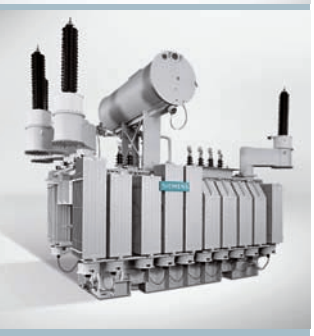


Transforming pure energy into flexible dynamic.

Power transformers up to 200 MVA

Answers for energy.

SIEMENS

A reliable supply – as individual as your needs

Power transformers – a crucial link between power plants and supply systems, and between networks with different voltage levels. However, the precise requirements for transformers vary from device to device and from site to site. That's why each transformer must be almost as unique as a fingerprint when it comes to voltage, power, climatic efficiency, network topology, permissible noise level, and other factors.

No matter what your needs are, you can always rely on your partnership with Siemens. Based on a detailed analysis of your requirements, we develop a high-quality, individualized solution for your network. The result is power transformers that meet all your expectations with respect to efficiency, availability, environmental compatibility, and longevity – while ensuring low maintenance over decades.

Product quality and service – in all circumstances

There are many good reasons for the high quality of Siemens transformers. For example, our plants have universally committed to using a quality management system certified in accordance with ISO 9001:2000. And before going into service, every transformer we produce must undergo a demanding, comprehensive test program.

But quality also results from seamless processes. Our perfectly harmonized product and service portfolio covers everything from consultation, design, and manufacturing to transport, startup, and our service TLM™ – Transformer Lifecycle Management™.

Always the best advice – at every point around the world

Why have utilities and industrial enterprises relied on Siemens transformers for a century? One answer is that we are always close by. As one of the leading transformer manufacturers, we offer you a closely connected network of sales, service, and knowledge. And there's also the way we combine expertise and passion: We make sure that your task is our task. That's something you can depend on around the world – in over 190 countries.

A great fit for requirements up to 200 MVA

The power range up to 200 MVA is classic territory for generator and network transformers. Transformers in this range can come in several variations – with off-load tapping switches or on-load tap-changers, with a combination of the two, or with reconnect devices under the cover or in the reconnect dome.

Naturally, at Siemens we can design transformers to meet every need. The range of possibilities includes separate-winding transformers and autotransformers, as well as three-phase and single-phase designs. The benefits our transformers can provide for utilities and industrial enterprises include flexible deployment, high mobility, and low maintenance.

In designing our transformers – just as in producing them – specific customer wishes as well as national and international standards (IEC, ANSI/IEEE, etc.) are taken into account.

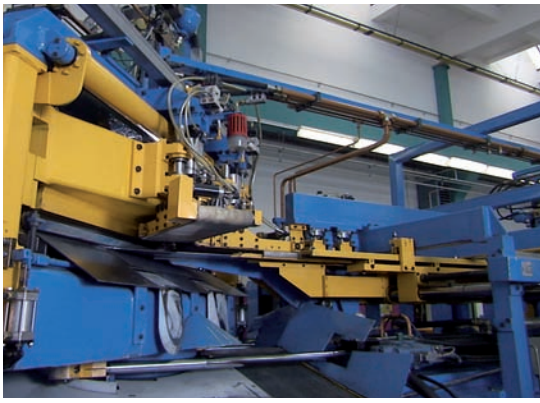
The interior makes a big difference: The iron core

On the right track right from the start: The iron core and windings influence the subsequent efficiency of a transformer. That's why we design our transformers as core types in which the wound and non-wound limbs of the core are located at the same level and connected by yokes.

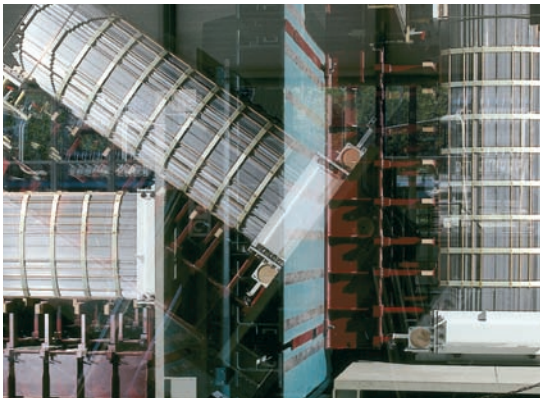
The choice of sheet metal also greatly effects the quality of the core. At Siemens, we use only high-quality, cold-rolled sheet metal. Depending on your requirements, we may also opt to laser-treat the sheet metal.

