



Transforming know-how into top technology all round. Siemens **Transformers.**

GEAFOL cast-resin transformers

Power Transmission and Distribution

SIEMENS

The safe technology

Cast-resin transformers

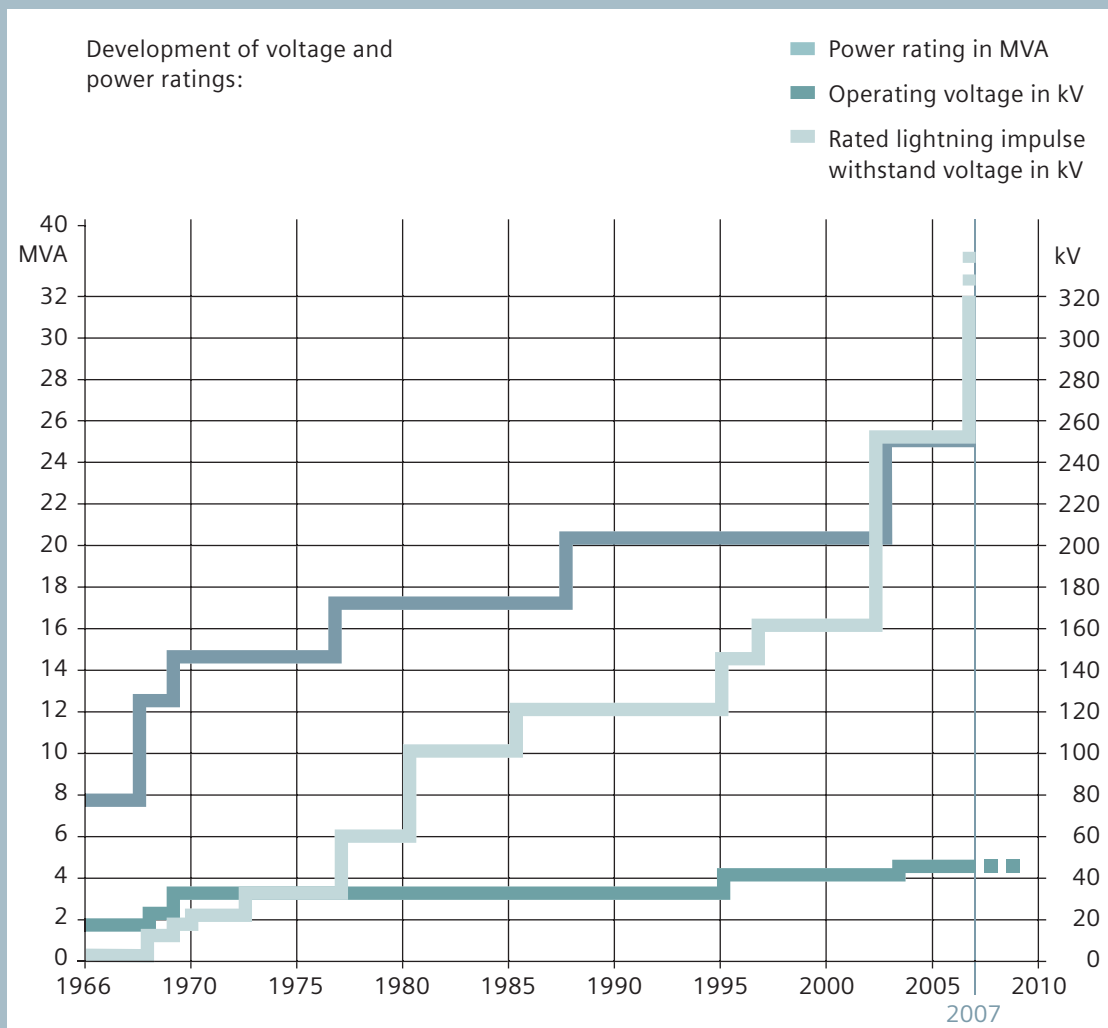
Wherever distribution transformers have to assure the utmost safety in areas frequented by people, GEA FOL® cast-resin transformers are the ideal solution. With GEA FOL, the limitations of liquid-filled transformers are avoided, but the proven characteristics such as operating safety and service life are retained.

