



## Extending transformer lifecycles with drying

SITRAM® DRY – stationary transformer drying and moisture monitoring with  
TLM™ – Transformer Lifecycle Management™

Answers for energy.

**SIEMENS**

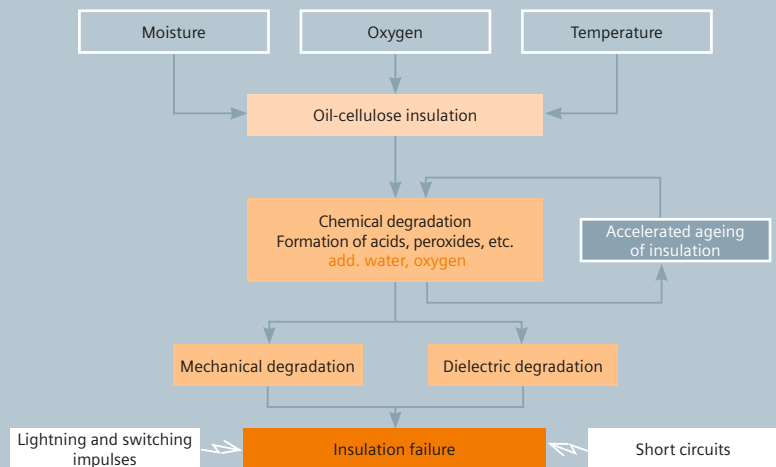
**SIEMENS**  
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# Stationary oil and insulation drying extends the life of your transformer

## The challenge:

The life of a transformer's solid insulation plays a key role in determining the transformer's lifecycle. In addition to high temperatures and oxidation processes, moisture is the primary enemy of the cellulose-based insulation system. Experts agree that maintaining low water content in cellulose and oil substantially prolongs transformer life expectancy. Since much of the moisture is stored in the cellulose and not in the oil, sporadic oil drying, which occurs during oil purification, is not enough on its own.

## Ageing processes in the transformer's insulating system:



Water causes the insulation to age, resulting in unexpected downtimes.

## SITRAM® DRY – the video

Experience the functions of SITRAM® DRY in sound and vision:

[www.siemens.de/energy/sitram-dry-video](http://www.siemens.de/energy/sitram-dry-video)

Water content and temperature influence the oil's breakdown voltage, as does the ageing of the fluid and solid insulation. As a result, the water content of the fluid and solid insulation has a major impact on the current operating condition and lifecycle of a transformer. Over the years, the water content increases due to hygroscopic binding of air moisture as well as cellulose and oil degradation. These processes cannot be entirely prevented. But there is a solution.

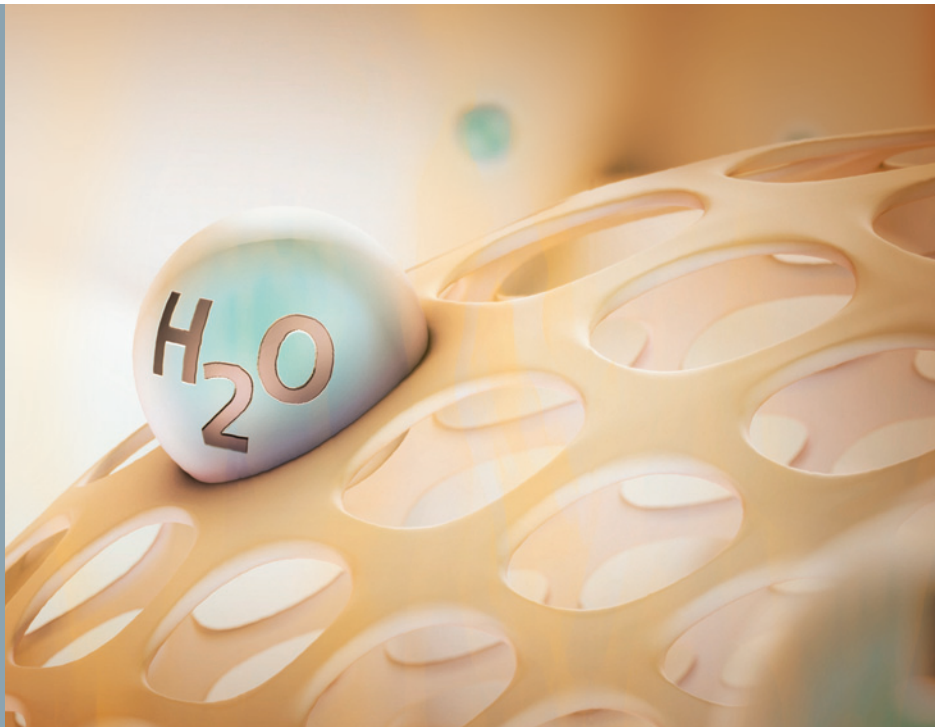
Conventional methods with the short-term use of conventional oil purification systems do not reduce moisture to the necessary extent. With SITRAM® DRY, Siemens offers a continuous bypass drying method in which the transformer oil is continuously passed through cartridges during operation. The sieve material contained in the cartridges adsorbs the moisture. The dried oil is then fed back into the transformer. Now that the state of equilibrium has shifted, deposited

