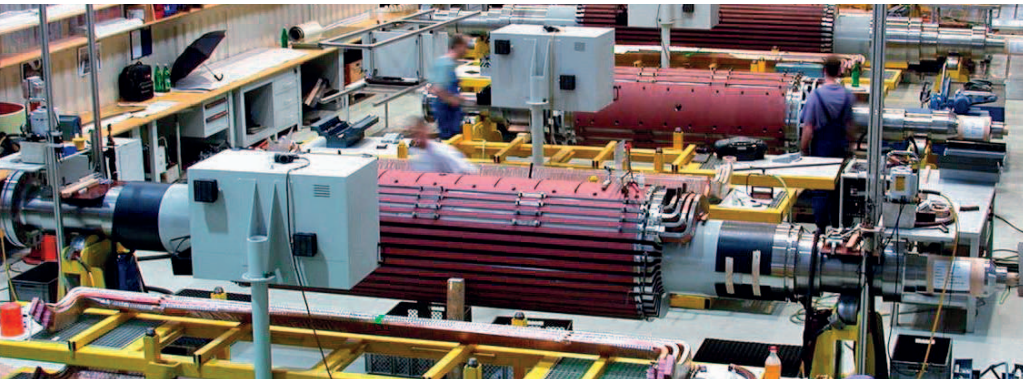
Close cooperation and permanent information exchange between the “Center of Competence for turbo generators” (CoC) and all other research facilities of ANDRITZ HYDRO guarantee the utilization of newest technological solutions, constant technical enhancement, and state-of-the-art design of our products.

Continuous growth and implementation of cost effective manufacturing processes led to the development of manufacturing centers, specialized on specific generator product lines and its different requirements in manufacturing technologies and work processes.

ANDRITZ HYDRO develops, designs, and manufactures state-of-the-art turbo generators for primary drivers as gas-, steam turbines and combustion engines with long life cycles and focus on highest electrical efficiency with minimal losses during operation.

Highlights:

- First turbo generator delivered in 1958
- Over 120 years of experience with electrical rotating machines
- More than 1,100 turbo generator units manufactured
- More than 110,000 MVA total output
- Operating in more than 60 countries



Turbo generators and services

Solutions for the thermal industry

The turbo generators of ANDRITZ HYDRO are utilizing the thermal energy independent of its different types (gas, steam, biogas etc.). We offer an optimal and reliable solution for thermal driven applications depending on the various fields of operation – as in industrial applications to cover own consumption or in combined cycle power plants for generation of electrical power.

The product range covers air-cooled and hydrogen-cooled turbo generators up to 350 MVA. Electrical auxiliaries, such as generator synchronization, protection, and excitation systems, are covered by our own products with optimal alignment to the chosen generator, the electrical layout and grid requirements. Our know-how in electrical power systems allows full customer support for topics like grid compliance, electrical simulations and electrical plant layout.

During the life cycle of the generators, service and rehabilitation can be provided to the customer, assuring the preservation of the assets and minimizing standstill, unplanned maintenance and improving the reliability and availability of the plant.

Scope:

- Multi-pole generators
- 4-pole generators
- 2-pole generators
- 50 Hz and 60 Hz applications
- Primary drive: gas/steam turbines, combustion engines
- Output: up to 350 MVA

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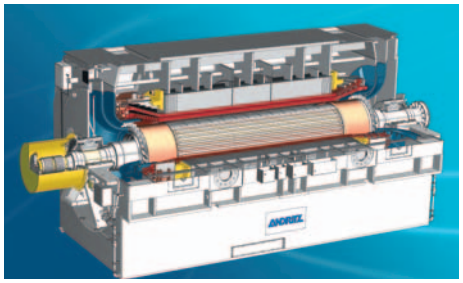
2-pole generators

