streamer electric

TRANSEC CL SERIES

ONLINE MOISTURE MONITORING & DRYING SOLUTIONS FOR OIL INSULATED TRANSFORMERS

2023 CATALOGUE


TRANSEL
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TRANSEL
#2

HISTORY TRANSEC ELECTRIC LTD

2004

TRANSEC UK Ltd created and the first TRANSEC unit launched.

2007

First installation of 22 units with ABB in India.

2009

Installation of TRANSEC units to UK HV Grid and in all the United Kingdom Nuclear Electric sites.

2012

Standardisation of TRANSEC installation on all new transformers of PGCIL India.Introduction of the first version of TRANSEC monitoring cabinet with VAISALA sensors.

2016

Cooperation with Streamer Electric AG. Starting to promote and sell in new regions like South-East Asia, Latin America, Africa.

2019

Streamer Electric AG taking over TRANSEC business. TRANSEC Electric Ltd is created. New investment made in TRANSEC, commencing the re-design of all units utilizing the proven moisture removal technology.

2021

TRANSEC launch new design i-version online transformer moisture removal system.

2023

Creation of new TRANSEC Global Installation and Regeneration Services Team with Client Competency Training and Technical Support.

THE ISSUE: MOISTURE IS THREATENING THE TRANSFORMER

Moisture is one of the primary causes of failures for power transformers and one of the main degradation factors for the insulation paper. It, therefore, increases the risks of operation failures and shortens the life expectancy of the asset.

Unfortunately, moisture can appear in a transformer from several sources, which are external or internal and it has a complex dynamic between the oil and paper within the transformer. The use of silica gel breathers, sealed tanks or nitrogen blankets can avoid all or at least the most of moisture from the atmosphere to affect the transformer. However, when the transformer is energised, the production of water inside the insulation is a natural and inevitable occurrence over time due to the depolymerisation of the cellulose paper.

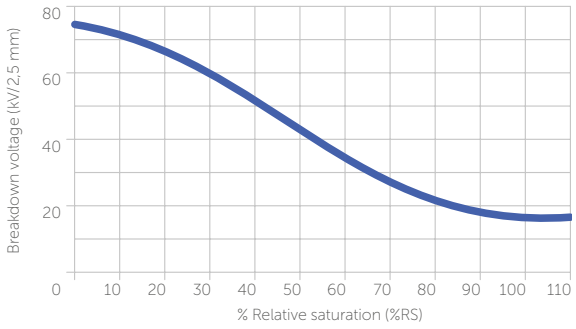


Figure 1. Dependency between breakdown voltage and water content in insulating liquid*

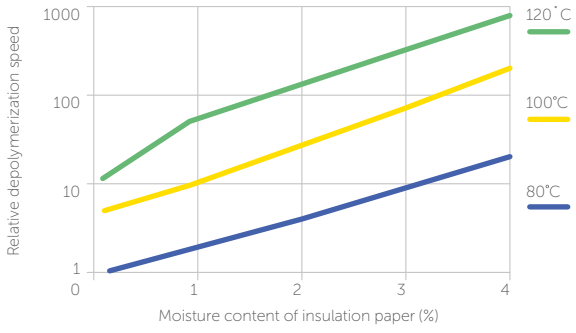


Figure 2. Cellulose depolymerisation speed dependence on moisture content in insulation paper for different temperatures**

EFFECT ON SAFETY

As shown in figure 1, the higher the relative water saturation, the lower the oil's breakdown voltage (BDV). As water migrates between the solid and liquid insulation in a transformer with changes in load and, therefore, temperature so does the relative water saturation in oil.

Peaks of relative saturation are usually observed during transformer state changes (high to low temperature or reverse). Moisture reduction is, therefore, a pivotal effort to be made to increase safety, especially for transformers with quick and frequent load changes.

EFFECT ON TRANSFORMER LIFE EXPECTANCY

The insulation paper's mechanical strength is defined by the degree of polymerisation, also called DP, representing the average length of cellulose chains in the paper. A new transformer typically has a DP between 1200 and 1000 while the end of transformer life is considered when the DP falls to 200. This degradation cannot be stopped, but its speed will depend on the water content in the paper (see figure 2).