water molecules diffuse from the cellulose insulation into the insulating oil, and the moisture content throughout the transformer drops. At the same time, the oil's breakdown voltage returns to normal levels once the process begins.

Optional temperature and moisture sensors at the inlet and outlet make it possible to control the drying process and, if necessary, signal when the cartridges are ready for replacement. Oil samples for DGA analysis can be removed at the inlet and outlet points.

Siemens extends the lifecycle of your transformer.  
With Siemens SITRAM® DRY.

# SITRAM® DRY – extending transformer life



Drying oil continuously produces a cellulose/oil diffusion gradient, thereby drawing the water out of the insulation.

## You get all the advantages

SITRAM® DRY offers a number of advantages over conventional drying methods. While all the oil is pumped off and purified in off-line methods, SITRAM® DRY lets you continue operation without interruption. This not only lowers your costs (no downtime costs, very low labor costs), but also guarantees very low water content in oil and cellulose over the long term, instead of only reducing oil moisture temporarily.

## Top quality and compliance with guidelines

Siemens has over a century of experience in transformer manufacturing. We are the only transformer manufacturer who also produces oil drying systems and uses them in our own transformers. We know what matters and we guarantee top quality and conformity with directives for every component – from water law certification of the cabinet to the Siemens coating layers on the flange.

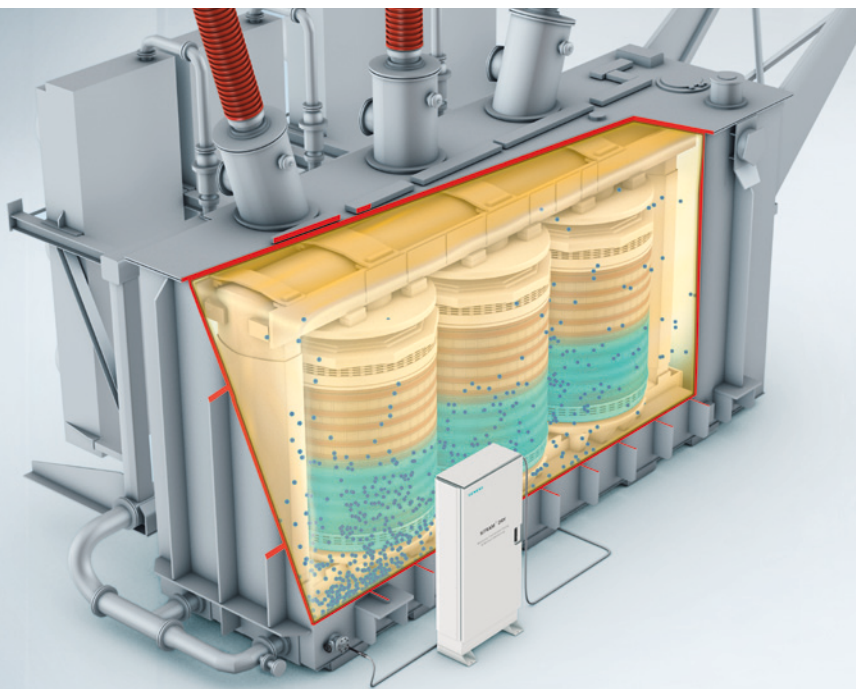


SITRAM® DRY can be installed with little effort – even during operation.