Air-cooled

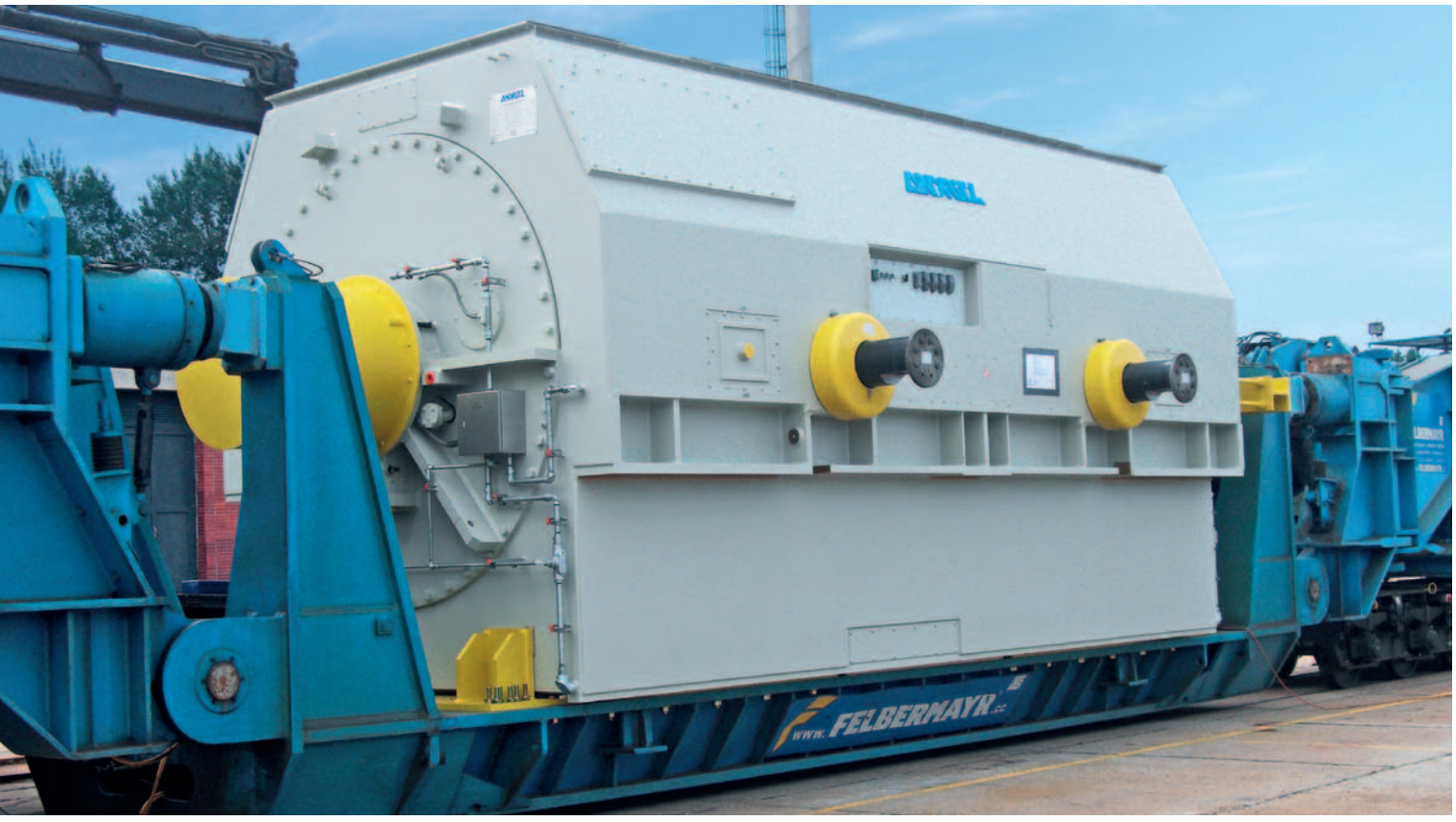
Within ANDRITZ HYDRO's turbo generator portfolio, air-cooled 2-pole generators can be highlighted due to several advantages. Among them are the appeal of low investment directly connected with the reduction of on-site construction time, low maintenance costs, high flexibility to changes of grid conditions and robustness against grid faults together with a high reliability and maximal efficiency. The initial costs are low by using compact and standardized models, avoidance of complicated auxiliaries and easy "plug & play" installation of the generator delivered in assembled condition. The chosen design of the rotor assures uniform temperature distribution. The stator winding is designed as a bar winding using roebel bars to ensure equal temperature distribution and low losses.
The insulation is based on the ANDRITZ HYDRO VACUBAND High Voltage Insulation System. Together with the Vacuum Pressure Impregnation Technology (VPI), excellent electrical, mechanical and thermal properties are assured.

