So why
Cast Resin Transformers?

The advantages speak for themselves:

 Minimal fire risk:
 Cast resin moulding material is not very flammable and can be self-extinguishing. There are no special fire prevention coatings, with associated fire conditions, the calorific potential of the cast resin transformer is minimal and there are no dangerous fire gases capable of long-term damage.

 Advantageous capabilities of the enclosure:
 Instead of transformer bays or cable housings, a simple enclosure can be used for access prevention. Enclosures can be complemented with the provision of high voltage flanges and low voltage cabinets to provide focal stations.

 No coolants:
 Cast resin transformers only need air for cooling. Liquid coolants – of whichever chemical type – cannot be released into the environment. There is therefore no requirement for bunding a cast resin transformer, which would be required for a liquid cooled type.

 Simple increased performance:
 Through optimised forced ventilation there is an increase in performance of about 40%.

 Unrestricted installation possibilities:
 The transformer is a key component in the electrical supply network, and speed of installation can be valuable. A cast resin transformer is easily accommodated; for example, no blastwalls are necessary. Consequently, the planning of the installation is simplified and installation costs are saved.

 High short time overload capability:
 The current density in the winding with cast resin transformers is considerably lower than with oil transformers. Short time load peaks, such as with wind power installations, can be easily overcome without there being a need to plan the relevant oversizing.
Why Cast Resin Transformers from SGB?

SGB are able to deliver Cast Resin Transformers with capacities up to 25 MVA and series voltages up to 36 kV. Our offer includes converter transformers, distribution transformers and special transformers. With more than 30 years experience in the construction of cast resin transformers, SGB has worldwide expertise, and this is expressed in remarkably high quality coefficients such as mean time between failure (MTBF) of over 1,700 years.

Thanks to their unique design, SGB Cast Resin Transformers offer a range of features which set them apart technologically from other cast resin transformers and make them a very dependable and very reliable solution.

For you the customer this means the following operational advantages:

+ High impulse voltages are controlled safely.
+ Thermal withstand capability makes overload possible.
+ Expansion and contraction of coils in service is tolerated, even for short circuits.
+ Long service life is guaranteed.

Summarised:

ResQ
Resin Quality by SGB

Further information on the unique distinguishing characteristics of SGB Cast Resin Transformers can be found on pages 4 to 7.
High voltage winding

The high voltage winding is the centrepiece of the cast resin transformer. Herein lies SGB’s great technical know-how. Core and low voltage winding are also important for the overall design, as all components are naturally interdependent.

Reserves-equipped
Overloads are permissible due to the thermal reserves provided by specific primary insulation.

Endurance-enhanced
Cooling ducts guarantee long service life.

Surge-proof
The double layer winding technology enables the control of high impulse voltages.

Quantum-leap
Glass fibre reinforcement of windings ensures that during operation, when the winding heats and expands, the design has the flexibility to react without damage to the winding even under short circuit conditions.

For our customers these specific features mean a high level of safety—both in relation to operation and their investment decision.

"Resin Quality by SGB":
These exceptional factors of quality are subsequently explained in detail.
**Reserve-equipped**
Thermal loads make overload possible
SGB Cast Resin Transformers not only have an advantage over oil transformers but also cast resin transformers incorporating established alternative designs. These use a high-voltage winding design where the conductor consists of aluminium foil strip and the coil/layer insulation is plastic. The insulation level of this type of system can only be considered as class F, when considering the insulation system as a whole.
It is quite different with SGB Cast Resin Transformers as SGB uses insulated profile wires for a double-layer winding where the primary insulation either consists of a high heat resistant polyesterimide coating with a temperature index of 200°C or Nomex thread winding of the temperature class C (220°C). As the operating temperature of SGB Cast Resin Transformers rarely reaches the limit of the temperature class F (155°C), the primary insulation has sizeable temperature reserves.

**Endurance-enhanced**
Guarantee high service life
Cast resin transformers must emit the resulting heat in the windings over the surface area of the coil to the cooler air surrounding the transformer. This has to be achieved with respect to the winding insulation class and without exceeding the average winding temperature, or the Hot-Spot temperature. The necessary cooling requirements can be calculated by considering the heat transfer coefficient, the ambient temperature, the surface temperature of the coil, and the size of the surface area.

With cast resin transformers of alternative designs, only the inner and outer surface area’s of the high voltage cylindrical coil are available for cooling. To provide the necessary surface area for cooling, the coils must be larger. SGB design of a double layer winding in comparison simply allows for the introduction of additional cooling ducts inside the coil. In this way very efficient cooling is achieved. SGB Cast Resin Coils can therefore be equipped with several cooling ducts.

