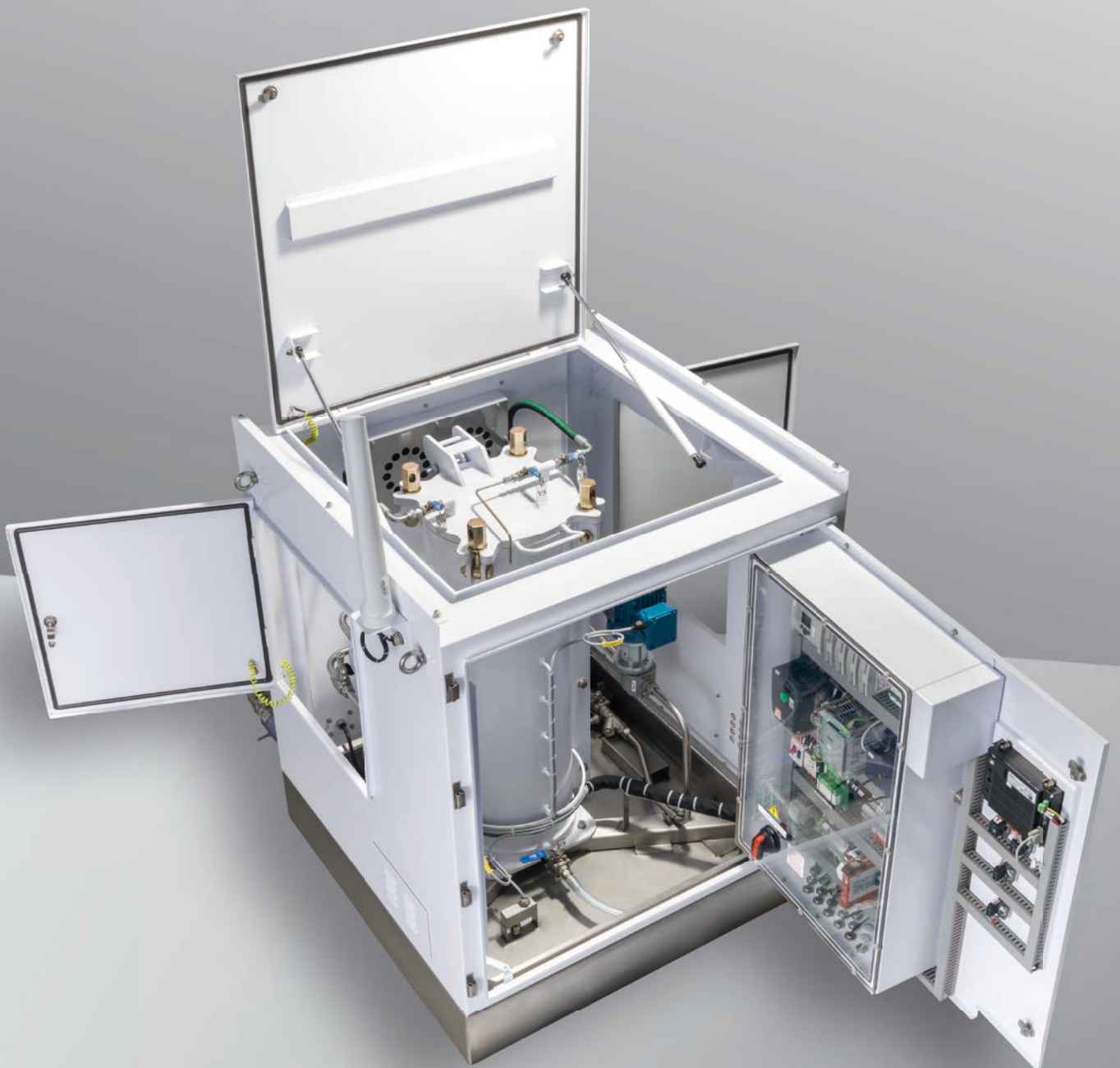




EXPIOTECH

ON-LINE TRANSFORMER DRYING.

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EXPIOTECH. LEADING MOISTURE MANAGEMENT SYSTEMS FOR OIL-FILLED POWER TRANSFORMERS.

With the unique features of the EXPIOTECH Moisture Management Systems (MMS), we offer valuable solutions to utilities and industries to optimize the lifetime of their power transformers.