GEA FOL cast-resin transformers comply with VDE 0532/IEC 60076-11. However, they can also be designed to meet special national regulations or customer wishes. We offer tailored solutions that meet all requirements when it comes to operating mode, low noise and loss levels, connection technology, type of cooling, as well as transport and installation.

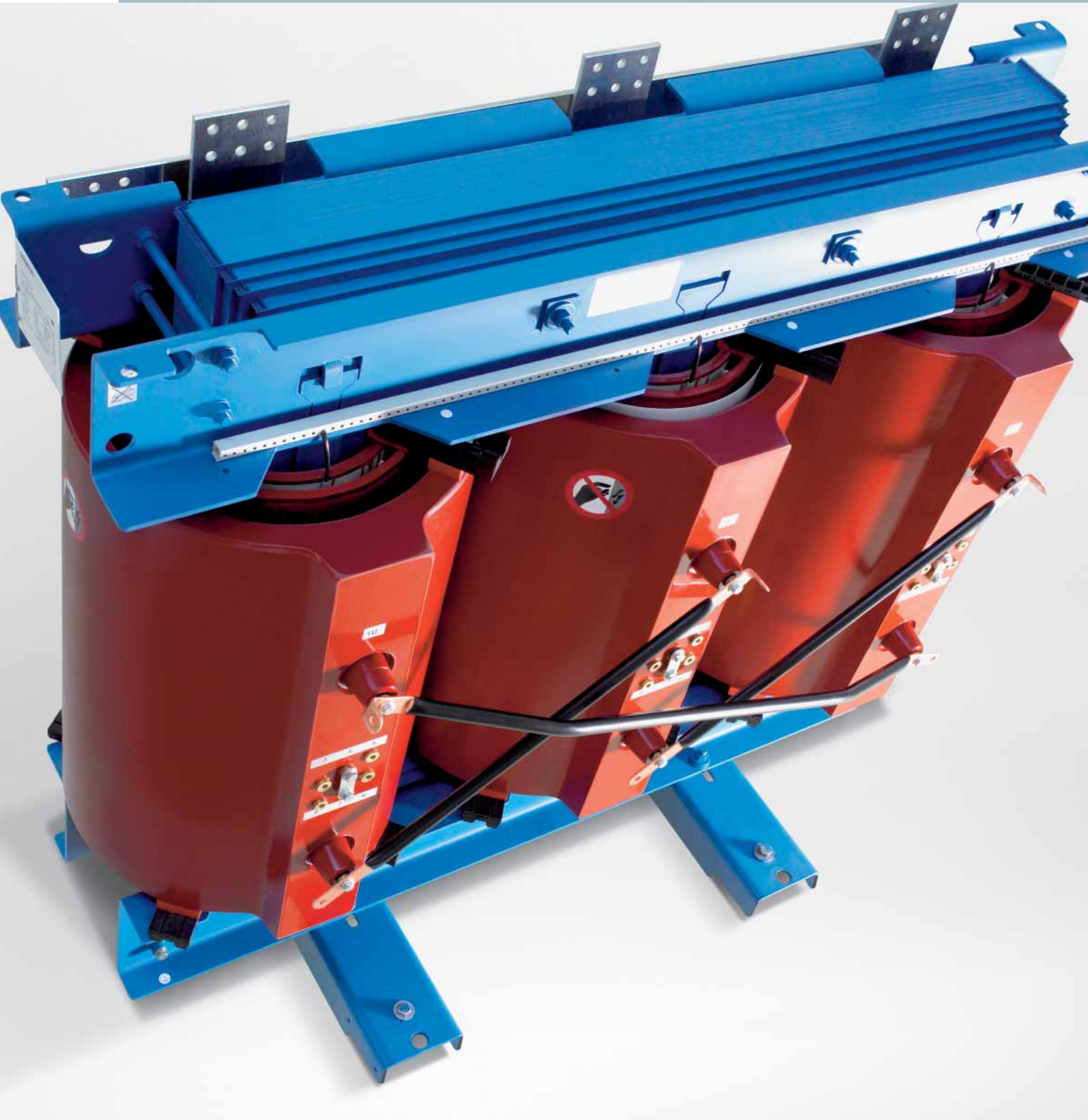
Safety proven 80000 times over

There are good reasons why GEA FOL cast-resin transformers are used wherever absolute safety is required. They can be found in high-rise buildings, hospitals, wind turbines, road and underground railway shafts, offshore installations, mines and many other similar safety-critical environments. It is not surprising that the superior GEA FOL technology is produced under license by many transformer manufacturers all over the world.

Over 80000 GEA FOL cast-resin transformers have proven themselves in power distribution all round the globe. The diagram below shows the power rating and voltage range developments achieved since 1966 as a result of continuous innovation.