SGB Cast Resin Transformers use appropriate materials and design to guarantee a consistent distribution of temperature inside the coil. The optimised cooling enables a reduction in temperature for the high voltage winding and furthermore a consistently distributed temperature for the entire transformer.
Surge-proof

High impulse voltages are controlled safely

Only SGB Cast Resin Transformers mould their high voltage coils in vacuum combined with a double layer winding. This ensures safety in the control of impulse voltages brought about by, for example, lightning strikes or vacuum switches.

- Regular coil winding of other transformers leads to much greater voltage stress, especially on the input coils, because 70% of the shock impact does not apply on the first 30% of the coils. The risk of winding short circuits therefore increases significantly.
- The SGB double layer winding by contrast guarantees linear fault distribution for all windings.

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**Distribution of voltage with a double layer winding**

The voltage values were measured against a total winding against earth

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**Impulse voltage test 1,2/50 μs**

---

**Turns [%]**

**Impulse voltage [%]**

---

**Cooling duct**
Quantum Leap

Overcome temperature shocks reliably. Cast resin transformers are subject to great mechanical and thermal shocks and strains in their transport and in particular when operated. Therefore of great importance is the ability of the transformer to safely control spasmodic temperature increases.

A decisive factor in this feature is the construction of the cast resin composite material, into which the conductors are moulded. This depends especially upon the tensile stress and the thermal coefficients of expansion of the composite material in relation to the winding material. With many cast resin transformers this composite material is comprised of epoxy resin which is mixed to over 70% with a mineral bulking agent, mainly quartz powder. Such a composite material can reach the tensile strength of the epoxy resin, about 50 N/mm. With the thermal coefficients of expansion the value of aluminium can roughly be met with maximum mineral filling but remains clearly above that of copper. This is the reason why cast resin transformers of usual technology were only available for decades with aluminium conductors. Recently there has been an improvement through an additional concentration of glass fibre on the surface.

It is quite different with SGB. Here the composite system is comprised of a glass fibre concentrated epoxy resin between the layers and on the surface with high tensile strength in the area of 120 N/mm and a coefficient of expansion which is equally close to that of copper and aluminium. SGB Cast Resin Transformers are produced with both copper and aluminium winding materials. Casting has always occurred under vacuum and is therefore free of voids. The advantage of the SGB composite system has frequently been recognised in tests. With an exit temperature of -50°C, SGB Cast Resin Coils have also safely passed the required temperature shock tests in accordance with IEC 60076-11 for climate class C2 based on a temperature of -25°C.
Core

With the calculation of cores for cast resin transformers, no-load losses, noises and no-load currents are quite considerable and in many cases, crucial quality features. As a result, the choice of high-quality materials for core design and manufacture is vital.

For SGB Cast Resin Transformers a cold-rolled, grain-oriented magnetic plate is used and has a typical loss factor of 0.85 W/kg. In most cases of application, values according to the requirements for no-load losses and noises can be reached. For special requests a so-called Hi-B plate is used with which the no-load losses can then be reduced further by approximately 15% and the noise level by around 5-7 dB(RAL) so that for specific applications, e.g. in hospitals, low losses and reduced noise requirements are met.

The cores themselves are manufactured on modern transverse and core-laying machines, which guarantee a shift in the so-called ‘step lap’ process with extreme precision. Put simply, the single sheets are tapped in the usual ‘step lap’ process by means of a repeated overlap and as a result the losses are reduced.

For corrosion protection, a high temperature 2-component coating is used. This coating gives protection to the core against the environmental elements to which it would be subjected. The coating also infiltrates between the individual core sheets and sticks them together which gives further benefits when handling noise and vibrations.

The core is fixed with a holding frame consisting of lower and upper clamping bars and flat-rolled tie rods directly on the core. The tie rods consist of magnetic flat-rolled steel and connect the lower and upper clamping bars together. The holding frame is constructed in such a way that the core plates are kept free from tensile load and compressive stress as far as possible because, as such, they retain their excellent features in relation to losses and noises. The loweryoke is allowed to rest, supported through mouldings made from glass fibre-strengthened synthetic material onto the lower chassis pillar to which bidirectional adjustable coils can be fixed. Different attachments such as additional footbridges, tabs, vibration-reducing components and others can indeed be chosen depending on the individual project and client requirements.
Low voltage winding

SGB Cast Resin Transformers' low voltage winding is almost always used as a full length foil winding. The advantages of this form of winding are evident:

- Reduction of additional losses
- Even temperature distribution in the coil
- High short circuit consistency

Exceptions exist if the LV winding is rated as less than 160 kVA or has a voltage rating of over 3 kV.

