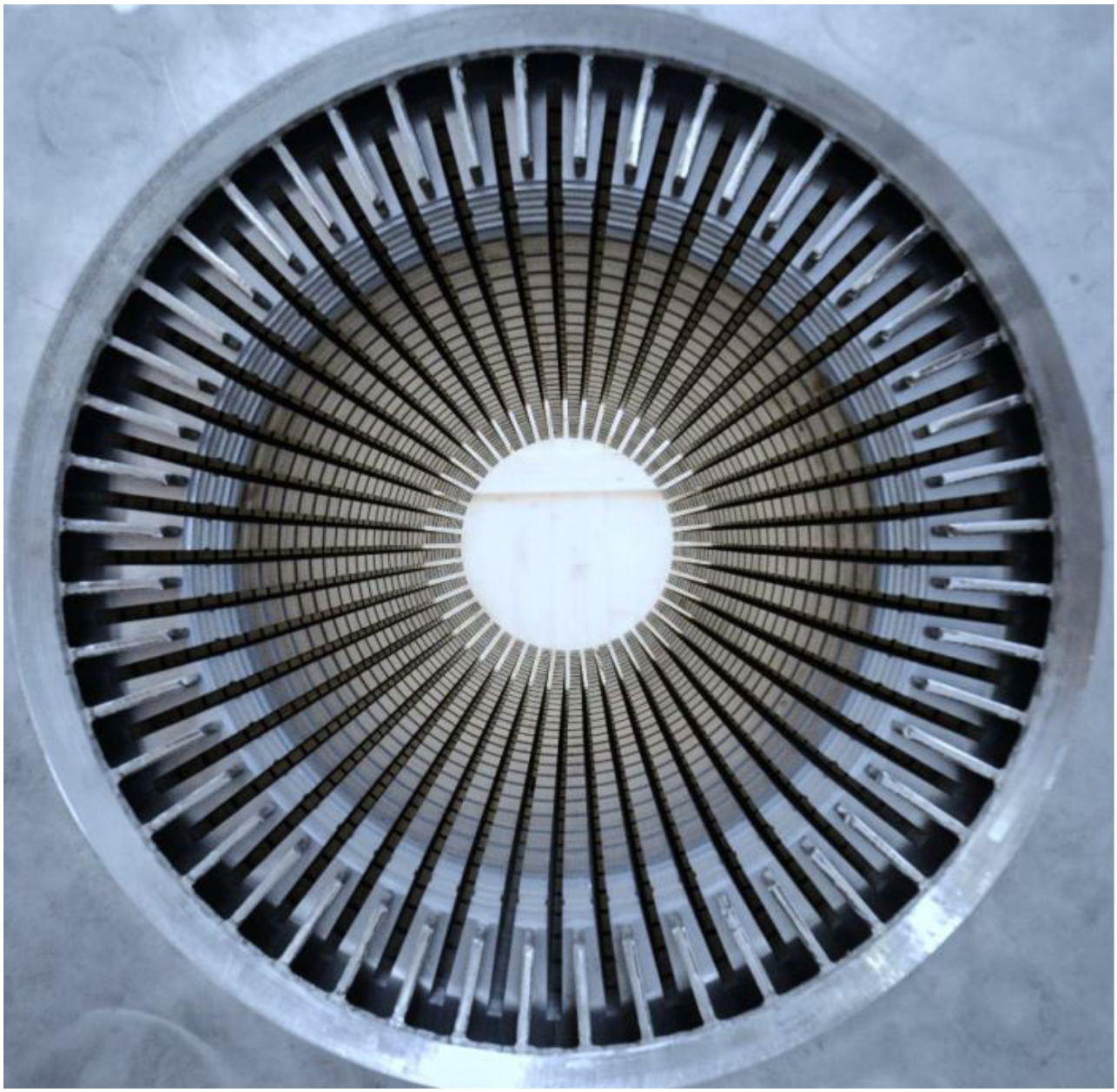
Services for hydro generators

For the reliable operation of hydro power plants



BIRR machines

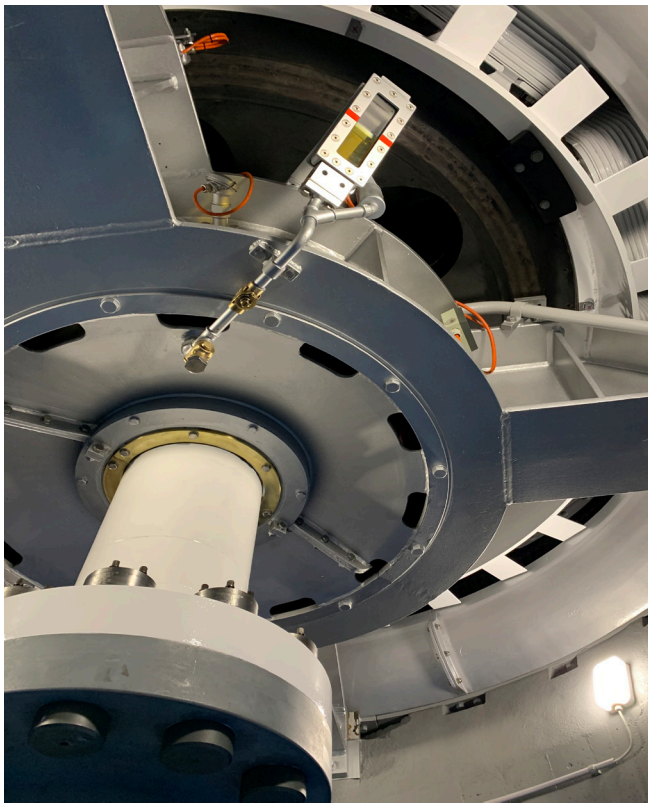
Service offer for generators

Birr Machines offers a comprehensive range of services for motors and generators, ensuring a high degree of reliability and availability for your equipment. Any unplanned downtime of these key components can result in a massive economic impact. Regular maintenance and periodic servicing are therefore a prerequisite for reliable operation.

Birr Machines offers all the necessary services to ensure a long service lifetime for your motors and generators. In the wake of the liberalisation of the electricity market especially, the reliability and availability of an installation are crucial for economic success, since you as an energy producer often have to provide appropriate guarantees.

Our employees have long-standing experience in the field of electrical engineering and bring with them specialised technical knowledge, as well as the required production and inspection know-how. The key components are manufactured in our Swiss factory at Kleindöttingen AG.

As a complete supplier, Birr Machines can perform all servicing and repair work for your power plant. This ensures the optimal coordination and planning during the work.