Air-cooled 2-pole generators can be equipped with various cooler types. These include totally enclosed water-to-air-cooling (TEWAC), closed air-to-air-cooling (CACA), or open-ventilated (OV) cooling and can be chosen according to the power plant requirements and conditions. Together with the possibility to use either a static or brushless excitation system a high flexibility can be offered. Our air-cooled 2-pole generators range up to 215 MVA.



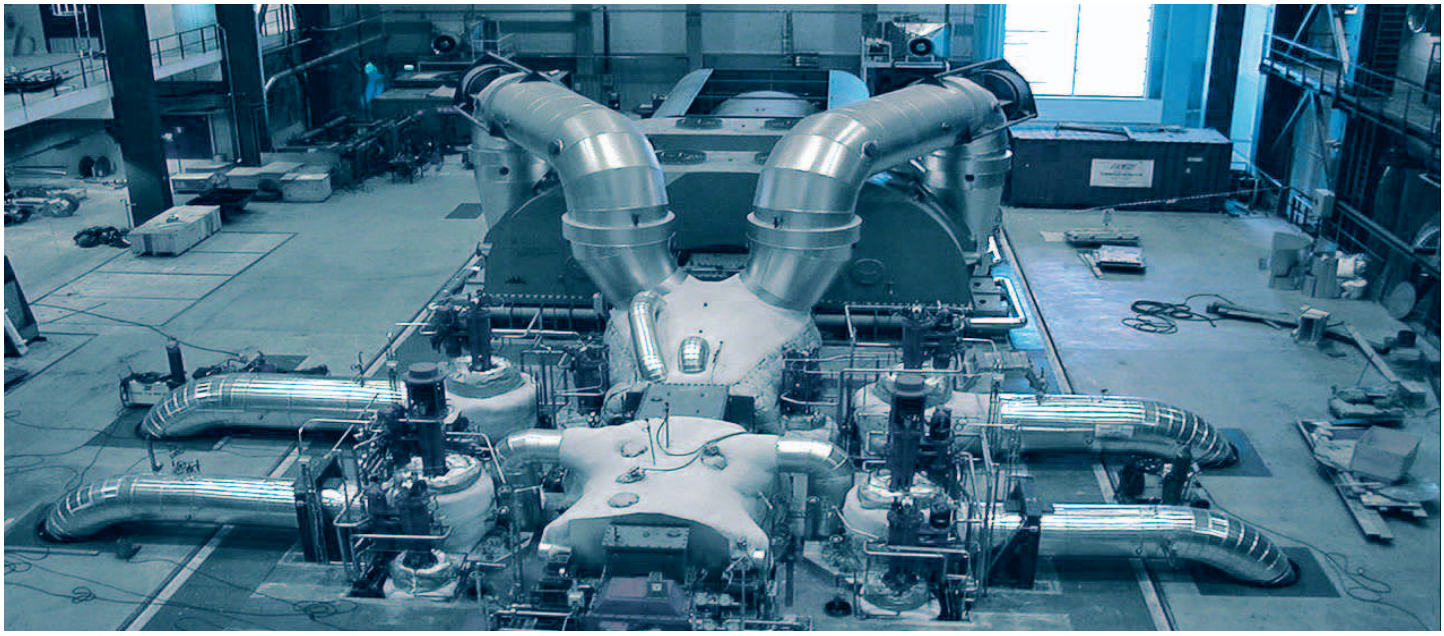
Technical features:

- Frequency: 50 Hz
- Speed: 3,000 rpm
- Voltage: 10.5 kV - 15.75 kV
- Cooling: TEWAC, OV, CACA
- Excitation: brushless (w/o PMG), static
- Output: up to 215 MVA



2-pole generators

Hydrogen-cooled



Hydrogen-cooled turbo generators are characterized by a compact design, lowest losses in operation and the highest possible efficiency due to the characteristics of hydrogen (H_2) – having better heat dissipation than air, low density and thermal conductivity. The absence of oxygen (O_2) prevents from damaging the generator's high voltage insulation system by any corona activity in the stator windings of the generator.

The generator with its compact dimensions generates an output up to 350 MVA.

The generator's interior is sealed from the atmosphere, which minimizes the effects of dust, salt, humidity, and any other aerosols. Together with a rotor shaft, manufactured from a single piece, solid forging from a vacuum casting high safety standards are ensured for the daily generator operation.

