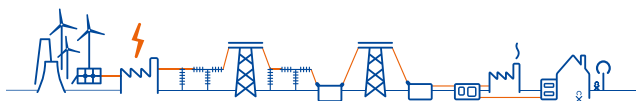


WELCOME

TO STARKSTROM-GERÄTEBAU GMBH REGENSBURG



SGB-SMIT AT A GLANCE

Combined, more than

450 

YEARS OF EXPERIENCE

Basis for know-how and
for know-why

More than

2.400 

EMPLOYEES

take care of
your project

In more than

80 

COUNTRIES

satisfied
customers



READY FOR YOUR MARKET

The SGB-SMIT Group manufactures transformers for applications worldwide. Sales and service centres on all continents ensure optimum attention.

Our products meet the requirements in accordance with the applicable national standards.



PRODUCTS

- large power transformers
- medium power transformers
- large liquid-cooled distribution transformers
- liquid-cooled distribution transformers
- cast resin transformers
- shunt reactors
- series reactors
- phase shifters
- Lahmeyer-Compactstationen®

Transformers from 50 kVA up to incl. 1,200 MVA
in the voltage range up to 765 kV.



QUALITY MANAGEMENT

The SGB-SMIT Group is certified in accordance with:

- DIN ISO 9001
- DIN ISO 50001
- DIN ISO 14001
- OHSAS 18001



TECHNOLOGIES

Technologies for conventional and
renewable energy.

WELCOME TO SGB REGENSBURG

We warmly welcome you to our facility and wish you a pleasant and informative stay at Starkstrom-Gerätebau GmbH, Regensburg.

Utilities and industrial enterprises world-wide trust in the products and services of the SGB-SMIT Group with subsidiaries in Germany, the Netherlands, Romania, the Czech Republic, Malaysia, China, India and the USA.

Resulting from a merger of locally operating, highly successful medium-sized companies, today the SGB-SMIT Group represents an efficient international network. A combination which unites the "best of both worlds" for our customers: From a global perspective we offer world-class quality and market expertise. From a local perspective our customers benefit from lean structures and short distances with regard to planning and production, transport and service.

Today, the company is Number One among the medium-sized transformer manufacturers in Europe. Our customers see us as a reliable and trustworthy partner capable of addressing and solving even the most complex tasks.

Growing with our challenges, continuing to develop and to design the optimum transformer for every customer – these are the key statements in our corporate philosophy.

Enjoy your visit to the headquarters here in Regensburg!



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PLEASE NOTE:

At SGB, great emphasis is placed on occupational health and safety, environmental protection and your personal safety. Thus we would like to ask you to understand that we have to familiarize you with some rules of conduct in order to allow you to move around the factory premises safely.

GENERAL INFO



Entering the factory premises is allowed only in company of an SGB employee. Please keep your **visitor badge** visible at all times during your visit. In order to clearly identify you as a visitor, we kindly ask you to wear the yellow safety vest during the guided factory tour. You will receive the safety vest at our front desk.



Production areas and test labs may only be entered wearing **safety shoes**. Access to areas marked with red-and-white or yellow-and-black barricade tapes is forbidden.

CAMERA SURVEILLANCE



The outer borders of the factory premises are under **video surveillance**.

TRAFFIC RULES



There is a **10 km/h [6.2 mph]** speed limit on the factory premises. Rail traffic has priority.

SMOKING BAN



There is a general **ban on smoking and drinking** within SGB. Smoking is only permitted in the designated areas.

NO PHOTOGRAPHS AND NO FILMING ALLOWED



Taking pictures or filming is forbidden – this also applies for mobile phones with camera function.

An authorization for filming or taking pictures can only be issued by the general management.

ANIMALS



Bringing animals is not allowed.

TEST LABS



Access to the testing areas of the test lab is only allowed if authorized by the person in charge at the test lab.

Access to testing areas for persons with active or passive implants (e.g. pacemakers, insulin pumps, metal articulations etc.) is strictly forbidden.