Regular maintenance ensures uninterrupted and reliable operation

Depending on the condition of your machines, maintenance and servicing work is required for restoring operational safety and preventing the accelerated ageing of components.

Based on our extensive survey of findings, which includes electrical measurements and visual inspections as standard, and can also be extended to include structural strength and service life calculations or optimisation studies, the necessary work is defined in cooperation with the customer.

This way, longer-term measures can also be planned in good time in order to avoid generator failure or to improve its efficiency through small adaptations.

Condition assessment
The condition assessment is carried out, on the one hand, via an intensive visual inspection and, on the other hand, via electrical measurements such as:

- Loss factor
- Insulation resistance
- Polarisation index
- Failure current measurement
- High voltage testing with either AC or DC

In addition, mechanical and electromagnetic thermal calculations can be carried out in an extended work order.

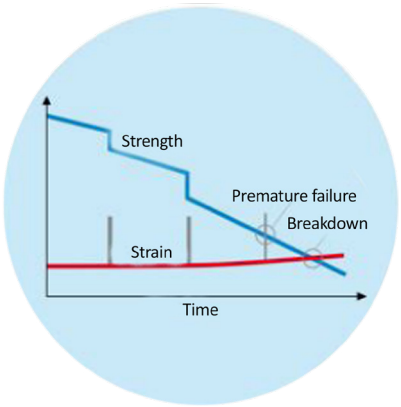
Once the information thus obtained has been analysed, corresponding maintenance, repair work and optimisations will be determined in dialogue with you.