For more than 40 years, SGB has been producing foil windings for distribution transformers and cast resin transformers. This long expertise is the reason for high-quality features such as:

- SGB uses treated material exclusively from foil manufacturers in special cylinders to guarantee that the edges are burr-free. This is an important requirement for electrical dependability.

- To connect the outbound connection edges with the tapes, there are two common practices, welding under inert gas or cold welding under high pressure (400 kN). Cold welding has been used for more than 20 years at SGB.

Benefits:
- No metallurgical changes of the winding material by means of a temperature process
- No foreign bodies which can occur with moulding

- By using multi-layer prepreg, there is a high-strength, thick-walled cylinder, which can accommodate the radial short circuit forces unsupported—compared with the otherwise standard solutions.
Cast Resin Transformer – Key Components

LV terminal
Bar cylinder
Low voltage winding
Conductor
High voltage winding
Upperyoke
Connection of temperature sensors
Carriage frame
Quality

SGB has been producing cast resin transformers for over 30 years and therefore has the greatest wealth of experience in this field worldwide. This remarkable know-how is reflected in exceptionally high quality coefficients, such as MTBF of over 1,700 years.

SGB Cast Resin Transformers naturally comply with all the usual quality standards such as:
- Fire class F1
- Environmental class E2
- Climatic class C2.

The manufacture of cast resin transformers is of course certified within SGB in accordance with ISO 9001 and ISO 14001.

As a provider to OEM customers with high quality standards, we are familiar with challenging quality systems such as, for example, Six-Sigma.

Classification societies such as Germanischer Lloyd, RINA or Bureau Veritas have approved SGB Cast Resin Transformers.
Tests

SGB Cast Resin Transformers are designed and produced as standard in accordance with IEC 60076-11.

SGB Cast Resin Transformers comply with all the tests required in IEC 60076-11.

All detailed inspections and type tests, e.g., short circuit tests or temperature rise tests as well as many special tests have been completed in the course of our supply. In this way the specific properties stipulated in the customer specification can also be checked, and met.

In conjunction with external institutes, we have also completed detailed measurements for the following areas:

- Electromagnetic tolerance in conjunction with Systron EMI Ltd, Rednitzhembach
- Fire gas analysis or low temperature carbonisation gas analysis of components of cast resin transformers in conjunction with the Allianz Centre for Technology, Munich
- Vibration test in conjunction with LABG, Munich
- Short circuit strength in conjunction with FGH, Mannheim and Zkuselnictvi High Power Laboratory, Prague
- Certification for -50°C in conjunction with Standard Elektro, Moscow
- E2 and C2 tests in conjunction with KEMA

SGB Cast Resin Transformers are supplied in more than 35 countries and naturally meet the relevant local standards in these countries such as for example, ANSI, IEEE, IEC, etc.
Overload capacity

It is possible to overload a cast resin transformer, in much the same way as is possible with liquid-filled types.

To guarantee a service life of over 20 years, overdos report and are controlled with a temperature monitoring system which shuts down the transformer at a fixed rated response temperature.

The IEC standard stipulates that transformers with class F insulation must withstand a temporary temperature of 180 degrees Celsius without immediate damage. Our choice of rated response temperature comes from the heating permitted in the low voltage winding. The rated response temperature considers the hotspot rate at the measuring point and depending on the heating of the coil it is 120° - 150°C, a maximum coolant temperature of 40°C, which is in accordance with VDE 0532, Part 6, is assumed.

If, in practical operation, the transformer is operating under the rated power and the ambient cooling temperature is below 40°C, then coil temperatures below the threshold values permitted arise as a result. This factor can be exploited for overdos report and the fixed response temperature of the thermistor is obtained. The extent and duration of the overload are determined through the preceding preload, the actual ambient temperature and the coil time constant. The diagram below for a 1,000 kVA cast resin transformer shows this correlation, based on a coolant temperature of 20°C and different permanent preloads. From this it follows that the transformer can be operated for around 19 minutes with an overload of 130 % of its rated power even with a 100 % permanent preload, until the temperature monitoring system responds.

As the "coil time constant" parameter depends very much on the specific technical requirements and build, universal overload diagrams are not possible. On request we can run modelling programs which will provide the data whereby all interpretation-specific parameters are taken into consideration (see diagram left).

