Transforming know-how into reliable energy.

TUMETIC and TUNORMA – Oil-Immersed Distribution Transformers

Answers for energy.

SIEMENS

TUMETIC distribution transformer with hermetically sealed tank

TUNORMA distribution transformer with conservator

Transforming high standards into leading solutions

On the last transformation step from the power station to the consumer, distribution transformers provide the necessary power for systems and buildings. Accordingly, their operation must be reliable, efficient and, at the same time, silent.

Under the names TUMETIC® and TUNORMA®, oil-immersed distribution transformers from Siemens meet all these requirements daily again. In thousands of applications, under extreme climatic conditions and in the smallest space – in distribution systems as well as in industrial plants. What these transformers stand for can be summarized in one single word: quality.

More than 100 years of experience – reliable partnership

The extraordinary quality is based on more than 100 years of experience of the pioneer in transformer technology – Siemens. Experience you take advantage of in all phases of your project:
From technical advice via layout, design, manufacture, transport, and commissioning up to the Siemens Transformer Life Management.

Each of our factories is regularly checked for compliance with the quality guidelines by independent bodies.

Oil-immersed distribution transformers from Siemens: Systematic quality …

Oil-immersed distribution transformers from Siemens are manufactured in accordance with our quality management system – certified to EN ISO 9001. Compliance with important standards, from IEC to VDE, is a matter of course, just as much as the exclusive use of high-quality materials. Qualified employees implement the demanding standards in daily practice.

So, quality is the logical result of a universal philosophy.

Checking means security – in production and testing

Every transformer consists of a large number of individual components which must interact smoothly in operation.

The high quality of Siemens transformers is therefore guaranteed by adhering to strict quality standards in production – all of them compiled in a quality assurance manual, which is also at the disposal of our customers.

Each manufacturing step is accompanied by quality checks – partly as a self-check with the associated evidence, partly by instructed quality experts. Final testing or acceptance tests are exclusively performed in the testing laboratory. And if you like to join the test of your transformer: Welcome!

State-of-the-art technology – tested and documented

Besides the routine tests for all transformers, we also take over the type and special tests on request.

For Siemens, however, quality assurance is even more. We support you in every respect as regards equipment monitoring and operation. And due to the fact that further improvement of the transformer technology is accelerated by the knowledge from daily operation, we offer you a continuous exchange of experience – for our common advantage.

… even with regard to environmental aspects

The protection of our environment and economic use of resources is more and more in the focus worldwide. This applies both to nature and growing cities, where power supply and industrial plants are often installed directly close to buildings, households and people. All Siemens factories work in accordance with an environmental management system certified to EN ISO 14001.

With Siemens transformers you are also on the safe side regarding environmental protection and sustainability. For especially high demands we offer special designs – as the following examples show:

- Environmental protection by alternative coolants and transformer fluids: Here, mineral oil is the most common, but not the only option. Ester and silicone are to be recommended for special requirements as regards fire safety and ecology (see also page 8 “transformer fluid“)
- Everything is all right in water protection areas – by designing the tank as a double tank
- No problems with radiation: Siemens offers low-radiation transformers complying with the strict Swiss standards – and conforming to the future European standards already today.




Oil-immersed distribution transformers from Siemens: Exactly matching your demand

The decisive factors for the layout of a distribution transformer are just your requirements, which we use for adjusting the different parameters – from the rated power to the vector group, from the coolant to the taps.

Of course the most different combinations are possible, which results in custom-made distribution transformers for almost every field and place of application.

Tailored to the requirements of practice – an example:

An urban industrial plant requires an especially ecological transformer. The Siemens solution fully meets this requirement – from biodegradeable transformer fluid up to extreme reduction in radiation. The sound level is at the limit of audibility, and the loss values are really acceptable – with no-load losses 30 % below the lowest loss range C which is presently defined in the European standards.