CONDUCT IN CASE OF ACCIDENTS, MATERIAL DAMAGE AND IN CASE OF FIRE

Please inform your SGB contact person about every accident or material damage. In case of injury, our first aiders or paramedics will be at your service.

INTERNAL EMERGENCY NUMBER



Calling an ambulance/emergency physician is possible via our internal emergency number 0941 7841-328 which will connect you with our front desk.



CO₂ - OR N-FIRE EXTINGUISHING SYSTEM

A warning signal will inform you about the activation of the CO₂ - or N-fire extinguishing system.

FIRE

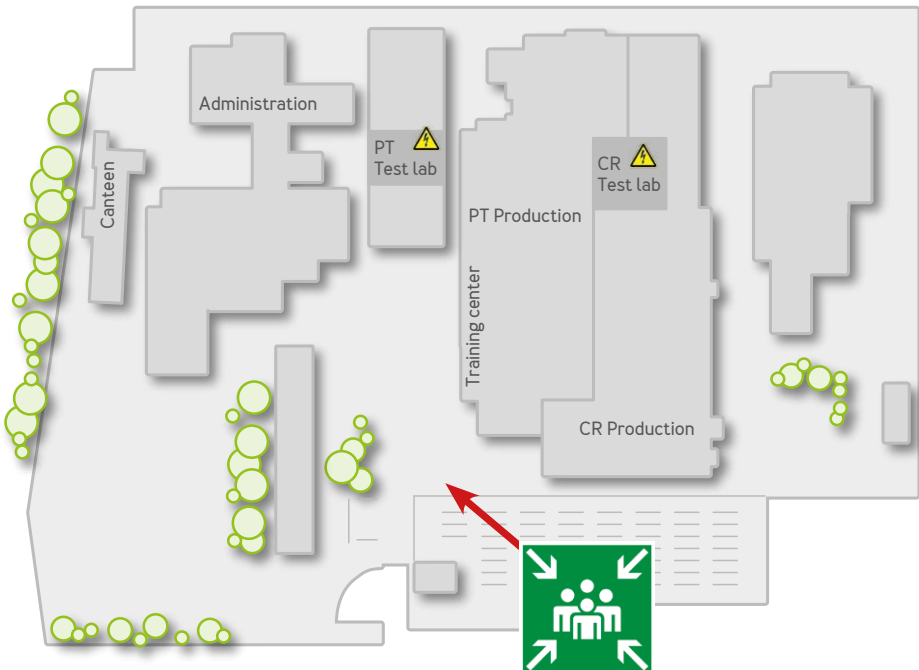


In case of fire, please operate the **fire alarm** and immediately inform an SGB employee.

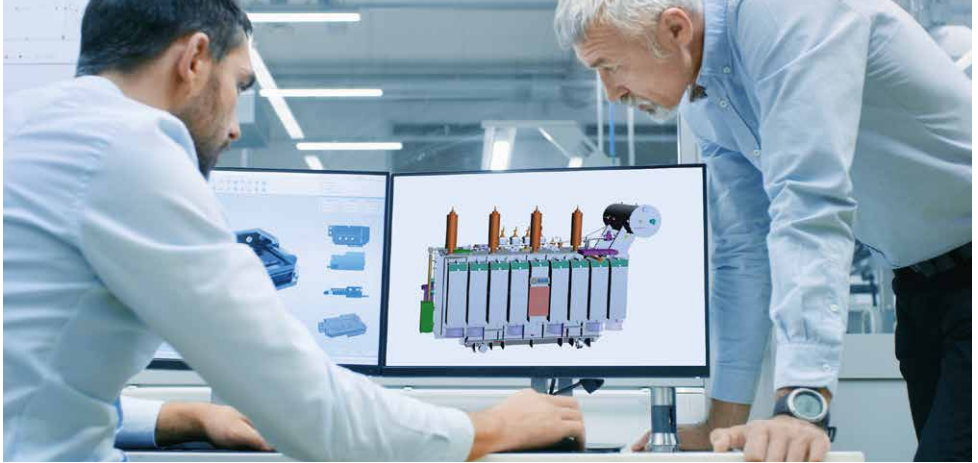


EVACUATION ALARM

As soon as the evacuation alarm is a continuous tone, all buildings must be left via the **escape ways**. Once the persons have left the buildings, they must gather at the **assembly point** (near the front desk, see in sketch below).