Why moisture management?

Moisture, in combination with temperature, is the primary factor affecting the degradation of the insulating paper and consequently the useful life of the transformer:

- Moisture accumulates over time and usage:
 - From outside: through breathing and ingress through joints
 - From inside: as a main degradation by-product of cellulose (paper) and oil oxidationEvery transformer is affected by a moisture level above 2% at some point in its service life
- A moisture increase in the paper by 1% reduces transformer lifetime by half
- A moisture level of 4% or more exposes the transformer to higher risks of electrical failures due to insulation breakdown from free water formation (during cool down) or bubbling (vaporization of the moisture in the paper)
- Moisture management is highly cost effective because it extends the transformer lifetime by up to 20 years

How to remove moisture?

Typically, all of the moisture (>99%) in the transformer insulation is contained in the cellulose and only a very small amount (<1%) in the oil. Drying needs to be controlled in order to avoid:

- **Insufficient drying**

Moisture can easily be removed from the oil in only a few days using on-line oil drying systems. However, most of the moisture in the paper is left untouched as the water diffusion process from paper to oil is slow. Eventually, the moisture level in the oil will reestablish at a level close to the initial level
- **Excessive drying**

Excessive drying of the paper will endanger stability of the windings due to the loss of the clamping force resulting from shrinking. When a heat-vacuum process is used, paper degradation can also result from exposure to high temperatures

To ensure an optimum drying process, constant monitoring of the moisture and evaluation of its content in the paper is necessary. Moreover, on-line drying systems should not influence the fault gases (DGA) for obvious protection and diagnostics reasons.

What is the EXPIOTECH smart drying concept?

Moisture Management Systems (MMS) units are equipped with intelligent moisture assessment and control via EXPIOTECH's own proprietary algorithms. The smart drying concept ensures:

- **Accuracy**

Paper moisture is evaluated by monitoring the oil's water content and temperature over time taking into account the oil-paper moisture dynamic equations. This ensures the most accurate assessment possible. Conventional methods of paper moisture assessment are known to have inaccuracies in the range of +/-50%
- **Optimization**

Once the initial moisture is accurately determined, a target moisture is established to optimize the drying with minimal risk to the winding stability. The MMS unit can then apply its unique filtering process until the required amount of water is removed
- **Control**

MMS units have on-board intelligence and full remote connection capabilities ensuring the highest control and safety of the process. Using a regular web browser, users can check the complete status, change the operating mode (evaluation or filtering), and stop or restart the process at any time. Any event or anomaly is automatically reported via SMS or e-mail

Remote connection also offers unequalled service and technical support capabilities, MR specialists from our subsidiaries can assist you on-line throughout the complete drying process.

EXPIOTECH MOISTURE MANAGEMENT SYSTEMS (MMS).

Significant extension of the transformer's life expectancy.



Remote GSM connection – process and alarms

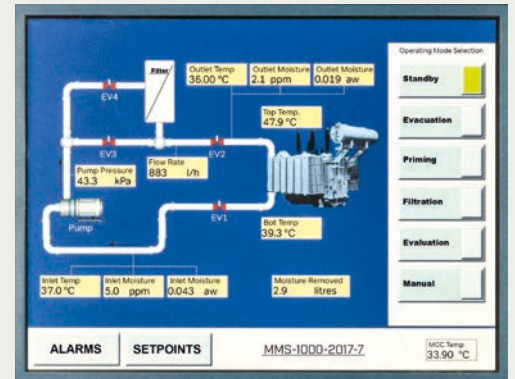
Filter changes do not require special tools

Vacuum pump to evacuate air when commissioning

The MMS is designed to accurately measure the moisture in the paper insulation and to remove it through a gentle filtering process using Velcon Superdri Technology, while the transformer remains energized and in full service. This process also filters out particles down to a size of one micron.