Inside the sealed stator housing hydrogen gas transports the heat of the active parts. It is cooled by gas-to-water heat exchangers. For filling and removal a gas system comprising compressed air, inert gas and hydrogen is used. It allows a staged and controlled filling and emptying procedure.

Technical features:

- Frequency: 50 Hz
- Speed: 3,000 rpm
- Voltage: 15.75 kV
- Cooling: hydrogen (H_2)
- Excitation: static
- Output: up to 350 MVA

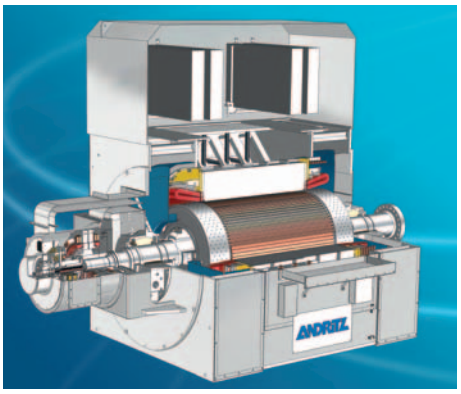
4-pole generators

Our thermal driven 4-pole generators offer high efficiency, output up to 60 MVA combined with low weight. A simplified foundation plate allows quick alignment and easy installation. The generator is available with totally enclosed water-to-air-cooling (TEWAC), closed air-to-air-cooling (CACA), or open-ventilated (OV) cooling and can be chosen according to the power plant requirements and conditions.

The excitation type (brushless or static) can be adapted to customer demands. Rather than having only a portfolio of "off the shelf" products, one of the main advantages of ANDRITZ HYDRO's turbo generators are the ability to customize products by using various options. A multiplicity of frame sizes and core lengths gives the possibility to achieve optimal electrical properties and best efficiencies at required operating conditions of the power plant. The robust design of the generator guarantees a long life-time and reduced maintenance costs.

Technical features:

- Frequency: 50 Hz and 60Hz
- Speed: 1,500 rpm / 1,800 rpm
- Voltage: 3.3 kV - 13.8 kV
- Cooling types: TEWAC, CACA, OV
- Excitation: static, brushless (w/o PMG)
- Output: up to 60 MVA

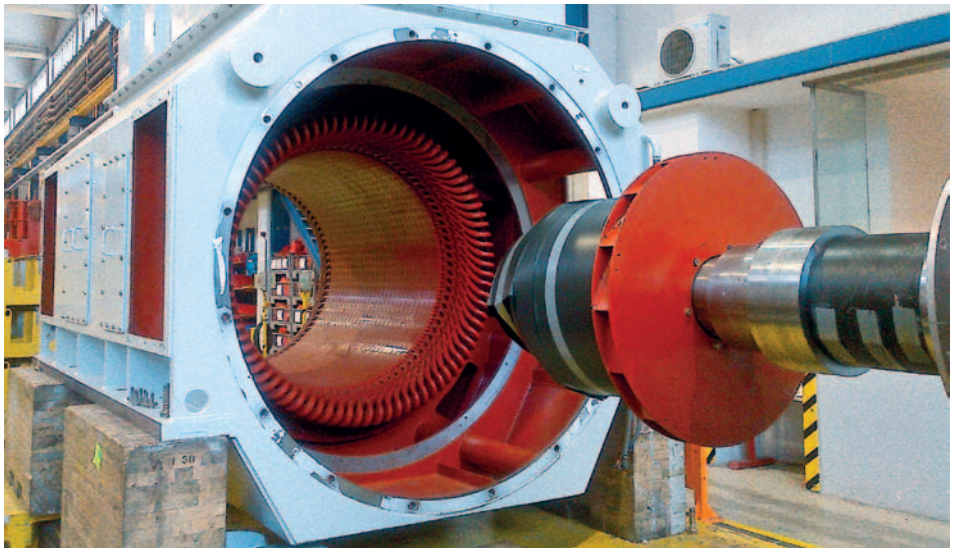


Multi-pole generators

A bridging of ANDRITZ HYDRO's multi-pole generators for hydro applications and our experience in turbo generators results in our ability to design and manufacture various types of air-cooled multi-pole generators, covering any speed, voltage and output. These turbo generators fulfill specific customer demands in terms of vibration resistance, electrical stability, high inertia, mounting arrangement, cooling design and offer the choice between brushless or static excitation systems.