The work is scheduled and implemented immediately or in the medium term, taking into account the urgency and any time constraints regarding the possible downtime of the plant.

When inspections are carried out on a regular basis, we can gain valuable insights into the ageing condition with the help of our «Birr Machines winding diagnoses» (winding diagnoses on the stator windings of rotating electrical machines).

Accelerated ageing of the stator winding insulation is thus detected at an early stage. This also allows you to plan more extensive overhauls and renewals of your engines and generators in a way that optimises their operation.

Regular maintenance ensures trouble-free and reliable operation



The materials and components of electrical machines are subject to thermal, electrical, mechanical and environmenta stresses. This leads to an ageing process that reduces the resilience of the materials over time (blue curve).

Operational strain – both permanent and short-term – is also present (red curve). There is a risk of breakdowns at the intersection of both curves.

For example, the «Birr Machines winding diagnosis» provides the necessary information to correct the course of the red curve (operating stress) and the blue curve (the stress capacity) through targeted measures.

Appropriate maintenance can help change the course of the red and possibly the blue curves, thereby avoiding premature failures.

Maintenance work
Birr Machines offers a complete range of maintenance and repair services:

- Cleaning and revision of the stator and poles, as well as exciter machines
- Bearing repairs
- Conversion to pressure oil relief
- Radiator inspections
- Instrumentation check

Stator inspections:
- Stator slot wedging: Re-wedging or completely new wedging
- Winding head as well as connectors and deflector: Renew the stabiliser, fasteners/spacers and terminal corona protection.

Pole inspections:
- New insulation
- Renewal of pole connections
- Renewal of coil connections; if required, work can also be carried out directly on-site at short notice.

Exciter inspections:
- Commutator and slip ring inspection
- Brush replacement
- Diode replacement

Regular maintenance ensures trouble-free and reliable operation

An emergency? We'll help you!
Damage cannot always be avoided even with the best maintenance. In an emergency situation, we are able to help quickly and without bureaucracy.

Based on a detailed damage analysis by our diagnostic experts, possible repair measures are suggested. In many cases, temporary repairs can quickly bring the system back into operation until an extensive repair can be carried out at a later stage.

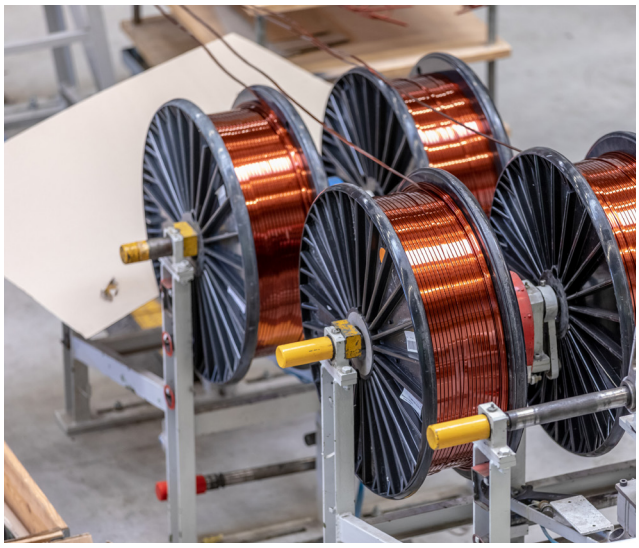
For example, in the event of a stator earth fault, it is possible to switch out the defective coil. Therefore, appropriate electromagnetic clarifications regarding the permissible load of the generator in such a case are required. If the analysis is available, operations can usually be resumed quickly.