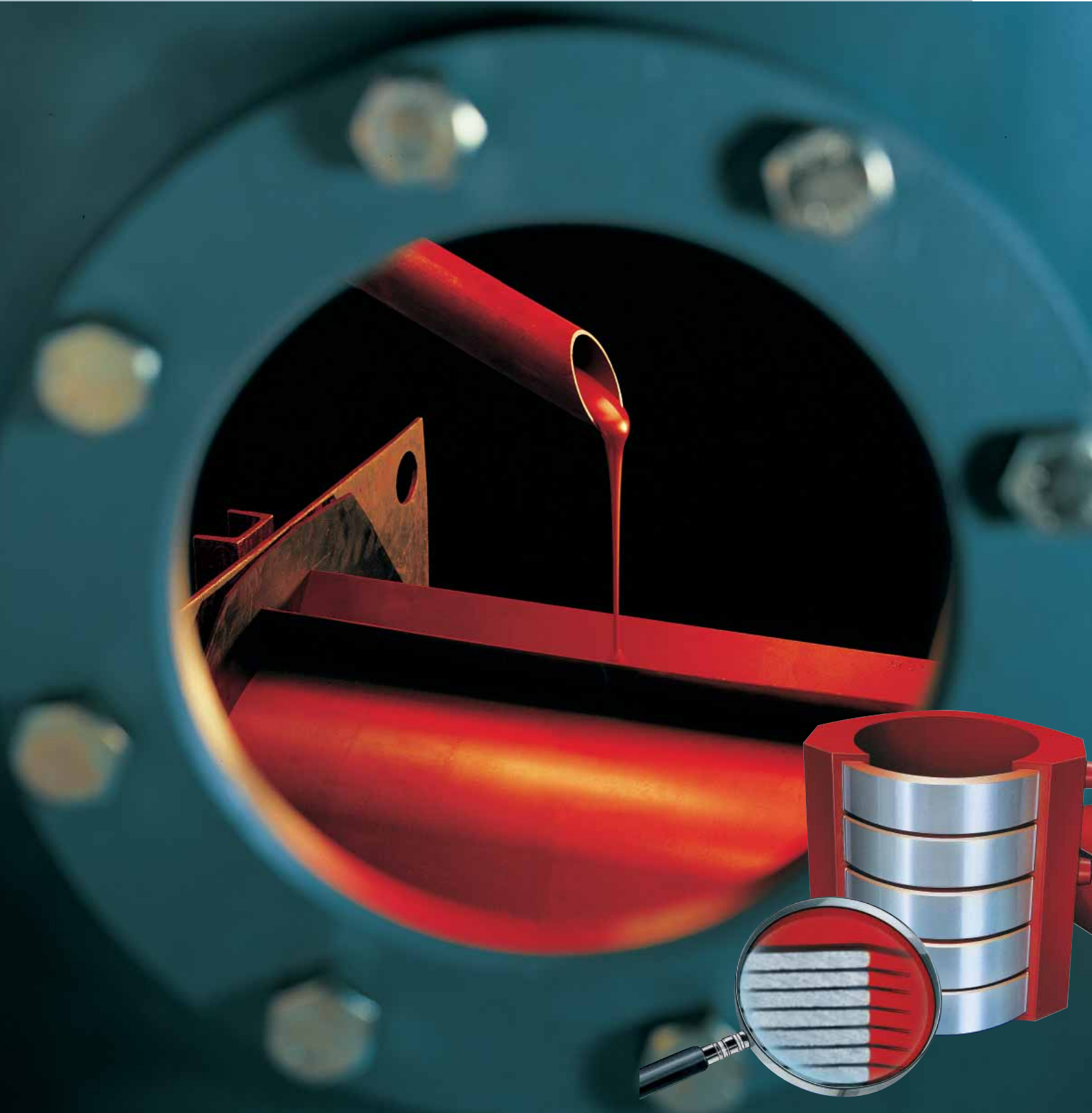


GEAFOL transformers, with their environmentally sustainable technology and versatility, ensure efficient energy distribution at load centers.



GEAFOL transformers cover an output range from 50 kVA to 40 MVA with operating voltages up to 41.5 kV.

Potting of the winding
in the vacuum furnace



Partially potted HV winding with
magnified cross-section of coil

The perfect technology

Cast-resin transformers

The GEA FOL principle has succeeded in producing transformers with excellent electrical, mechanical and thermal characteristics, which have also proved to be particularly compatible with the environment.

Maintenance-free – environmentally friendly – rugged: The insulation

GEA FOL transformers are insulated with an epoxy resin/quartz powder mixture. This is an environmentally acceptable material that makes the windings maintenance-free, moisture-resistant, tropicalized, flame-retardant and self-extinguishing. Even when the insulation is exposed to arcing, no toxic gases are generated. The windings are clamped between resilient spacers that provide effective vibration insulation both from the iron core and mutually between windings. The result: GEA FOL transformers are as quiet as oil-immersed types.

Electrically safe: The aluminum foil winding

The coils of the high-voltage windings are made of aluminum foil. Why foil windings? Because foil windings combine a simple winding technique with a high degree of electrical safety. The insulation is subjected to less electrical stress than in other types of windings. In a