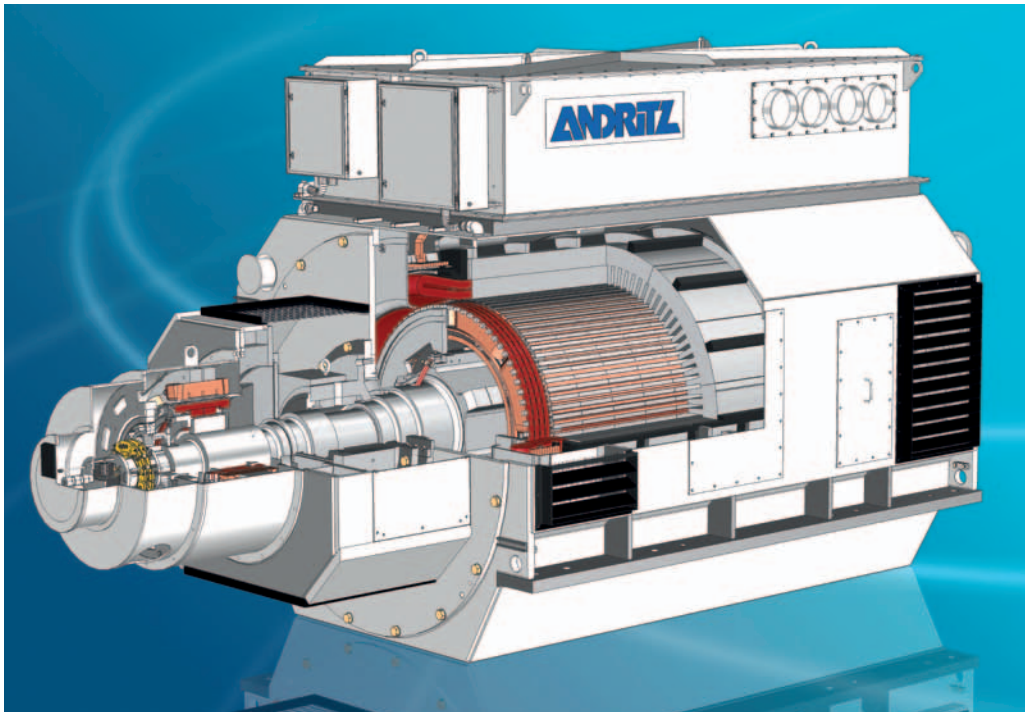
The depicted gas motor driven multi-pole generator was designed for decentralized, small size power plants utilizing combustion engines for power generation. It guarantees high flexibility for changes of grid conditions, robustness against grid faults, and provides stabilization of the grid.

The open ventilation design allows a quick and simple installation also in remote areas. Dual terminal outlet design includes dual internal wiring and allows an easy switch of the outlet terminals from left to right side. This allows maximum flexibility during plant set-up.



Technical features:

- Frequency: 50 Hz and 60Hz
- Speed: 900 rpm / 1,000 rpm
- Voltage: 3.3 kV - 13.8 kV
- Cooling: open ventilation
- Excitation: static, brushless (w/o PMG)
- Output: up to 15 MVA



Generator control panel

Highlights:

- More than 300 installed Generator Control Panels (GCP)
- Standardized and integrated solution
- Seamless communication for efficient data exchange
- Space-saving cubical design
- Modular and cost-effective concept

ANDRITZ HYDRO has a long term experience in delivering secondary technology for thermal power plants, which plays an important role for control and regulating the turbo generator set.

We offer a complete and integrated solution for the Generator Control Panel (GCP) consisting of:

- Excitation
- Electrical protection
- Automation & Control functions
- Synchronization
- Local unit control

Our standardized and integrated solution is based on a modular concept with a seamless data exchange between all devices in a generator control panel. With the usage of standard IEC communication protocols even the interaction between several generator sets is possible.

We deliver the automatic voltage controller (AVR) for brushless as well as static excitations systems. Depending on the requirements we are able to supply two-channel systems. As an option we supply an integrated power system stabilizer (PSS) functionality and static excitation systems for a static frequency coverter (SFC) start.