## Factors for a long transformer life

- **Online drying**  
SITRAM® DRY continuously draws moisture not only from the oil, but also from the cellulose insulation, and without additional heating or vacuum.
- **Increases breakdown voltage**  
SITRAM® DRY increases the breakdown voltage back to normal values after only a short time of use.
- **Cost-effective, rugged solution**  
SITRAM® DRY features top-quality components made in Germany, and low maintenance.
- **Installation and operation without interruption**  
SITRAM® DRY can be installed, operated and maintained while the transformer is in operation.

SITRAM® DRY is part of the SITRAM® family.  
These modular solutions help you maintain the availability and operating life of your transformers.



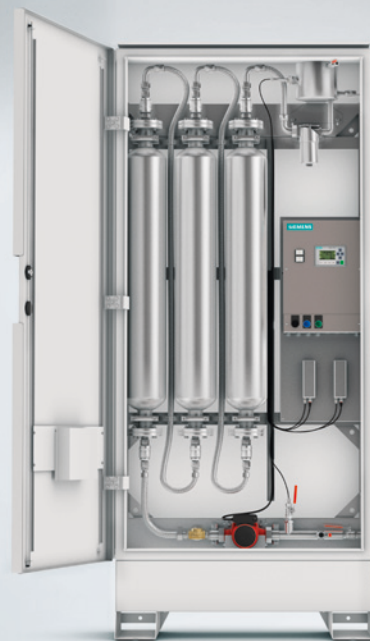
Continuous oil drying is necessary in order to reduce the moisture in oil and insulation over the long term.

### Modular system

SITRAM® DRY is a modular concept that can be easily adapted to individual requirements. It supports oil transformers of any size – from 1.6 MVA to 1,200 MVA. The system can be installed in both new transformers and older models during operation. Two basic designs, a frame version and a cabinet version, are available.

In the frame version, SITRAM® DRY is mounted in an open steel frame, together with optional moisture sensors (LCD display). The cabinet version is a good choice if you are not only concerned with ease of installation, but also want to protect the drying system from external influences. The cabinet has a pressure equalization system, prevents animals from getting inside and is certified for a protection class of IP 55 and higher.

Optional monitoring modules for convenient system maintenance are available, including a traffic light monitor for controlling the pump operating state and the degree of cartridge saturation. A notification module that transmits status reports by e-mail or SMS text messaging is available for remote monitoring.



The filter cartridges can be changed with little effort.