ENGINEERING



At SGB, the design departments for power transformers and for cast resin transformers are split into three groups:

1. ELECTRICAL DESIGN

This department utilizes state of the art software tools to design transformers and shunt reactors, which exactly match customer requirements 100 % with respect to electrical and electro-mechanical stresses as well as noise and thermal design.

2. MECHANICAL DESIGN

Our products are designed and optimized using 3D Solid Edge. Thus, we provide our customers with the opportunity to visualize their product early in the development phase and to avoid conflicts on the construction site.

Design Verification Tools help us validate and verify special requirements such as dielectric stresses or mechanical peculiarities.

3. RESEARCH & DEVELOPMENT

This department has two major goals:

Firstly, to continuously improve our products in terms of quality and costs in order to ensure our market position.

Secondly, to evaluate trends on the market, to verify the feasibility of implementing new technologies and materials via design guidelines or software solutions in terms of an efficient, practical approach.

POWER TRANSFORMERS



There are hardly any problems we have not yet solved, hardly any designs that we have not already built. Our long-standing experience in the field of power transformers gives us the flexibility and competence we need to face future challenges in an innovative manner.



POWER TRANSFORMERS



WAREHOUSE

In the past few years, the incoming goods area was adapted to match the work flow in our factory. Separate receiving bays were set up for copper, core sheets, tanks and auxiliary equipment. Consequently, internal movements were reduced and throughput time decreased.





WINDING SHOP

For Power Transformers, all windings are made of copper, which is insulated by varnish and/or paper.

The winding shop is equipped with 3 vertical and 6 horizontal winding machines. These facilitate manufacturing of all common known winding types, including the extremely economic SMIT type. Each winding is pre-dried and pressed with a design pressure corresponding to the specific short-circuit requirements. Drying is effected in two vapor phase ovens under isostatic conditions.

Windings must be produced within tolerances of a few millimeters, despite lengths and diameters in the meter range. Therefore, a special focus is put on the skills of the winders and their commitment to produce quality. To become a winder requires 3 years of training. To maintain a stable staff we mainly employ people who have completed our inhouse apprentice program.

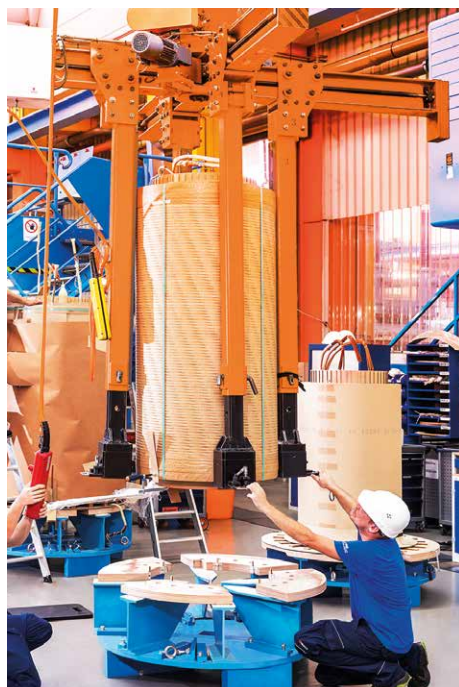


POWER TRANSFORMERS



BLOCK ASSEMBLY DEPARTMENT

Block assembly of the individual windings optimizes the work flow and provides an additional benefit in maintaining the integrity of the insulation system. Key in this case are the adjustable assembly platforms which guarantee an optimal working height at any time in the process.





GEORG CUTTING LINE

Our Georg 1000 Cutting Line cuts the required sheets for the yokes and legs of the transformer core.