We have deliberately only shown the overload capacity for the temperature produced with temperature monitoring. As a result we do not expose the transformer to temperatures above the threshold temperature. Consequently uncontrolled overdos are prevented from leading to thermal strains that could lead to an exceptionally short service life.
Noise

Reducing the noise from transformers radiating into the surroundings is becoming more and more important. SGB Cast Resin Transformers are therefore manufactured as standard with reduced losses and noise.

In addition to the choice of induction and the type of core material SGB also employs mitred joints in the "step lap" process to improve noise properties and reduce transformer losses.

The specific noise level of cast resin transformers in AN operation without an enclosure can be established, in practice, the possibilities are:

\[ \text{A} = \text{evaluated sound pressure level} \]
\[ \text{L}_{\text{AP}} \text{ in dB} \]

\[ \text{A} = \text{evaluated sound power level} \]
\[ \text{L}_{\text{AP}} \text{ in dB} \]

and associated measurement service \( L_s \) in dB.

The definition of these values and how noise measurement is carried out is defined in the German Edition of European Standards 60551/ Association for Electrical, Electronic & Information Technologies 0532 T7.

Important terms in this document are:

+ Reference plane (from the thread measure, which includes the heat radiating surface)
+ Length of measuring path \( p_{\text{m}} \) in m
+ Measurement area \( S \) in m²

(See accompanying sketch above)

As with dry-type transformers for safety reasons, the measurement for cast resin transformers are made at a distance of 1 metre from the reference plane. For oil-filled transformers with enclosed windings, a distance of 0.3 metre may be measured from the vessel.

The following combination of \( L_{\text{WA}} \) and \( L_{\text{A}} \) with \( L_s \) is set in the German Edition of European Standards 60551/ Association for Electrical, Electronic & Information Technologies 0532 T7:

\[ L_{\text{WA}} = L_{\text{AP}} + L_s \]
\[ L_s = 10 \log S : S_0 \text{ in dB} \]
\[ S = 1.25 \times p_{\text{m}} \text{ and } S_0 = 1 \text{ m}^2 \]
\[ p_{\text{m}} = 4 \times MA + (DWA + 2) \text{ m} \]
\[ MA = \text{Dual spacing in m} \]
\[ DWA = \text{Coil outer diameter in m} \]
\[ h = \text{Height of core in m} \]
References

The size of SGB CastResin Transformers available comprises ratings of up to 25 MVA and series voltages up to 36 kV. As well as standard transformers, SGB also manufactures converter transformers in 12-pulse, 18-pulse or 24-pulse types, specific transformers or special products such as chokes, for example.

Applications with increased requirements

- Installation in climatic zones with extremely low temperatures
  SGB CastResin Transformers have been certified by the independent Institute of Inspection Standard Elektro, Moscow, up to -30°C.

Typical applications

- Industrial distribution networks
  SGB Cast Resin Transformers are here in the load centre and allow for efficient operation.

- Installation with high environmental and oscillation demands
  SGB Cast Resin Transformers are preferred due to the strength of their robust manufacture - e.g. glass fibre strengthened high voltage winding used in: onshore and offshore wind energy, shipbuilding and oil platforms.
+ Power generation
On the strength of their high dependability SGB Cast Resin Transformers are in every type of energy generating installation as any malfunction here can have dramatic & costly consequences.

+ Infrastructure
Wherever trouble-free operation of complete infrastructure is dependent upon the reliability of fewer individual components, specific quality benchmarks are set. For this reason on the strength of their exceptional dependability, SGB Cast Resin Transformers are preferred thanks to the unique winding concept.

+ Research and development
Science frequently makes specific technical demands which differ fundamentally from those industrially. On the strength of the high technical competence of SGB and the quality of SGB Cast Resin Transformers, SGB is also the preferred supplier in this field e.g. for nuclear fusion installations or particle accelerators.

+ Water protection areas
The environmental compatibility of SGB Cast Resin Transformers allows for use in water protection areas e.g. also as pole-mounted substations.

+ Customer Substations
SGB Cast Resin Transformers are in single substations in small industrial firms, supermarkets and shopping centres.

+ Cityscape

+ Industrial plant

+ High voltage lines

+ Power generation

+ Infrastructure

+ Research and development
Installation Conditions

SGB Cast Resin Transformers do not demand much at the installation site. This is as a result of the reduced requirements for ground water protection, fire prevention and functional preservation as described in the German Institute for Standardisation and Association for Electrical, Electronic & Information Technologies 0101 and 0108 and ELT Bau V0. With SGB Cast Resin Transformers, no protective measures for the prevention of water pollution are necessary.