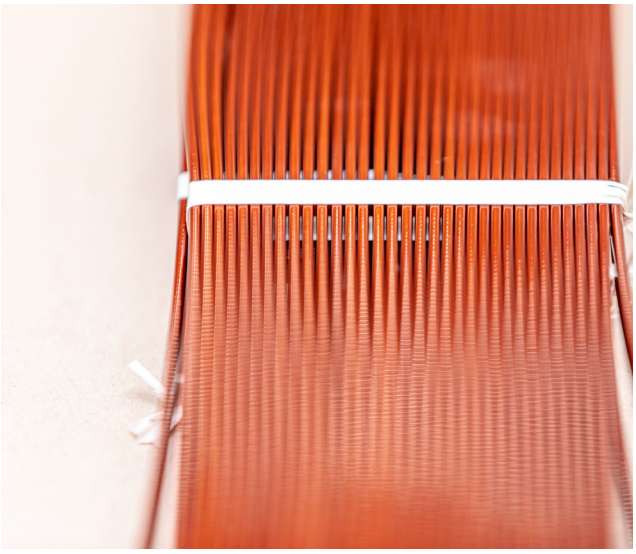
Partial renewals and the replacement of components

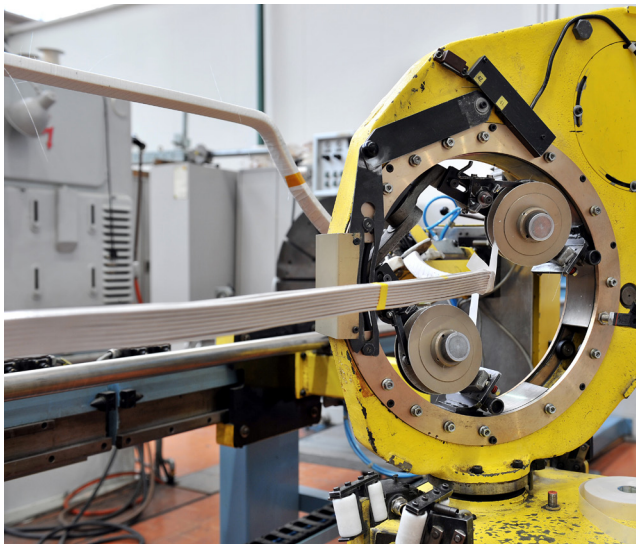
Generators are extremely durable machines. Nevertheless, individual components reach the end of their service lifetime after a certain period of operation. The risk of unplanned breakdowns and major repairs increases. From this point of view, replacing components is a good idea, as this can eliminate any technical problems that may exist.

Stator winding

When replacing the stator winding in the existing laminated core, Birr Machines uses an insulation system that has been tried and tested on the market for decades. The production is based on a vacuum pressure impregnation process, whereby all the components such as corona protection, slot filling and winding head support are optimally matched to each other. Even if only these components are replaced, copper losses can be reduced, at least for very old machines.







Partial renewals and the replacement of components

Poles
The poles are exposed to high mechanical stresses during operation. This especially applies to fast-running machines with a large number of start/stop cycles. This can cause problems with the pole coil support, as well as with the winding isolation, thereby affecting reliable operation.

It is recommended to re-insulate the pole winding and pole cores or to renew the pole coil supports. In some cases, it is advantageous to completely manufacture new pole coils. This can reduce the downtime of your machine, for example, as the prefabricated pole coils can be replaced in a relatively short time.

Furthermore, it is possible to improve the design in terms of reliability –
and in some cases efficiency.

In principle, a comprehensive crack inspection should be carried out on the existing poles and the rotor body, especially if your machines in question are subject to very high mechanical loads. In order to obtain precise knowledge about the static and cyclic loads and thus about the calculated service life, we can also carry out strength and fatigue strength calculations.