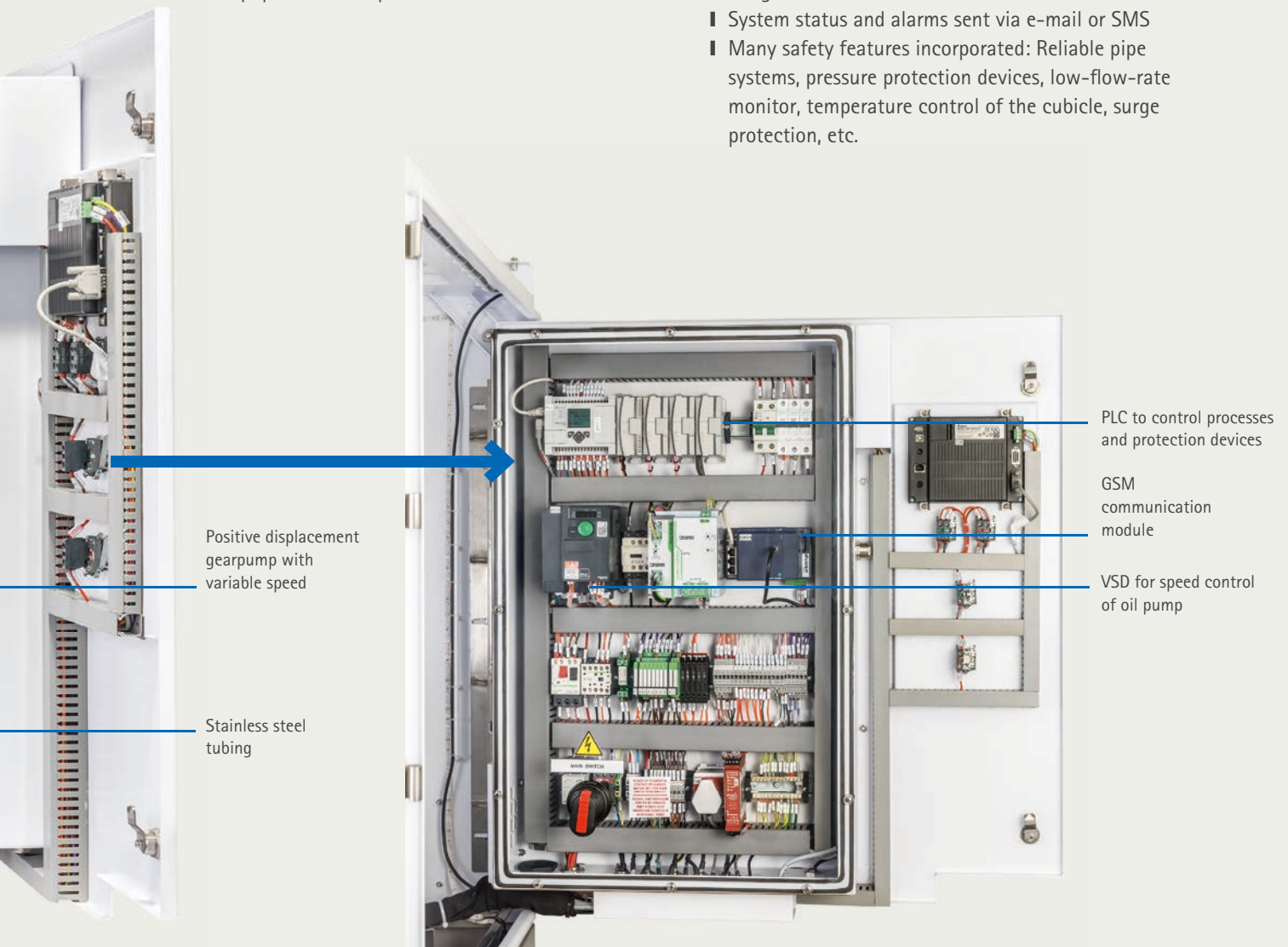
The MMS enables transformer operators to fully manage and control the moisture content of the transformer oil and insulation thus extending the transformer's useful service life.