conventional round-wire winding, the interturn voltages can add up to twice the interlayer voltage, while in a foil winding it never exceeds the plain voltage per turn because each layer consists of only one winding turn. The result: High power frequency and impulse voltage withstand capability.

Why aluminum? The thermal expansion coefficients of aluminum and the used cast resin are so similar that thermal stresses due to load changes are kept to a minimum.

No gas inclusions: The epoxy resin casting process

The high voltage windings are potted with epoxy resin under vacuum at a high temperature. This procedure prevents undesirable gas inclusions. The quality of the potting combined with the electrical advantages of the foil winding plays a decisive role in providing freedom from partial discharges (up to twice the rated voltage). The low-voltage strip winding is also of aluminum. The width of the aluminum strip is equal to the length of the coil. This considerably reduces axial short-circuit forces in the transformer. The conductor strip and the insulation material are bonded together by heating and thus form a compact unit with sufficient strength to withstand radial forces reliably.

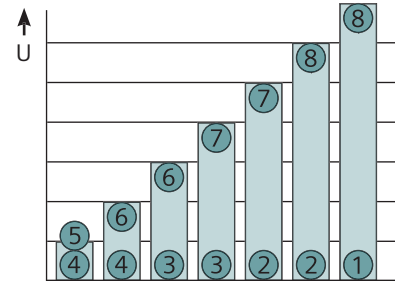
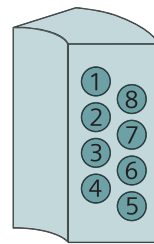
Universal: The application areas

Dry-type transformers must be marked with proven environmental, climate and fire resistance ratings. Our GEA FOL cast-resin transformers are suitable for universal use and satisfy the requirements of the highest defined classes, as proven in comprehensive testing:

- Environmental class E2
- Climate category C2*
- Fire resistance class F1

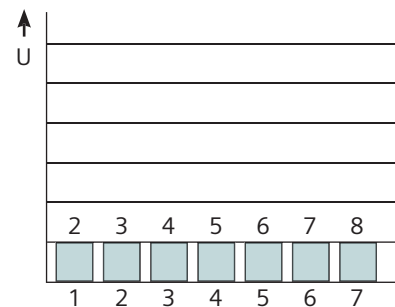
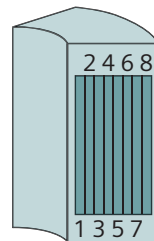
* For outdoor installation, IP 23 degree of protection must be maintained.

Voltage stress



Round-wire winding

The interturn voltages can add up to twice the interlayer voltage



Foil winding

The interlayer voltage is equal to the interturn voltage

The flexible technology

Cast-resin transformers

50 % performance reserves – with radial-flow fans

Radial-flow fans with temperature-dependent control can be installed to provide capacity reserves and to cover peak load periods. In this way, the transformer output can be raised by up to 50%. To simplify installation and connection, the transformer is optionally available with connection on either the HV or LV side, top or bottom. Plug connections are also available.

Uncomplicated: Planning with maximum freedom

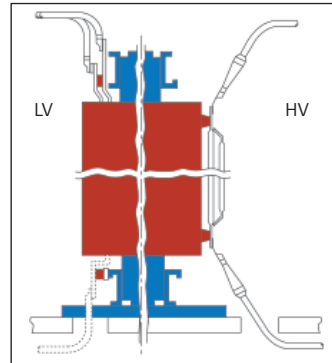
Planning with GEA FOL does away with the limitations imposed by conventional transformer technology. Since these transformers can be installed without difficulty at load centers, optimum supply system concepts are possible. No special safety features are required (such as coolant-collecting troughs).

Since the GEA FOL transformers often need less space than liquid-filled and gas-insulated transformers, a higher output can be accommodated in the same area.

The modular design of the transformer is another economical feature. Windings, for instance, can be mounted and replaced on the spot.

Economical: No maintenance, no maintenance costs

GEA FOL transformers are practically maintenance-free. Once connected, in most cases they can be left to get on with their job. If the advantages of GEA FOL transformers are taken into consideration as early as at the planning stage, the overall costs of a power supply system can often be considerably reduced.