Partial renewals and the replacement of components

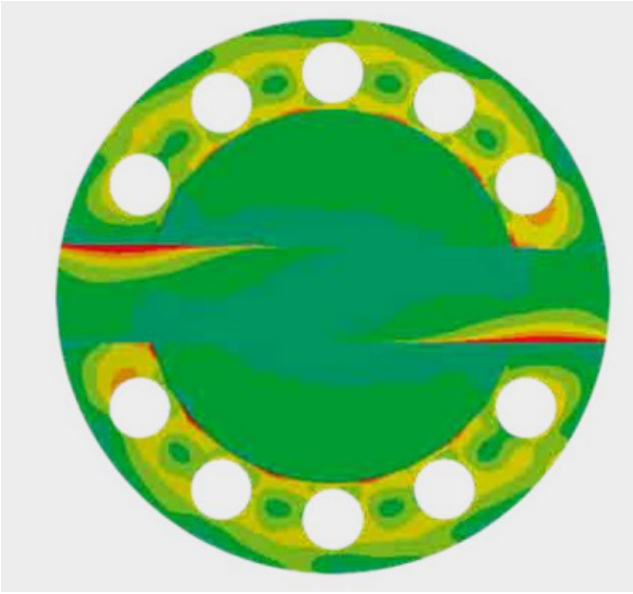
Optimum power transmission because of a new coupling!
In many power plants, the coupling between the turbine and generator is still designed with a cross wedge. In this design, the risk of fretting corrosion and cracking is very high.

We recommend a conversion to a friction coupling where the wedge is eliminated. The friction can be significantly increased by means of coated sheets between the flange surfaces. These sheets can be reused several times without any loss of effect. This ensures an even, flat surface and thus optimal power transmission, which cannot be achieved with a conventional and time-consuming coating.

Extend the service life of the bearings!
In the case of older installations, no special measures have been taken for the bearings during start-up. As a result, the load of the shaft lies directly on the bearing shells before starting up, and only with increasing shaft rotation does an oil film form between the shaft and the bearing shell.

Therefore, at each start-up, there is a risk of increased wear and tear. Here, it is advisable to retrofit the bearings with a high-pressure oil relief system. As a result, there is already a sufficient oil film between the bearing segments and the shaft at start-up, enabling wear-free and smooth operation.

Mechanical stress in coupling with cross wedge



Partial renewals and the replacement of components

Protect your generator from coal of carbon brushes!
Direct current exciter machines together with slip rings are still in use in many plants. The conversion to a brushless AC exciter machine with rotating diodes does not require carbon brushes.

The maintenance costs are reduced because, on the one hand, brushes are no longer needed and, on the other hand, contamination by coal dust is avoided. Birr Machines has experience based on more than 200 converted generators over the last 20 years.

Get rid of oil mist from your generator!
Oil mist, coal and brake dust can form a conductive, sticky layer on the machine windings. This leads to partial discharges, which can expand to short circuits.

With appropriate experience, the causes of these contaminations can be identified and eliminated through suitable measures. Often, the cause of oil contamination is the insufficient tightness of bearings and poor air pressure conditions in the machine. This can be remedied, for example, by using an oil mist extraction system combined with appropriate bulkheads.

Complete renewal – the key to profitable power plant operation

Economically profitable power plant operation permanently requires high availability and productivity. If your machine has reached the end of its service lifetime, it is advisable not only to replace individual components, but to carry out an overall optimisation. This is the only way to achieve the economic optimum for you as a power plant operator.

Furthermore, the installation of a new stator winding in a laminated core that is over half a century old also poses significant risks to operational reliability. We therefore recommend that the condition of the components that are to be left in the machine should be checked from a technical and commercial point of view.

Replacement of the stator sheet metal body and poles
If stator sheet metal bodies and poles are to be replaced, a redesign is first carried out with the involvement of all the relevant specialist areas.

Electromagnetic design

- Optimisation of the stator sheet metal body including the slot filling. By using low-loss sheets, the losses can be significantly reduced in some cases.
- Replacing the poles, which in some cases also eliminates mechanical problems

Complete renewal – the key to profitable power plant operation

Ventilation and Cooling
– Optimisation of the stator cooling channels
– Redesigning the fan and adjusting the cooling air volume