Touchscreen - for local control and display of parameters

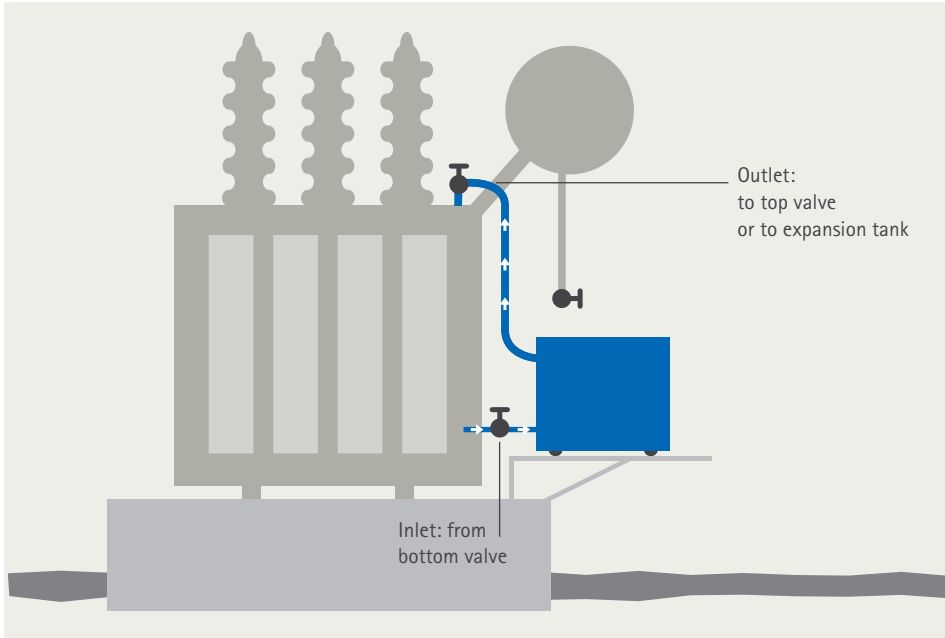


Features

- Highly efficient moisture filtering based on Velcon Superdri Technology
- Does not affect fault gases (DGA interpretation) and other markers (furans, methanol)
- Does not affect oil properties such as aromatic content or oxidation inhibitors
- Filter changes can be done by a single operator in under 30 minutes using simple hand tools; no specialist personnel, special tools or lifting equipment are required
- Used filters are disposed of with normal oil residues
- On-board intelligence for accurate evaluation of moisture content and full control of its removal
- Computer assisted operation: Easy to maintain and operate
- Very low power consumption using regular AC supply
- Autonomous operation, remote supervision and control through an internet-based process using a regular web browser
- System status and alarms sent via e-mail or SMS
- Many safety features incorporated: Reliable pipe systems, pressure protection devices, low-flow-rate monitor, temperature control of the cubicle, surge protection, etc.

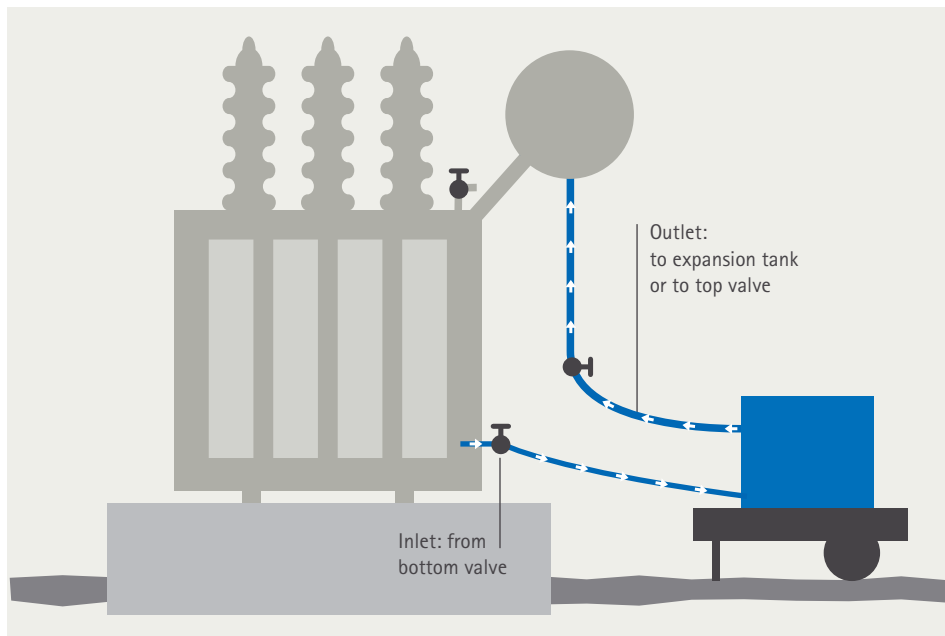


APPLICATIONS.