The electrical protection consists of all standardized functions, needed for turbo generator sets. We are able to select from a wide range of own developed protective relays with the required functionality included.

With the help of the automation system we are providing control functions, such as brush control or changing synchronization areas. Furthermore the automation system is used for interfacing to the dispatch centers. The integrated solution for the generator control panel will be concluded by an independent synchronization device.

For operation and displaying all corresponding data from one turbo generator set, a local unit control touch display will be assembled directly in the generator bay.

Based on our long-term experience, a wide-installed base for generator control panels and well-educated engineers, we ensure a sustainable solution for the station automation in your thermal power plants.

After-sales service and rehabilitation

The turbo generator division of ANDRITZ HYDRO with its long term experience is able to support customers during the operation time of facilities to reach their goals – the maximization of energy output, improvement of competitive position, and development of sustainable creation of value.

This is achieved by preserving highest availability and by minimizing the risk of unwanted standstills of generators and auxiliaries.

With the direct contact to the design and research departments, the provided service solutions always incorporate state-of-the-art technology for serviced generators.

With the technological experience and know-how, ANDRITZ HYDRO is able to service and maintain third party products as well.

Offered services:

- Inspections (generator, auxiliaries, excitation, protection systems)
- Diagnosis and analysis/technical support
- Stator/rotor rewind
- Delivery of spare parts
- Erection and commissioning
- Refurbishment
- Exchange of retaining rings
- Dynamic balancing
- Repair of third party products
- Upgrading

Research and development

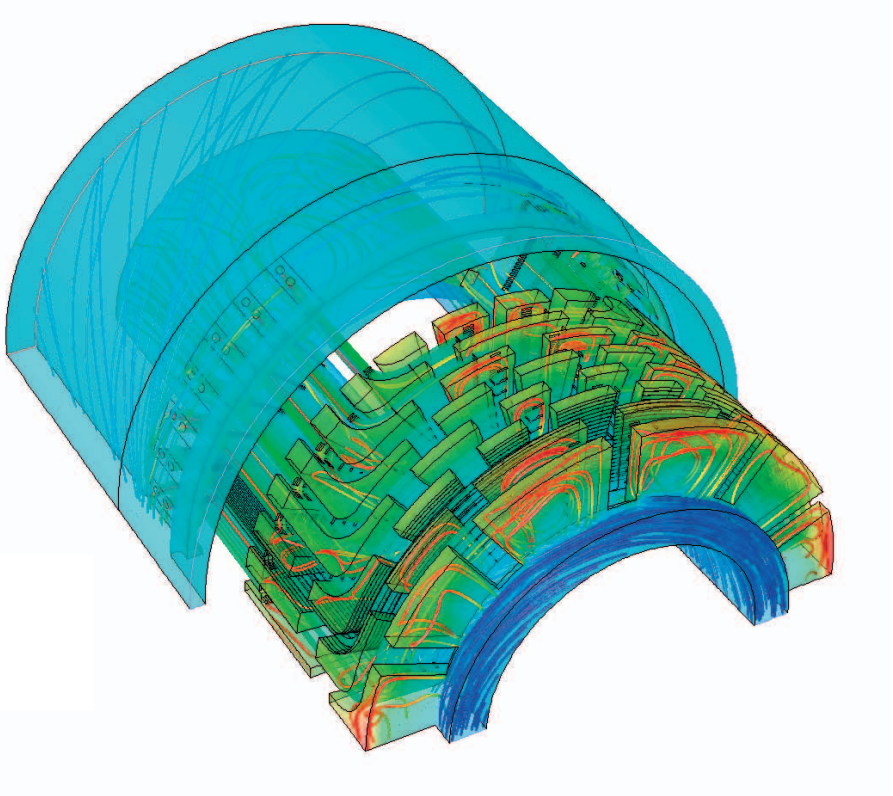
ANDRITZ HYDRO has more than 120 years of experience in design and development of electrical equipment. Due to the changing market conditions, customer requirements, and technological developments, there are still many challenges for research and development (R&D), comprising generator technology, automation, auxiliaries and grid compliance.