Should the cast resin transformer however be equipped with rated voltage above 1 kV for installations for crowds of people in accordance with the German Institute for Standardisation and Association for Electrical, Electronic & Information Technologies 0108 and ElT Bau V0, the additional demands required would arise.

SGB Cast Resin Transformers are for indoor use only as the ingress protection is to IP 00 only. The cast resin surface of the transformer coil does not have a guard when operated. For that reason protection against accidental contact is necessary and this can be achieved by attaching a protective strip or safety guard in the transformer enclosure, which is given the correct protection ratio in accordance with EN 60076-3. Alternatively, to protect against water, they must be placed in an enclosure with a relevant IP degree of protection.

Cast Resin Transformers can be housed with medium and low voltage switchgear together in an enclosure. As no additional measures are essential here for oil drip pans or fire prevention, substantial expenses for transformer enclosures can be saved on this part of the construction site. With open air installation an enclosure is mandatory. The IP degree of protection of the enclosure therefore has to be determined.

When planning the site, it is essential to take into consideration particular extreme installation conditions which may exist. It is possible that special measures must be taken with the use of a cast resin transformer in altitudes of over 1,000 m due to the low air density. SGB can advise you individually and can adapt the equipment to the on-site conditions.

SGB Cast Resin Transformers come with additional fittings for use in ships, excavators, earthquake areas or wind power plants etc, where there are increased mechanical demands. In addition SGB Cast Resin Transformers have a decisive advantage in that all components are always visible and as a result any potential mechanical damage can be identified and repaired immediately.
Transformer-options

Enclosures
Cast Resin transformers are supplied with open terminals. Enclosures with accessible installations, and guards are therefore often required, where the degree of protection can be selected in accordance with the German Institute for Standardization 40 090 and 57 101 / VDE 101.

The SGB enclosure kit offers cost-effective standard enclosures with optional features and simple installation on-site due to pre-assembled delivery. IP23 for interior installations and IP33 for open-air installations are provided as standard but all other options are also available. Gland plates and angle brackets are provided for the cable connection from below.

Power increase with fans
By attaching fans, the cast resin transformer with the cooling method AN can be easily converted into the cooling method AF providing an increase in capacity of up to 40% or above in special cases. This facility gives the planner freedom in the initial design of the structure. In principle it is possible to regularly use the increased power resulting from the cooling method, AF, in standard operations.

The redundancy concept for a distribution grid with two or more cast resin transformers is attractive. The transformers are sized in such a way that in standard operations about 70% of the power is delivered — a reasonable interpretation for cost effectiveness — with a transformer malfunction, the AF-power of one transformer would suffice to take on the power of the other transformer during planned maintenance or in the case of a malfunction without any operational restrictions.

The enclosures have the appropriate air inlets and outlets for natural or forced air cooling to conduct heat resulting from transformer away. At the site installation the ventilation to provide the necessary cool air flow must be considered.
Accessoires and Monitoring

Transformer equipment
In addition to the basic components – core, windings and frame – ancillary equipment is necessary in order to interface to the electrical infrastructure. Initially these are the electrical connections and transformer monitoring and, as an option, fans, enclosures and further mechanical add-on parts such as busbars, earthing switches, anti-vibration pads and transformer supports – according to special instructions.

Electrical connections
- High and low voltage connections are opposite each other as standard on the side wall of the transformer. (Illustration 1)
- The high voltage connection points are incorporated mechanically and electrically into the high voltage cast resin coil together with the tapping lugs. (III. 2)
- The low voltage terminal buses including the neutral point are led out upwards. (III. 3)

Execution of connections
400 - 630 KVA (III. 4)
- 800 KVA (III. 5)
- 1,000 kVA (III. 6)
1,250 - 3,150 kVA (III. 7)

These are the standard connections for the vector group Dyn, other project-specific connections are possible on request.
**Monitoring the temperature**

Temperature monitoring by means of PTC Sensors (resistors with dramatic resistance change at the response temperature) is generally provided for each cast resin transformer. As the low and high voltage windings stay together in thermal equilibrium, the thermistors are positioned on the low voltage winding. Importantly they protect the vacuum cast high voltage windings against improper high temperatures, which can occur with overload, insufficient cooling and high environmental heat. Core monitoring by means of PT100 or PTC Sensors are possible if the customer so wishes.