Coils in widths from 200 mm to 1,000 mm can be cut to lengths of up to 5,200 mm. Preventive maintenance/calibration of the machine is performed by our suppliers together with our staff. The last upgrade to the machine, including the integration of state-of-art PLC, was performed in January 2013.



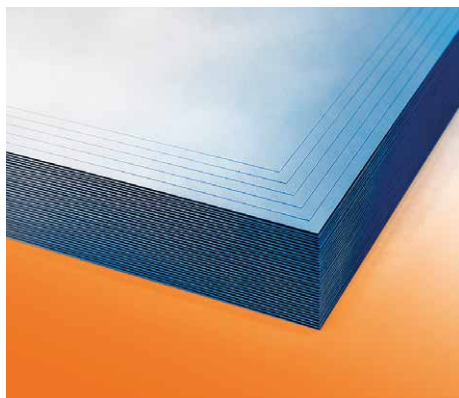
POWER TRANSFORMERS



CORE DEPARTMENT

For power transformers, now even 3 leg cores are robot-assembled in an automated core stacking and clamping cell.

Where it is necessary to take into consideration the design drawings and parts lists of the transformer, stacking and clamping can be performed manually by trained SGB personnel.





ACTIVE PART ASSEMBLY

The following operations are undertaken in this department:

- Placing the winding blocks on the core legs
- Stacking of the top yoke
- Mounting the cover to the active part
- Installation of all leads from the windings to the tap changers, bushings, etc.

In total 10 assembly areas are available. Each active part is completed by a group of workers. SGB power transformers use a design in which the active part is mounted to the tank cover. This guarantees that all leads are already connected in their final position before the active part is dried and tanked.

Special hydraulically operated pressing equipment for simultaneously uniform clamping of all three phases at one time, is utilized in the final clamping process before tanking the unit.

DRYING PROCESS OF ACTIVE PART

Drying of the active part is effected in 2 vapor phase ovens, each measuring 12 m in length, 3.3 m in width and 4.5 m in height. The drying process is automated to a large degree. Some specific transformer data need to be entered and then the drying process starts and is controlled automatically. The process is stopped once the criterion of 0.5 % moisture is reached.



POWER TRANSFORMERS



FINAL ASSEMBLY

The dried active part has to be placed inside the tank with minimum contact time to the ambient atmosphere to avoid humidity absorption in the insulation materials. The tank cover is clamped to the tank frame and welded or bolt-fastened, depending on customer's specifications. Once the cover is connected to the tank, the vacuum process is started. As soon as the required vacuum is reached oil filling can begin. Each transformer undergoes a pressure test at 1 bar excess pressure over 48 hours in order to ensure that the tank and/or the bolted connections and welds are leakage-free.

Furthermore in this area, all external fittings and components are mounted, and the secondary wiring is carried out. Customers' wiring specifications are observed and mostly exceeded, as all our SGB control cabinets are made of stainless steel.

At this stage of production, our internal quality control will cross-check the complete manufactured transformer for compliance with the customer's specifications and our quality standards and technical regulations. Finally, the unit is ready for testing.





HIGH VOLTAGE TEST LAB

Every unit manufactured within the factory is tested according to the applicable standards and as required by the customer's specification.

The test bay provides two test stations for most of the special and type tests required by common standards such as IEC, ANSI, BS, and VDE. Additionally, the test bay is equipped with a separate, state-of-art test station for impulse tests. Thus, three transformers can be tested in parallel. We only need to use external laboratories for dynamic short-circuit withstand tests.

Our test equipment comprises:

- measuring equipment for losses, harmonic analysis, noise levels
- AC generators for various frequencies, e. g. 60 Hz, 125 Hz.
- Dielectric tests can be performed up to 460 kV AC and max. 1,200 kV lightning impulse voltage.

To meet increased demands for partial discharge free transformers, our test laboratory is shielded to provide a maximum of 20 pC background noise level.