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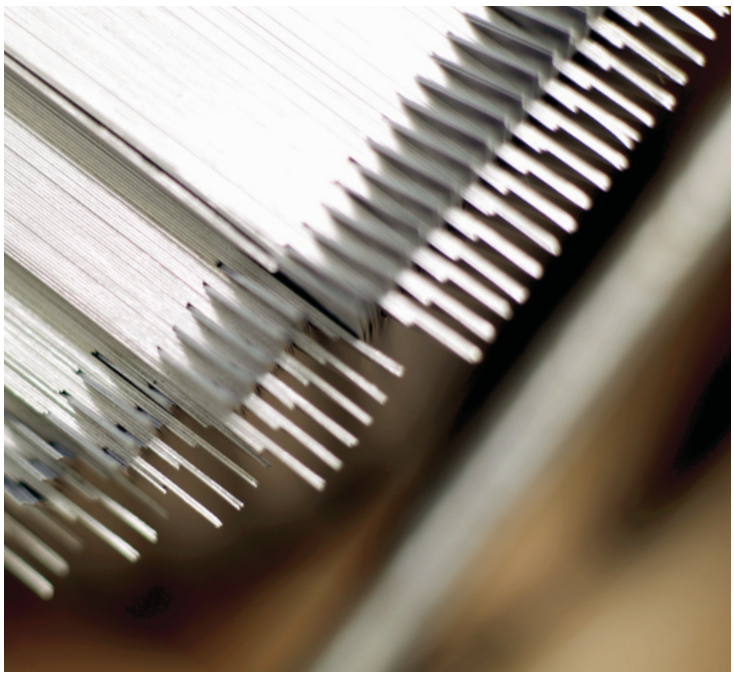


Custom work – in macrocosm and in microcosm

Low losses, low noise: The iron core

Whether in design, manufacturing methods or materials – the cores of Siemens transformers represent the latest state of technology. The silicon-alloyed electric sheet steel used is grain-oriented, cold-rolled and insulated on both sides, guaranteeing low losses and noise – and these values are even improved by laser treatment.

Numerically controlled cutting machines provide for careful treatment in the cutting process in order to avoid mechanical tension in the core and thus unwanted properties right from the beginning. Standard use of step-lap cutting additionally minimizes losses and noise.

Systematically safe: The winding

The winding as the centerpiece of the transformer must be especially protected – both against high electrical stress due to external overvoltages and against mechanical overloads by short circuits.

Siemens transformers are systematically designed to meet these requirements. The windings are made of copper or aluminum. Low-voltage windings are made of strip or flat wire, and the high-voltage windings are manufactured from round or profile wire. The use of insulating paper that is partially coated with epoxy resin ("diamond-dotted paper") bonds the winding into a compact block while drying and increases the short-circuit capacity additionally.

The layer insulation is adapted to the occurring alternating voltage strain in daily operation. Large-scale oil channels are provided in order to secure sufficient cooling of the windings and to avoid "hot spots". All leads are short-circuit and surge-proof, contributing to the high reliability of the transformer – with an above-average service life.

Tightness decides: The tank

Whether during transport or operation – the tank must be absolutely tight under mechanical stress. Preconditions to achieve this are constructional experience, the most modern calculation methods and high-quality welding work.

Special attention is paid to corrosion protection. Pretreatment of the surface by sandblasting contributes to corrosion protection, just like multicoating with preset drying times for each layer. On request, hot-dip galvanization provides for even better protection.

The tank must dissipate the entire heat loss of the transformer into the ambient air. This makes the volume of the transformer fluid change. In hermetically sealed transformers, the corrugated walls absorb the change in volume. In the case of expansion tank transformers, the conservator compensates this change.

The sheet-steel lids of Siemens transformers are bolted together with the tank – or welded on request. In any case the steel thickness and the bracing is dimensioned in such a way that the lid withstands the stress of transport and operation.

Oil-immersed 630-kVA distribution transformer TUMETIC:
View into the inside

1 **Core and windings**
Both are held together by a pressed structure and bolted together with the tank lid. The complete unit can be lifted out of the tank.

2 **Core**
High-quality electric sheet steel, most modern core design and optimized lamination provide for low-loss and noise-optimized operation.