PERMANENT INSTALLATION

- Permanently installed on a transformer (side mounted or on a separate platform)
- Stainless steel piping to and from the transformer
- Maintains the paper moisture at a constant, optimum level
- When installed on a new transformer, ensures a maximum lifetime by maintaining the factory moisture level
- Oil moisture and temperature data available for monitoring purposes



MOBILE UNIT

- Unit is installed on a mobile rig such as a trailer for periodic drying of a fleet of transformers
- Incorporated vacuum pump for on-line energized installation, if de-energization is required for safety reasons, installation can typically be carried out in less than 4 hours
- Double pipe system with protection switch: collects and directs any leak to the cabinet tray

TECHNICAL DATA.

MMS 1000.



Technical data	MMS 1000 mobile version (* where different for the permanent version)
Nominal voltage	220/240 V single phase (standard), other options available
Nominal frequency	50 Hz/60 Hz
Rated current	8 A
Peak current	2 x rated current
Connection	Single phase L+N+E
Cabinet material specification	304 stainless steel, powder coated with raw, brushed base
Color	White and raw brushed stainless steel
Dimensions (approx. W x D x H)	Main cabinet: 1055 mm x 1050 mm x 1270 mm Toolbox (mobile version): 750 mm x 725 mm x 570 mm
Weight	Main cabinet approximately: 380 kg Toolbox and pipes (mobile version) approximately: 200 kg
Cooling	Standard: Air cooling with extraction fans which are temperature controlled Optional: Panel air condition unit, 750 Watt
Ambient conditions	Maximum range of ambient temperature: 0 - 50°C Recommended ambient temperature for continuous operation: 35°C Transport and storage: -10 to 60°C
Oil temperature	0 - 120°C
Moisture sensors	Vaisala moisture in oil transmitter MMT162, analog output RS485 +4 - 20 mA
Oil pump*	Midland BA150RVCC gearpump - flow rate 13 l/m to 51 l/m (nominal flow rate = 16 l/m)
Oil pump motor*	0.55 kW, 6 pole, 930 rpm, 380 V, IP55
Actuator valves	KLD 20, stainless steel ball valve, 230 V electric actuator, 3 wire system
Solenoid valves	Burkert 6281, 8 watt, 230 Volt, 50/60 Hz 2/2-ways (normally closed)
Flow meter	Burkert SE35, IP65, output 4 - 20 mA, measuring range - programmable
Oil sight glass	Flowpoint SP-020-NPT (316 stainless steel)
Pressure transmitter	WIKA A-10, measuring range 0 -10 bar, 0 - 80°C, output 4 - 20 mA, 2 wire, power supply 8 - 30 V DC
Float switch (main cabinet)	D3001D, switching voltage 240 Vac/200 Vdc, max switching current: 0.5 A, -20 to 120°C
Vacuum pump*	PVR, model EM4, pump speed 4 w ^m ³, ultimate vacuum 2 mbar, 220 V 50/60Hz
Vacuum gauge*	WIKA bourdon tube pressure, model 213.53, Scale -100 to 0 kPa
Certification	CE
Communication	GSM modem (standard), other options available as per customer specification
Filters	4 x SD 1107 HT

MORE POWER, MORE VALUE.

MR-EXPIOTECH Transformer Moisture Management Systems (MMS) enable transformer operators to accurately measure the moisture in the insulation of a transformer, to remove moisture as required and to maintain the moisture at low risk levels, all with the transformer remaining in normal service.



Cost effective

- Low operating costs – typically 60% less than the conventional heat-vacuum drying process
- Significant extension of the transformer's life expectancy of up to 20 years leading to important reduction of capital replacement costs



Smart drying technology

- On-board intelligence and web-based application
- Accurate paper moisture evaluation and controlled process to avoid the risk of over-drying
- Full remote supervision and control – anytime and anywhere



No undesired side effects

- No influence on fault gases (DGA trend not affected for protection and diagnostics)
- No influence on other markers (furan, methanol), oxidation inhibitors or aromatic content
- Gentle filtering process using Velcon Superdri Technology that cannot damage the paper (unlike heat processes)



Service

- Worldwide MR service network
- Fast remote assistance and service possible through web-based connection

Maschinenfabrik Reinhausen GmbH

Falkensteinstrasse 8
93059 Regensburg, Germany

Phone: +49 941 4090-0
Fax: +49 941 4090-7001
E-mail: sales@expiotech.reinhausen.com

www.reinhausen.com

THE POWER BEHIND POWER.