To meet increased demands regarding oil analysis, SGB has set up its own oil laboratory to provide timely results for DGA samples taken during testing.



POWER TRANSFORMERS



SHIPPING HALL

After passing the electrical tests the unit is then moved into our newly built shipping hall. Depending on final destination and transport mode, parts are disassembled and properly packed before final dispatch to the customer.

Transformers exceeding weight limits for road transport are drained of oil and filled with dry air.

The preferred means of transport is by truck, but also train and ship transports are organized by our logistic department.





Up to and incl.

200 MVA

POWER

Up to and incl.

245 KV

OPERATING VOLTAGE

Up to

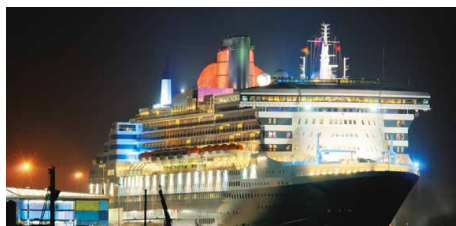
1.050 KV

BIL

CAST RESIN TRANSFORMERS



The SGB-SMIT Group has over 30 years' experience in the design and manufacture of cast resin transformers. Thanks to their special design, SGB cast resin transformers offer a range of features which distinguish them from other cast resin transformers in terms of technology and also make them a highly reliable and extremely safe solution.





WINDING PROCESS

HV WINDING

The high-voltage winding (HV winding) is the heart of the cast resin transformer. It holds the precious technical know-how of SGB.

Cast resin transformers are essentially characterized by the conductors of the HV winding being embedded firmly in an encapsulated cast resin body with a smooth surface. This is achieved by using inner and outer moulds. Thus, the conductors are wound first onto the inner moulds with glass fibre mats as layer insulation in-between winding layers. The outer mould is then placed on the winding which is then moved to an oven for pre-drying. The subsequent encapsulation process takes place at predefined temperatures in the autoclave. The prevailing vacuum prevents inclusions in the encapsulation compound which is a mix of epoxy resin components and varnish. The mixing ratio and the entire encapsulation process are monitored automatically.

Subsequently, the winding is hardened in an oven with the resin solidifying and assuming its final appearance.

This design used exclusively by SGB provides a number of advantages:

- Thanks to the multi-layer winding principle, high surge voltages and switching voltages are controlled safely.
- Cooling ducts provide thermal reserves and allow for overload.
- The special design of the composite system made of a glass fibre reinforced epoxy resin provides high resistance to temperature shocks.



CAST RESIN TRANSFORMERS



WINDING PROCESS

LV WINDING

In most cases, the low-voltage winding (LV winding) is designed as a foil winding. For higher system voltages or high currents, LV windings are occasionally designed as a cast layer winding similar to the HV winding.

The LV winding (coil) consists of conductor foil and prepreg which is used as insulating material. The busbars are connected to the foil by means of cold pressure welding under high pressure. The coil is finally cured in an oven to provide it with the required resistance.

This design features certain benefits:

- Reduction of all losses (eddy-current losses)
- Balanced temperature distribution in the windings
- High short-circuit capability





FINAL ASSEMBLY

During assembly, the coils are fitted onto the core, ensuring all electrical clearances are met, and secured in their position by means of supports. In standard cases, the transformer is completed by mounting temperature sensors in the LV windings, LV busbars and HV terminals (in most cases delta-connected windings).



CAST RESIN TRANSFORMERS



HIGH VOLTAGE TEST LAB

SGB cast resin transformers are designed and manufactured according to international standards (IEC 60076-11, IEEE C57.12.01, GOST R 54827-2011, CSA C9-02 etc.). Prior to shipment, all transformers undergo routine testing in accordance with the respective standard for which they were designed, in order to ensure all requirements are met.