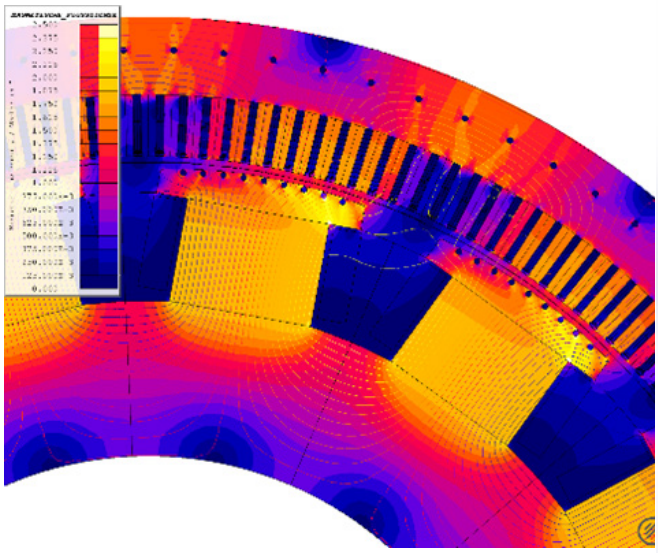
In many cases, the rotor body and, if necessary, the poles can be kept. During operation, these are exposed to high mechanical loads. This especially applies to fast-running machines with a large number of start/stop cycles.

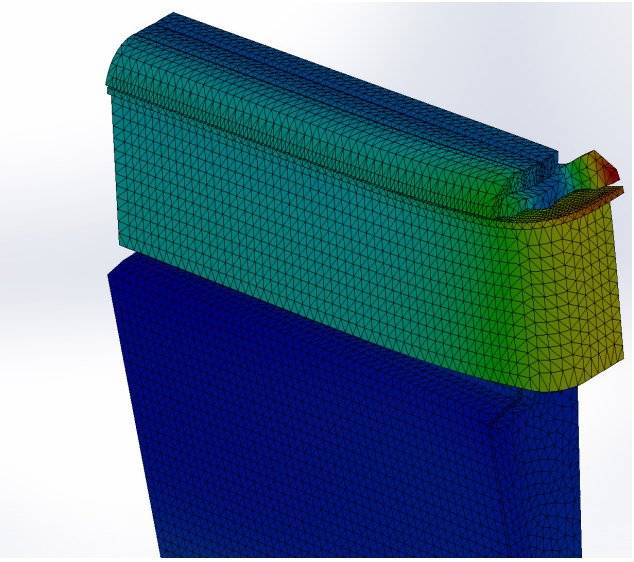
In addition to an intensive inspection for crack formation, it is appropriate to provide mathematical evidence of the expected remaining service lifetime. This can ensure that an investment is actually worthwhile while retaining existing components. After all, they are expected to perform for more than half a century.

Verification of mechanical durability
With each start/stop cycle, there is an expansion of the material and then a release of tension. Depending on the forces acting, the material can withstand a certain number of such load cycles before crack initiation occurs. If this is the case, a comprehensive mathematical investigation is necessary. Detailed finite element calculations are used to determine the locations with the maximum stresses, for example in the rotor mounting slots, the pole claws or the pole end plates.

Based on these results, we can use appropriate procedures to determine the expected remaining service lifetime (number of minimum possible load cycles). This ensures that the required service lifetime is actually achieved.

With the above-mentioned measures, losses can be significantly reduced, especially in the case of older generators, and additional investments can be quickly amortised through the additional production profit.





Complete renewal – the key to profitable power plant operation

Reduce downtime to a minimum – thanks to prefabricated components
The rewinding or recalibration of a stator is usually associated with a production stoppage. We offer the option of prefabricating a complete stator or at least a slide-in stator and replacing it in the shortest possible time. Through careful planning and conscientious preparation, downtimes and thus your production loss can be reduced to a minimum.

The stator can usually be replaced within about four weeks. For smaller machine diameters, the stator laminators package including winding can be prefabricated and the so-called slide-in stator can be installed in the existing housing within a short period of time. With this solution, Birr Machines has now renewed more than 40 machines.