Using state-of-the-art numerical controls, we cut the sheet metal precisely to the millimeter for step-lap layering. This ensures favorable flux distribution at joints, providing the basis for low losses and minimized noise during no-load operation.

Working toward our goals with sophisticated precision



The first step:
Cutting the sheet metal. If it is found to be free of burrs, it is then divided longitudinally and cut into its final shape as individual sheets. Computer control allows easy compliance with even the narrowest tolerances.



The second step:
Laying the core. Afterwards, the iron core is reoriented from a horizontal layer to the vertical assembly position.

Rugged precision: The windings

Transformer windings must be able to withstand high electrical and mechanical loads in daily operation. Our windings made from copper wire definitely pass the test of time. Their high mechanical stability ensures safe operation, no matter what type of winding you need to meet your power and voltage requirements.

For high voltages – disc windings

Windings made of disc coils are the best choice for high voltages. Our disc coils are divided by radial and axial channels for oil cooling and continuously wound without soldered connections. We fabricate them on vertical and horizontal benches. Precise control systems help produce a constant contact pressure and winding tension, while our experienced coil winders bring their expertise to every step of the process

For low voltages – multilayer windings

Multilayer windings are well suited for low voltages. These cylindrical coils are arranged concentrically on top of each other and separated by axial oil channels.

Transposed conductors use many enamel-insulated, twisted section wires to minimize losses.

Netting tape windings: our efficient, proven alternatives for paper-insulated lines – for voltages up to 52 kV.

The perfect preparation for a rigorous working life: The windings are pressed, dried under constant pressure, measured precisely, and readjusted geometrically as needed.

Vacuum switches:

Vacuum switches are a time-tested technology used by Siemens since 1993.

Adapting to network conditions: Voltage adjustment

A tapped winding is typical of Siemens power transformers. It helps to adjust the transformation ratio to network conditions safely, simply, and gradually – whether off load, via tapping switches, or under load, by means of on-load tap-changers.

As a rule for off-load devices, the tapping switches are adjusted manually. For on-load tap-changers, however, separate motor drives can be controlled either onsite or remotely.

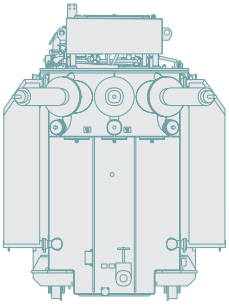
On-load tap-changers for voltage adjustment under load:

Vacuum switches are playing an increasingly important role for on-load tap-changers, since they lengthen maintenance intervals and reduce maintenance expense. Both factors help reduce the lifecycle costs of your transformer.

Protecting heavyweights: The tank

Another main component of each transformer, the tank, accommodates the core-and-coil assembly and oil filling – two heavyweights topping the scales at 100 to 150 tons apiece. To protect these key elements, the Siemens tank design combines a relatively low dead weight with static security and high oil impermeability. The tank also includes high-quality corrosion protection to help ensure a long service life.

If desired and necessary, in most cases transformers up to 200 MVA can be designed for convenient transportation.



On its way to the customer:

The size and weight of transformers place high demands on transportation.

An important step during final assembly:
After drying, the active part is inserted into the tank as quickly as possible, so that the insulated parts don't attract moisture from the air.

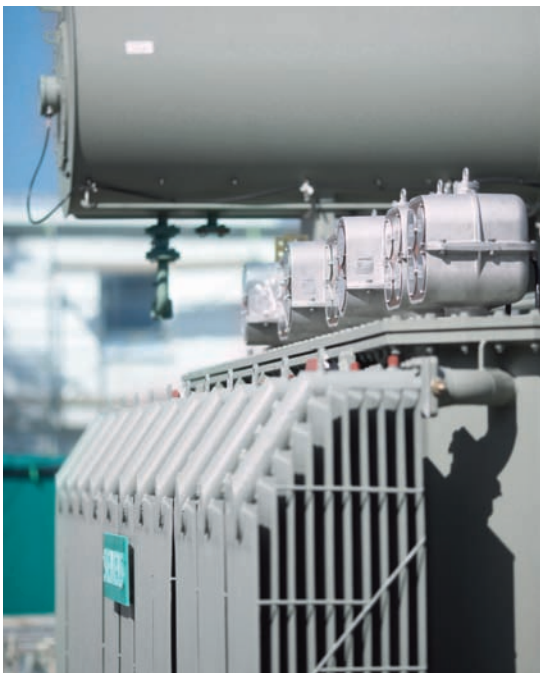
The parts become a whole: Final assembly

The main components of the core-and-coil assembly of the transformer are the core, windings, pressed panels, on-load tap-changers, and connecting lines. At the assembly stage, the mechanical stability of the windings plays a particularly important role.