Optional methods of connection;
special version: LV connection at the bottom



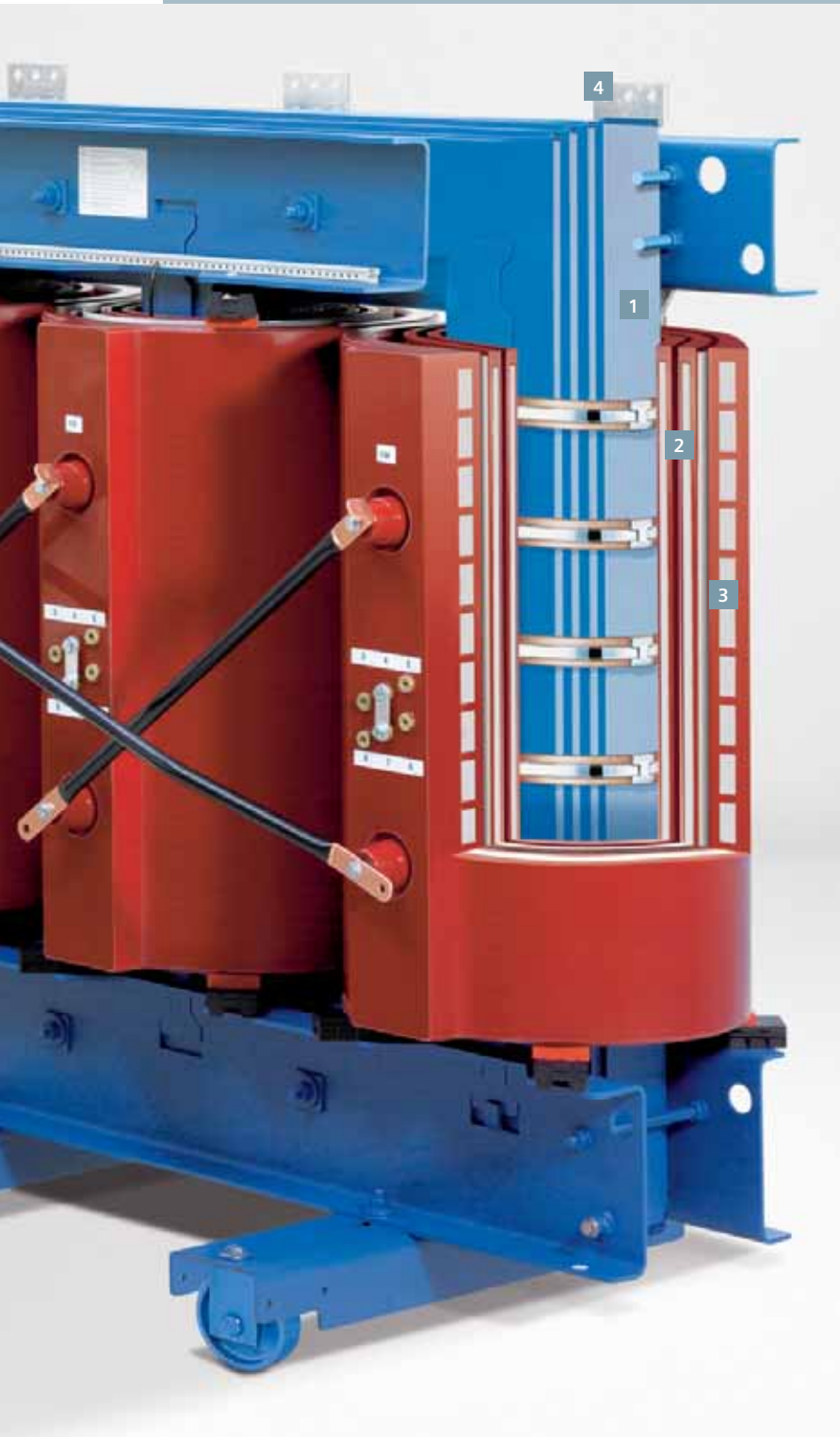
Radial-flow fans increase performance by up to 50 %.



GEA FOL standard protective casings, e.g. to IP 20 degree of protection; optionally, modified housing designs are possible.

GEAFOL

Transformer technology
at a glance:



- 1 Three-limb core**
Made of grain-oriented, low-loss electro-laminations insulated on both sides
- 2 LV winding**
Made of aluminum strip; turns firmly glued together by means of insulating sheet wrapper material
- 3 HV winding**
Consisting of vacuum-potted single foil-type aluminum coils; see also page 4
- 4 LV connection**
- 5 HV connection**
Variable arrangement, for optimal station design

HV tapings on high-voltage connection side; for adjustment to system conditions, reconnectable in deenergized state

- 6 Coil support system**
To insulate core and windings from mechanical vibrations, resulting in low noise emissions
- 7 Clamping frame and truck**
Rollers can be turned around for lengthwise or sidewise travel
- 8 Insulation: Mixture of epoxy resin and quartz powder** makes the transformer nearly maintenance-free, moisture-proof, tropicalized, flame-resistant and self-extinguishing
- 9 Connection tubes**

Temperature monitoring
by PTC thermistor sensors in the LV winding (on request PT 100)

Paint finish on steel parts
Thick-layer coating, RAL 5009, on request:
Two-component varnish or galvanizing
(for particularly aggressive environments)

Modular design
E.g., windings can be individually mounted and replaced on site

Ambient class E2

Climatic category C2 (if the transformer is installed outdoors, degree of protection IP 23 must be assured)

Fire class F1

630 kVA GEAFOLE cast-resin
transformer, U_n = 20 kV

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