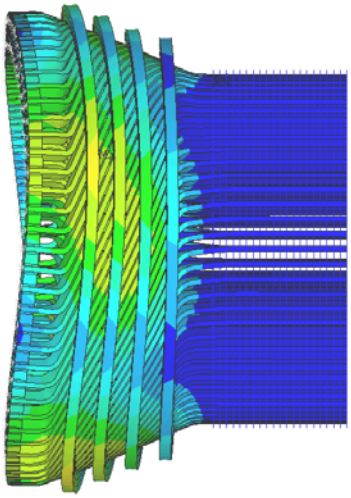
Our global R&D activities are focused on achieving improvements in processes, materials and design methods.

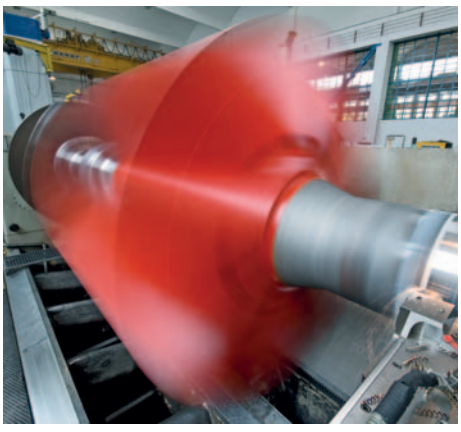
Besides the finite element analysis, which has become a standard tool for static and dynamic stress analysis, 2D and 3D electromagnetic field and frequency analysis, the computational fluid dynamics (CFD) is used for optimizing cooling air flow and investigations on heat transfer.

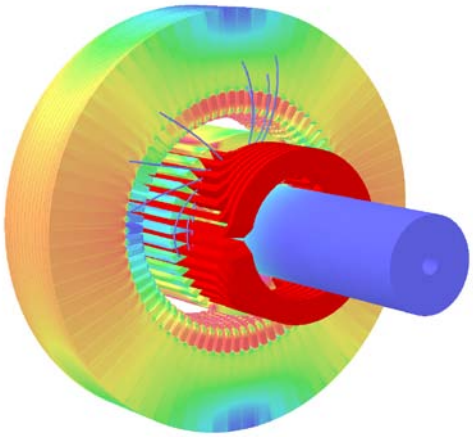
Flexibility of operation and robustness of electromechanical equipment over a long life cycle are today's major challenges. Therefore, the research activities are targeted at the optimization of mechanical and electrical performance.

By developing and applying numerical simulation methods and verification by measurements using internal test facilities (generator-, bar- and other high-voltage test fields, miscellaneous laboratories, balancing and overspeed facilities) and on-site as also by cooperation with universities we maintain a steady technological progress which meets the high expectation of our customers.









Our global presence

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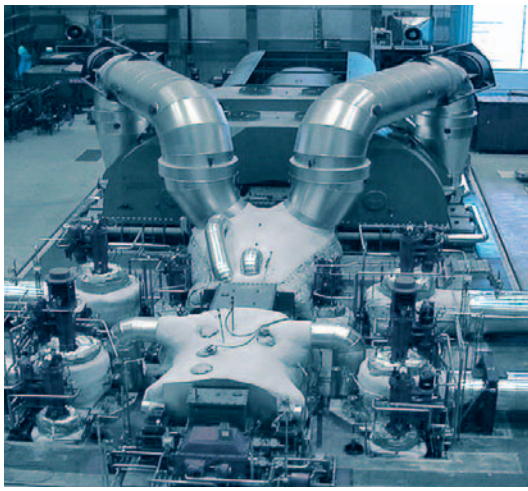


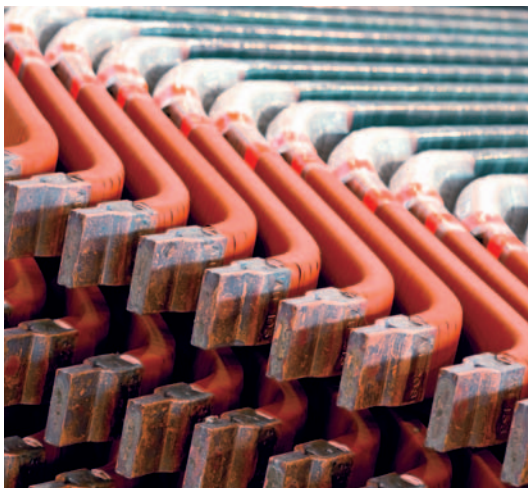

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