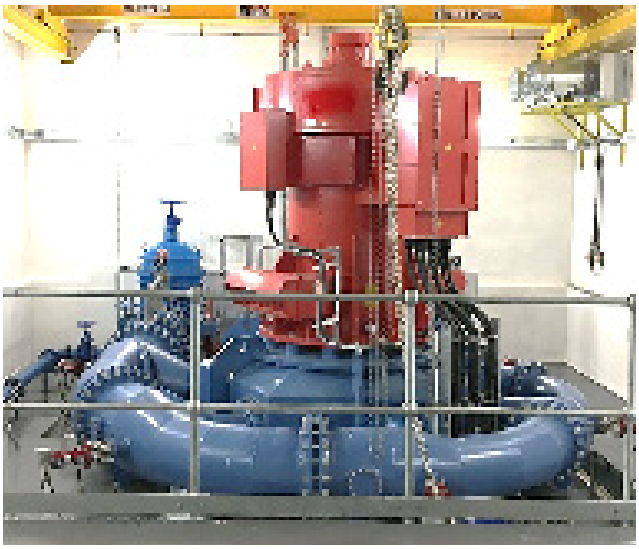
New installations/compact generators tailored to your needs

New installations/compact generators tailored to your needs
In the compact installation sector (up to approx. 50MVA), Birr Machines is your partner for customised solutions for new installations of compact generators. Even with higher volumes, we will be happy to support you on request.

Our experienced specialists develop the system for you, adapted to existing or new infrastructures. The latest technologies and the most modern measuring equipment and software solutions are used. In cooperation with our customers, we develop optimal and cost-effective solutions.

Our generators can be equipped with a wide variety of prime movers. In addition to hydropower, diesel engines, gas turbines, steam turbines and condensers are used as prime movers.

Excitation systems are selected to suit the application and user preferences such as static excitation (slip rings) or brushless excitation DC or AC. With our proven isolation system, we cover voltages up to 15.2kV in the 50 to 60 Hertz frequency range.



Birr Machines production facilities

Birr Machines produces key components such as stator bars, coils and rotor poles in its own factory in Kleindöttingen AG according to customer specifications, with assembly also taking place here.

Our manufacturing facility is at the cutting edge of technology.
The employees have many years of experience in the construction of electric machines and ensure the highest quality.

Birr Machines production facilities

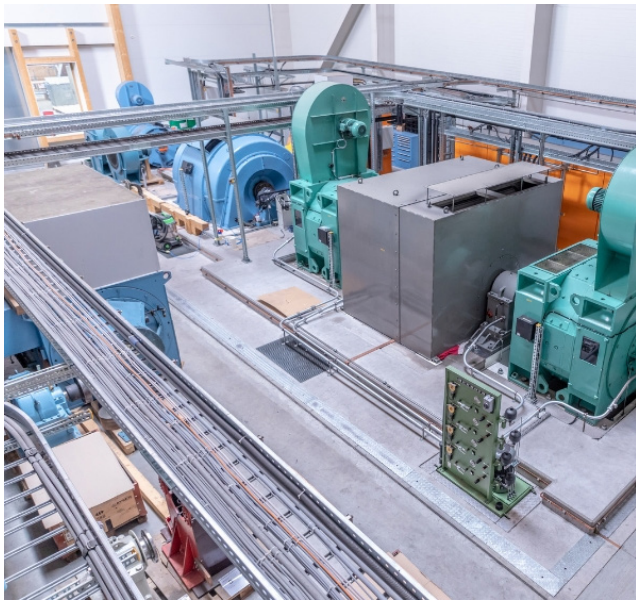
Production of stator windings
We use an insulating system originally developed by BBC/ABB for bars and winding production, based on the vacuum pressure impregnation process. In this process, the bars are insulated with mica paper tape and impregnated under vacuum with resin.