### Comprehensive service

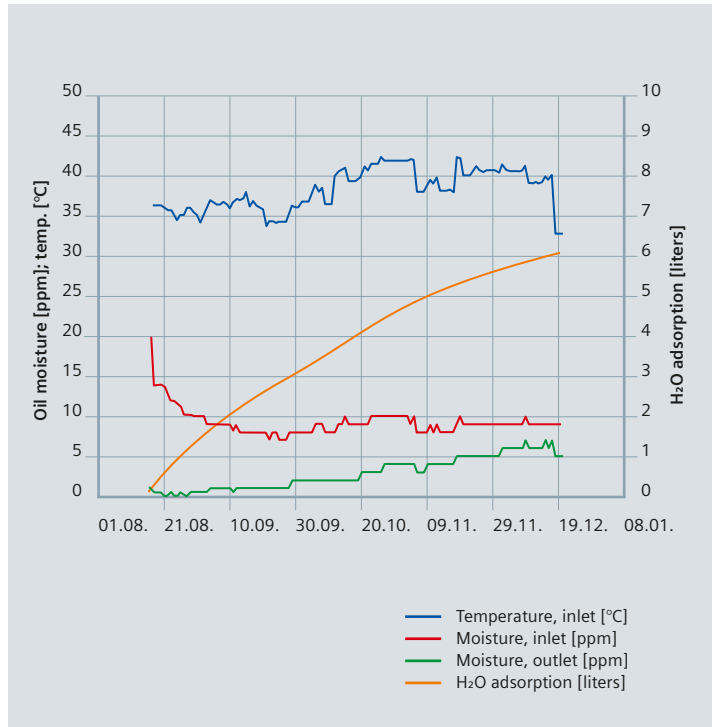
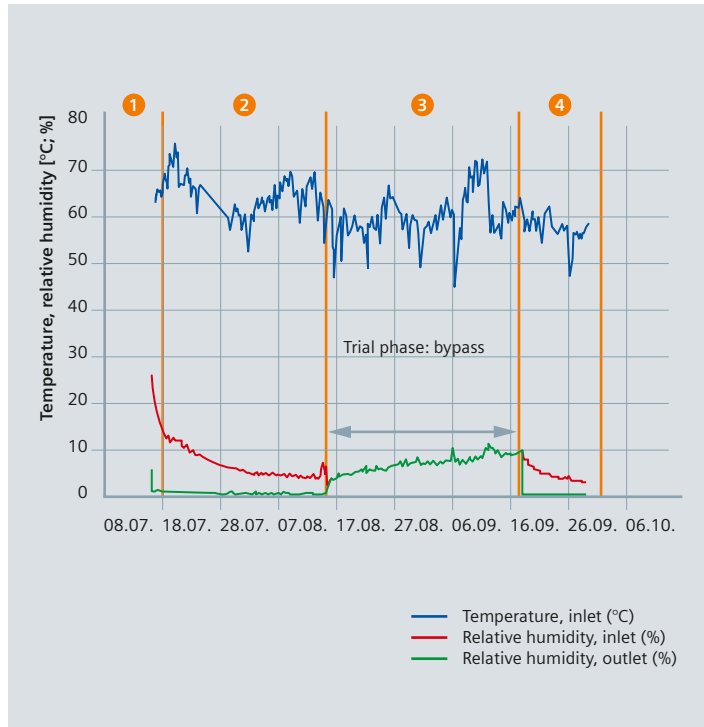
SITRAM® DRY is an extremely rugged system and requires little maintenance. Thanks to the moisture sensors at the inlet and outlet, the degree of cartridge saturation can be determined very precisely, and the cartridge replacement times can be predicted by trend analysis. The cartridges are replaced with little effort, thanks to the fast-release couplings, safely and drip-free.

With our services, you decide how much of your own drying work you wish to perform, or whether you want to do it at all. From installation and process monitoring to cartridge replacement, we give you as much support as you want.

For online configuration of your SITRAM® DRY visit:  
[www.siemens.com/energy/TLM](http://www.siemens.com/energy/TLM)

# SITRAM® DRY

## Technical data



Cumulative precipitation volume when using SITRAM® DRY in a 44-MVA/110-kV transformer, 1977 model

### Example of the drying process in practice

The normal drying process takes place in two phases. During the first phase, the water content of the oil is quickly reduced (2–3 days in our example). This substantially improves the breakdown voltage.

The second phase is determined by how much moisture is further diffused out of the solid insulation after being precipitated from the oil. The flow of moisture decreases steadily, along with the relative humidity concentration.

In a trial, the filter cartridges were removed from the cycle. The relative humidity in the oil continued to rise steadily during this test phase. Over the observed time frame of around four weeks, the moisture began to achieve a new equilibrium between the oil and solid insulation. The filter cartridges were then reconnected to the oil cycle, and the oil moisture dropped rapidly once more.

This trial impressively demonstrates the period of time required for equalization processes between the solid insulation and the oil. Once again, this illustrates that temporary drying methods do not achieve the desired effect, and only a stationary drying system can reduce moisture over the long term.

	Frame version	Cabinet version
Dimensions		
Height	2,100 mm	2,430 mm
Width	1,000 mm	1,040 mm
Depth	400 mm	400 mm
Weight (filled)	approx. 230 kg	approx. 400 kg
Protection class	IP 43	IP 55
Electrical connection	110 V – 230 V, 50 Hz – 60 Hz, 0,4 kW	
Environmental conditions	–10 to +50 °C	–30 to +50 °C
Max. oil temperature	105 °C	
Modules	Temperature and moisture transmitter at the inlet and/or outlet (LCD display)	
		Control and monitoring module, incl. 2 temperature and moisture transmitters
	Transport frame	Specially coated cabinet
	Installation kit; 2 flexible connecting hoses, 2 special-purpose flanges, isolator, set of gaskets	

We reserve the right to make technical changes to the described details and technical data. Modifications to special transformers and local conditions will result in deviations from this standard product description. Continuous enhancement of the method as well as the components used in SITRAM® DRY are unavoidable in order to optimize use.

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