Normally two thresholds are incorporated: The first one signals any temperature excess at the limits of the normal service life consumption, i.e. continuous nominal load at 20°C coolant temperature. It should warn the operator to initiate measures to cool the transformer. The second system is geared to the boundary temperature of the declared temperature class which should not be exceeded as this would result in accelerated service life consumption. The transformer should then be shut off. The three resistors are wired onto a terminal block. From here there is a double-conductor connection to the tripping unit, which is provided loose for free installation into the switchgear.
### Selection table series 10 (U_m = 12 kV)

<table>
<thead>
<tr>
<th>Capacity (kVA)</th>
<th>Model type</th>
<th>P_e (W)</th>
<th>P_e 75°C (W)</th>
<th>P_e 120°C (W)</th>
<th>U_e (%)</th>
<th>L_max (db)</th>
<th>L_max (db)</th>
<th>Total weight (kg)</th>
<th>Measurements in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>DTHL 50/10</td>
<td>240</td>
<td>1,350</td>
<td>1,550</td>
<td>4</td>
<td>39</td>
<td>50</td>
<td>350</td>
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<tr>
<td>100</td>
<td>DTHL 100/10</td>
<td>420</td>
<td>2,000</td>
<td>2,000</td>
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<td>51</td>
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<tr>
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<td>640</td>
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<td>2,500</td>
<td>4</td>
<td>42</td>
<td>54</td>
<td>800</td>
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<tr>
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<td>DTHM 250/10</td>
<td>800</td>
<td>3,000</td>
<td>3,100</td>
<td>4</td>
<td>45</td>
<td>57</td>
<td>1,000</td>
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<td>DTHL 400/10</td>
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<td>4,300</td>
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<td>4</td>
<td>56</td>
<td>68</td>
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</tr>
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<td>56</td>
<td>69</td>
<td>1,500</td>
<td>A 60 B 60 C 60 D 60 E 60 F 60 G 60</td>
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<tr>
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<td>6,300</td>
<td>7,200</td>
<td>4</td>
<td>57</td>
<td>70</td>
<td>1,600</td>
<td>A 60 B 60 C 60 D 60 E 60 F 60 G 60</td>
</tr>
<tr>
<td>800</td>
<td>DTHL 800/10</td>
<td>1,750</td>
<td>7,600</td>
<td>8,500</td>
<td>4</td>
<td>58</td>
<td>72</td>
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<tr>
<td>1,000</td>
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<td>10,700</td>
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<td>4,750</td>
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<td>66</td>
<td>81</td>
<td>5,100</td>
<td>A 60 B 60 C 60 D 60 E 60 F 60 G 60</td>
</tr>
</tbody>
</table>

- **A**: Selection tables, normal and reduced noise levels.
- **B**: Lightning impulse voltages in accordance with IEC 60 076.
- **C**: Declared sound levels apply to AN operation without enclosure.
- **D**: Sound pressure level measurement distance 1 m
- **E**: Sound power level see Page 15 ‘noise’
- **F**: Different capacities, execution for Um 36 kV as well as different test levels are available on request
- **G**: Vector groups up to 125 kVA Ym 5, above that Dyn 5

![Diagram of transformer dimensions](image)
## Selection table series 20 (U_m = 24 kV)

<table>
<thead>
<tr>
<th>Capacity (kVA)</th>
<th>Model Type</th>
<th>P_r (W)</th>
<th>P_75°C (W)</th>
<th>P_120°C (W)</th>
<th>u_h (%)</th>
<th>l_max (db)</th>
<th>l_max (db)</th>
<th>Total Weight (kg)</th>
<th>Measurements in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>DTTHL</td>
<td>260</td>
<td>1,450</td>
<td>1,650</td>
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**Tables-Key**
- Normal execution
- Loss and reduced noise levels
- Industrial or special execution

Details on general hints for planning, installation conditions or connections are at: www.sgb-trafo.de/de/productgth.aspx
Manufacturing range

- Cast Resin Transformers up to and including 25 MVA and service voltage up to 36 kV
- Oil transformers up to and including 1,000 MVA, service voltage up to 525 kV in accordance with all relevant standards and in special execution
- Regulating transformers with on-load tap changers
- System enclosures for cast resin transformers
- Transformers with line drop or parallel regulation
- Pole mounted transformers
- Earthing transformers and arc suppression coils
- Rectifier and furnace transformers
- Resonant-circuit reactances, coupling transformers and reactors for AF ripple control systems
- Shunt reactors and current limiting reactors
- Compact stations

Subject to technical modifications