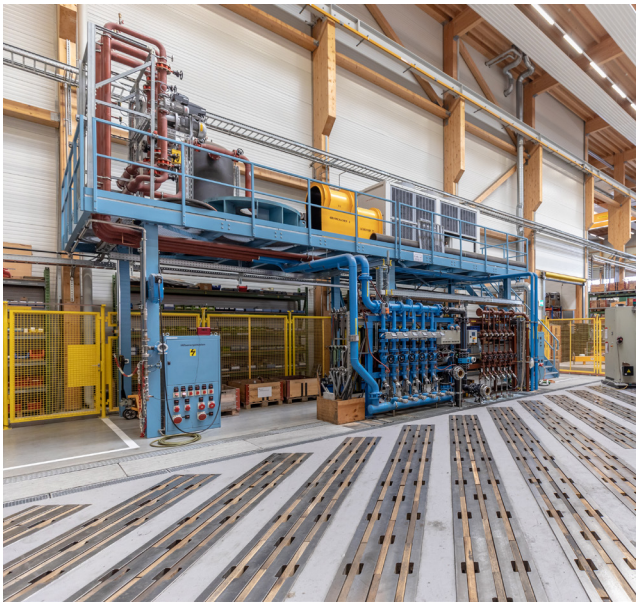
State-of-the-art process monitoring ensures a traceable production process and guarantees our high-quality standards. To further ensure quality, a final inspection with electrical tests and mechanical checks is carried out on each bar.

Final assembly
Final assembly. The assembly takes place directly at the same location in Kleindöttingen AG. This eliminates the need for transportation and also minimises lead times and production risks. With our crane capacity of up to 80 tonnes, we cover a wide range of electrical machines.

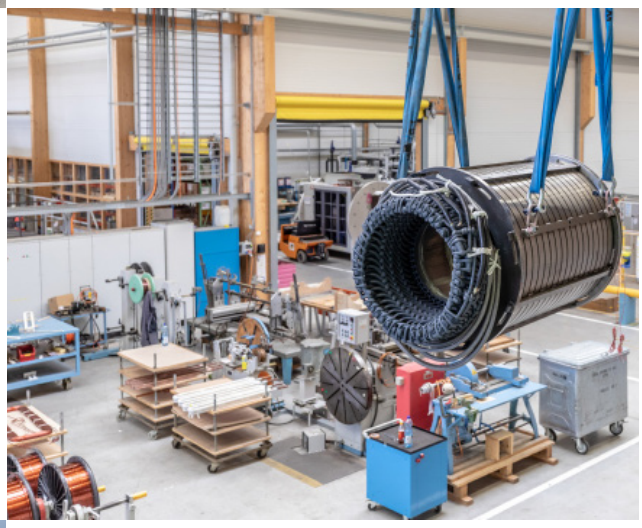
Tests
In addition to the usual routine tests, type and load tests in accordance with the applicable standards (IEC, NEMA, IEEE, BS, etc.) are also carried out by experienced test managers in our modern and well-equipped test facility.

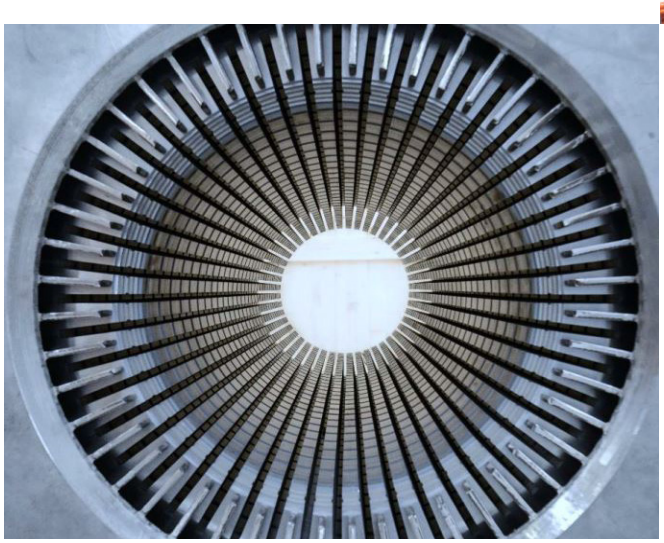
The voltage and frequency can be selected individually for each project by means of installed converter groups, including a dedicated supply for single-phase machines at 16 2/3Hz.
Static tests (AC/DC high-voltage tests), high induction tests, partial discharge, dissipation factor measurements, and real-time vibration analysis are also used in our test facility. We are also happy to offer order-specific tests on request.





Customer success is our passion





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