We use a common press ring for all windings of a limb in order to maintain the geometric positions of the windings as precisely as possible and minimize axial thrusts. After the vapor-phase process, where we dry the core-and-coil assembly, we adjust the clamping force of the windings hydraulically, with great precision.

As soon as all screwed joints on the still-hot (approx. 100° C) core-and-coil assembly have been inspected and secured, we place it in the tank and fill it under vacuum with high-quality insulating oil. Once all built-on parts are mounted (such as the motor drive, control cabinet, bushings, and monitoring equipment) and the unit's stand time has elapsed, the power transformer is ready for final inspection and testing.

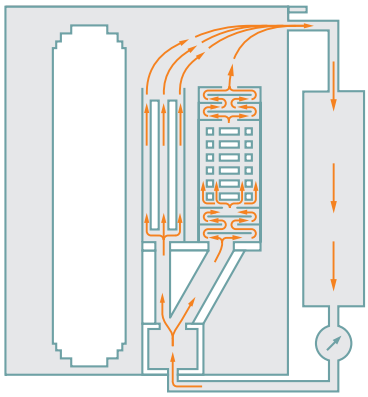
The transformer is being evacuated and filled with insulating oil.



A cool head in every situation: Transformer cooling

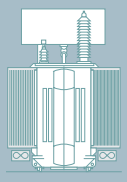
Efficient cooling plays an important role in providing a transformer with a long service life and highly reliable operation.

It's your project requirements that determine which type of cooling is used. For oil-air cooling, we typically use one of the following types: ONAN, ONAF, OFAF, or ODAF. However, for oil-water cooling customers prefer use either OFWF or ODWF. We recommend a transformer mount or a separate installation for radiator assemblies and for oil-air and oil-water coolers.

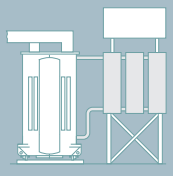


More effective cooling – thanks to a directly aligned oil conduit into the windings.

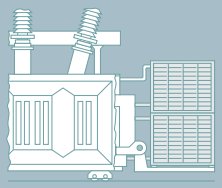
Cooling methods:



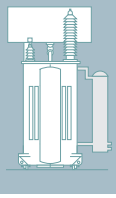
Built-on radiators with and without fans (ONAF / ONAN)



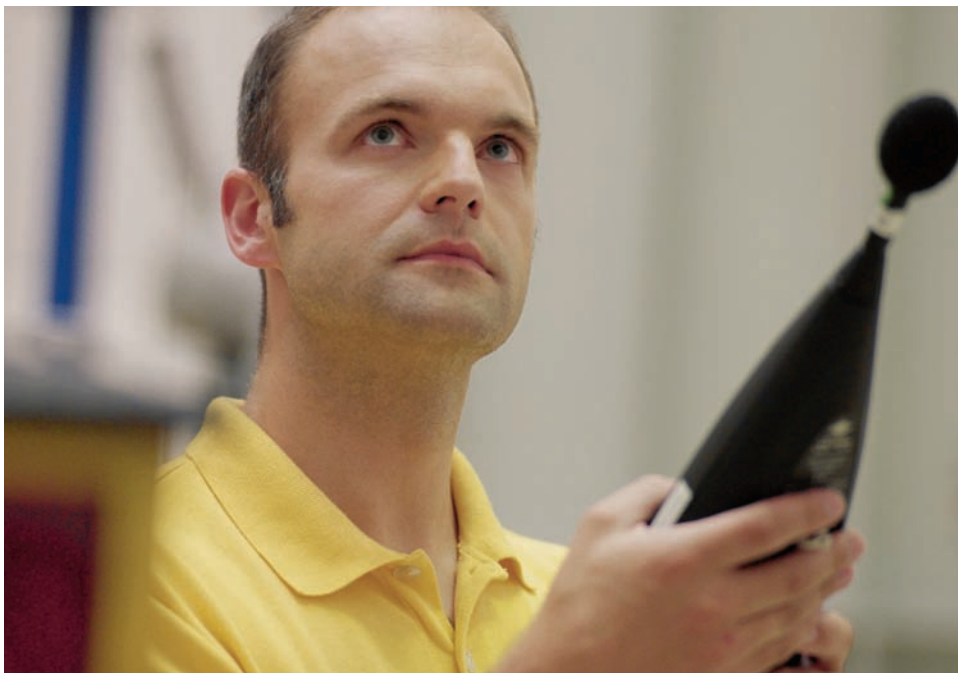
Separate radiator battery (ONAN / ONAF / OFAN / OFAF / ODAN / ODAF)