3 **Windings**
Construction and materials guarantee a long service life.

4 **Tap changer**
Used to adjust the ratio to the local voltage conditions. It can be adjusted from outside in de-energized condition.

5 **Low-voltage bushings**

6 **High-voltage bushings**

7 **Thermometer bag**
Important accessory for temperature monitoring.

8 **Tank**
The TUMETIC design shown here is hermetically sealed. Elastic corrugated walls take up the volume changes of the transformer fluid.

9 **Truck**
Plain transport wheels can be aligned for longitudinal or transversal movement.

10 **Conservator**
In the TUNORMA type, it is equipped with an oil level indicator and a filling socket.

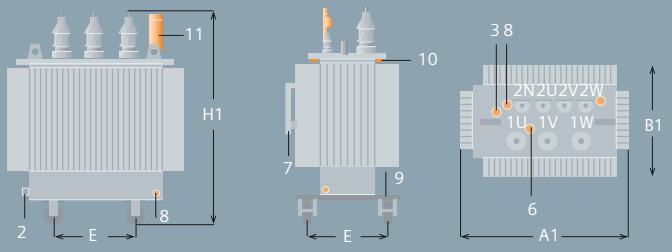
11 **Corrosion protection**
The surface gets a multicoating in the standard color cement gray (RAL 7033). Special colors or galvanization are possible.

From oil to ester: The transformer fluid

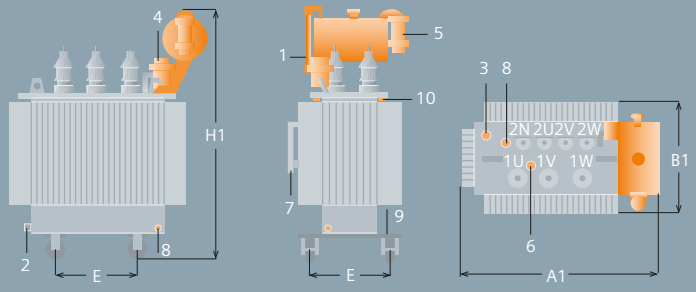
Insulating and cooling – these tasks represent high requirements for the transformer fluid: It must be insensitive to high temperatures, to the influence of air oxygen and catalysts; furthermore it has to be resistant to aging and non-corrosive. Siemens uses the adequate fluid for each customer requirement and application:

- **Mineral oil,** which complies with the specifications of the international standards for insulating oils, IEC publication 60296 – for distribution transformers without special requirements.
- **Silicone oil,** which is self-extinguishing in case of fire. Due to its high fire point above 300 °C it has been classified as a K-liquid according to IEC 61100.
- **Ester,** which is nonhazardous to water and has a very good biodegradability. Additionally, ester offers high fire safety due to its high fire point above 300 °C, and has also been classified as a K-liquid according to IEC 61100.

TUMETIC distribution transformers
(hermetically sealed tank)



TUNORMA distribution transformers
(with conservator)



1 Oil level indicator
2 Oil drain valve
3 Thermometer pocket
4 Buchholz relay (on order)
5 Dehydrating breather (on order)
6 Adjustment facility for tap changer
7 Rating plate (movable)
8 Earthing terminal
9 Pulling lug, ø 30 mm
10 Lashing lug
11 Filling tube

Perfectly prepared for any task – whether “standard” or “special”

TUMETIC and TUNORMA – two transformer types, many applications. The standard design already covers a wide range of requirements, but as we know from long years of experience, special applications ask for special solutions. That is why Siemens offers a wide variety of useful additional solutions, assembly appliances and devices. Here are some examples:

- Safe-to-touch outside-cone and inside-cone plug-in bushings on the high-voltage side instead of porcelain bushings.
- Transformer connection terminals on the low-voltage side with or without covers.
- Bar bushings on the low-voltage side with or without covers.
- Air-filled cable connection boxes for special protection requirements.
- All relevant protection and monitoring devices for distribution transformers.

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