ROUTINE TESTS:

- Test with applied power frequency withstand voltage
- Measurement of transformer ratio and verification of phase-shifting
- Measurement of winding resistance
- Test with induced power frequency withstand voltage
- Measurement of no-load losses and no-load current
- Measurement of short-circuit impedance and short-circuit losses
- Verification of temperature sensors
- Partial-discharge measurement



TYPE TESTS:

- Lighting impulse test
- Temperature rise test



SPECIAL TESTS:

- Measurement of harmonics of no-load current in % of the fundamental
- Measurement of the magnetization characteristic
- Measurement of the zero impedance[s]
- Measurement of the insulation resistance
- Partial discharge measurement after additional test procedure
- Determination of the A-weighted no-load sound level via sound pressure method
- Determination of the winding capacitances to the earth and between the windings, and of the loss factors
- SFRA (Sweep Frequency Response Analysis acc. to IEC 60076-16)



FIELDS OF APPLICATION

SGB-SMIT cast resin transformers require minimum preparation works at the site of installation. Below, please find a few examples for possible applications.

Automotive / electromobility:

Substations, subdistributions and infrastructure projects.

Railway:

DC supply for underground and suburban railways.

Storage batteries and charging stations:

"Split-Powerline" concepts.

Mining:

Underground and surface infrastructure, crane and excavator operations.

Chemical / pharmaceutical sector:

Rectifier and distribution applications for installation inside and outside.

Power plants / PSC:

"Power to" applications.

Navy:

Ship engines, shore connections in harbours.

Metals and paper industries:

Roller mill motors and pumps.

Oil and gas:

Refineries, air separation units and oil and gas platforms.

Computer centres:

Server facilities and cooling.

Renewable industry:

- Onshore wind
- Offshore wind

CAST RESIN TRANSFORMERS



Up to and incl.

25 MVA

POWER

Up to and incl.

36 kV

OPERATING VOLTAGE

Up to

200 kV

BIL

EXTRAORDINARY QUALITY



QUALITY

SGB has been manufacturing transformers for over 70 years now. Our customers profit from our many years of experience and our special know-how.

An extremely high level of quality has always been an important element in the manufacture of our products. Transformers have, on principle, a long service life, however, this is only ensured if appropriate quality-assurance measures are provided.

Thus, we had our quality assurance system certified for the first time in 1993 according to DIN EN ISO 9001. Over the years, the quality assurance system has been expanded and developed into an integrated management system with quality, environmental protection, occupational safety and health and energy management.

In the field of power transformers and cast resin transformers, we continue to work on constantly improving our systems and products.

Our customers appreciate SGB quality “Made in Regensburg”. Our longstanding business relationships are the best indicator for our customers’ satisfaction and our high level of quality.

THE LONG JOURNEY OF ELECTRICAL ENERGY

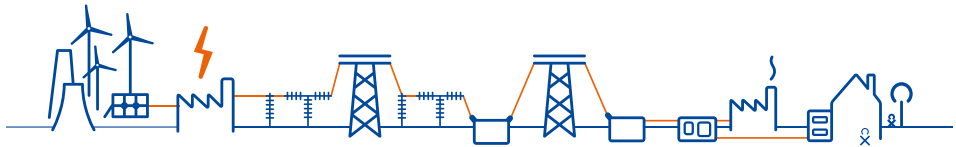
Electricity undertakes a long journey before it comes out of the wall sockets in our homes. Most of our electrical power is generated in large power stations using coal, gas, hydro and/or nuclear power as well as increasingly from renewable energy sources.

In order to transport this electricity over long distances with a minimum of losses, the voltage is transformed at the power station to e.g. 400,000 Volt. This is 1,730 times the voltage we use at household level (230 Volts).

Transformation down to the voltage we can use takes place in stages – from high voltage (400,000 Volt) via medium voltage (10,000 Volt) down to low voltage (400 Volt / 230 Volt).

For these different transformations, transformers of different capacities are needed. The SGB-SMIT Group supplies the complete range of transformers required during the energy's long journey to our households.

The Regensburg factory manufactures power transformers up to 200 MVA / 245 kV and cast resin transformers up to 25 MVA / 36 kV.




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