Built-on air cooling system (OFAF / ODAF)



Built-on oil/water cooler (OFWF / ODWF)



Ensuring a long transformer life: Final inspection and testing

Before delivery, every transformer undergoes strict final inspections and testing. In Siemens' in-house test fields, each transformer must complete a rigorous series of tests. Only flawless transformers leave the plant. The test regimen ranges from routine tests with voltage tests – including lightning impulse voltages – to temperature-rise tests. It also includes a broad range of special tests (for example, tests of noise level or harmonic components).

With Siemens, you can always be sure that quality is not just a set of tests – it's part of everything we do. It's no coincidence that Siemens power transformers are among the most reliable in the world.

Quality assurance begins right when you place an order, and it's part of every step until you take delivery of the transformer. It can also be part of the entire service life, if you wish. An important part of this quality-assurance process is shown here: the high-voltage testing hall.

Siemens power transformers: A global success story

Around the world, increasing numbers of people and fast-growing economies need reliably supplied electricity. Transformers play a crucial role in ensuring a trustworthy supply of power.

As a global player, Siemens works with utilities and industrial enterprises around the world, on all continents and in every climate. You'll find us in megacities, in deserts, and even in tough applications 15 meters under the ground.

There are tens of thousands of successful role models for your project – and we'd like to tell you about some of them.

New York (USA)

In the middle of the city, amidst of the hustle and bustle, this low-noise power transformer for Con Edison meets the strict requirements for noise level in the octave band.

Abu Dhabi (United Arab Emirates)

For the boomtown on the gulf: Between 2000 and 2006, Siemens supplied Abu Dhabi with a substantial number of 40 MVA/145 kV transformers – 50 in total.

Powerlink (Australia)

These transformers with a separately erected battery coolers are equipped with optical temperature sensors. They supply the city of Brisbane (Australia) with electricity.

From the desert to the megacity (Pakistan)

This three-phase, 40 MVA (132/11.5 kV) transformer is optimized to have same footprint as a 20 MVA transformer. As a result, it can be used in many different locations, including deserts, the countryside, and cities.

Carvoeira (Portugal)

This 220 kV/66/10 kV transformer was built for the Portuguese utility REN (Redes Energéticas Nacionais). It is equipped with ONAN/ONAF-cooling, weighs about 200 tons and has a built-in short circuit reactor.

Lillegrund (Sweden)

Deployed on the high seas, this 120 MVA ONAN, 138/33 kV transformer from Siemens proves itself in all types of wind and weather and at sea.

Rio Bijao (Honduras)

Honduran cement is the claim to fame of Cementos del Norte S.A. (CENOSA). The 15 MVA, 3 8/4.16 kV power transformers from Siemens play a major role in ensuring the reliability of the cement-production process.

M'sila Cement Plant (Algeria)

Reliability even under the toughest service conditions: This three-phase 45/55 MVA, 220 kV transformer for M'sila cement plant is facing desert climate, polluted environment, and continuous heavy load.

Published by and copyright © 2010:
Siemens AG
Energy Sector
Freyeslebenstrasse 1
91058 Erlangen, Germany

Siemens AG
Energy Sector
Transformers Division
Katzwanger Strasse 150
90461 Nuremberg, Germany
e-mail: t-sales.ptd@siemens.com

For more information, please contact our
Customer Support Center.
Phone: +49 180/524 70 00
Fax: +49 180/524 24 71
(Charges depending on provider)
e-mail: support.energy@siemens.com

Power Transmission Division
Order No. E50001-G640-A106-V1-4A00
Printed in Germany
Dispo 19200, c4bs No. 7483
GB 090605 470895 WS 04102.0

Printed on elementary chlorine-free bleached paper.

All rights reserved.
Trademarks mentioned in this document are
the property of Siemens AG, its affiliates, or their
respective owners.

Subject to change without prior notice.
The information in this document contains general
descriptions of the technical options available, which
may not apply in all cases. The required technical
options should therefore be specified in the contract.

www.siemens.com/energy