In CIGRE brochure D1.01.10 (2007), "Fallou showed that the rate of degradation of the paper at an initial value of 4% water content was 20 times greater than that at 0.5 % water content."

Moisture is having a significant effect on the speed of paper degradation and therefore on its life expectancy.

* CIGRE Moisture measurement and assessment in transformer insulation — evaluation of chemical methods and capacitive moisture sensors, page 10

** CIGRE Moisture measurement and assessment in transformer insulation — evaluation of chemical processes and capacitive moisture sensors, page 14

THE SOLUTION: MAINTAINING A DRY TRANSFORMER BY CONTINUOUS FILTRATION

Maintaining a low level of moisture in a transformer provides significant benefits in terms of operations and risk as it carries a constant high insulation level. It is therefore possible to load the transformer at a higher level and to make this load vary without risk of damaging the transformer.

Also, it has consequent financial benefits since it elongates the asset's life by slowing down the paper degradation. This degradation creates particles or even sludges. Finally, moisture is also responsible for the creation of acids in the oil. Hence keeping a low level of moisture will lower the maintenance costs.

ONLY CONTINUOUS FILTRATION IS EFFICIENT IN REMOVING MOISTURE FROM A TRANSFORMER

As moisture is created continuously and as it is one of the primary concern for the transformer safety and life expectancy, it seems counter-intuitive to apply a temporary solution for this ongoing problem.

Also it is essential to note that more than 98% of the water in a transformer is in the paper, while a meagre amount is dissolved in oil. The diffusion time of water from paper to oil is prolonged. This is why punctual filtrations are not solving the moisture issue.

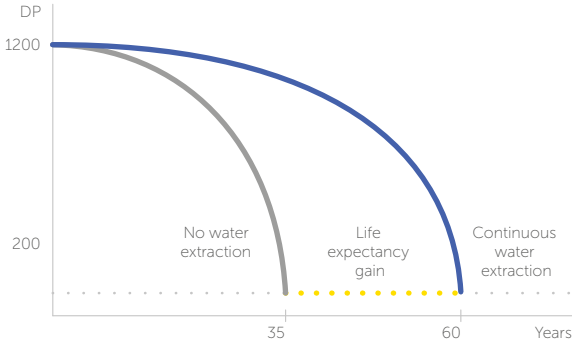


Figure 3. Benefit of continuous online drying system

	Oil filtration	LFH or similar method	Online drying system
Solution type	Temporary	Temporary	Continuous
Transformer live during process	Up to user risk assessment (oil flow >500l per hour)	No	Yes
Dries oil	Yes	Yes	
Dries paper	No		
Improves Breakdown voltage	Temporarily (months)		
Extend life expectancy	No		
Dissolved Gasses level maintained		No	
Operator free process			
Cost	$	$$$	$

THE ISSUE: ASSESSING THE AMOUNT OF WATER IN THE TRANSFORMER

1. More than 98% of the water present in the transformer is contained in the paper insulation while less than 2% is in the oil. Unfortunately, the insulation paper is not easily accessible for water assessment.

2. Water solubility in oil varies depending on oil temperature and therefore PPM differs also. Hence it is not possible to check the PPM value to define the amount of water in paper.

3. If PPM and oil temperature are known some curves exist (see Oomen curves figure 4) to link the water PPM in oil and the water content in the paper. But these curves are only really valid at equilibrium which is in general never reached on a running transformer.

4. As the water diffusion time is faster from the paper to the oil than the opposite it is possible to reach on the same transformer, several very different PPM values for the same oil temperature even at a few days difference (see figure 5).

5. As a result of the previous points, taking an oil sample once or twice per year to assess the moisture level in the transformer seems irrelevant.

6. Furthermore, oil samples can be contaminated at the sampling time or in the laboratory. As the moisture level is anyway very low in oil, any contamination (simple contact with the ambient air) will affect the sample PPM result. The chart (figure 6) shows PPM analysis results of 7 different laboratories on 3 different oils.

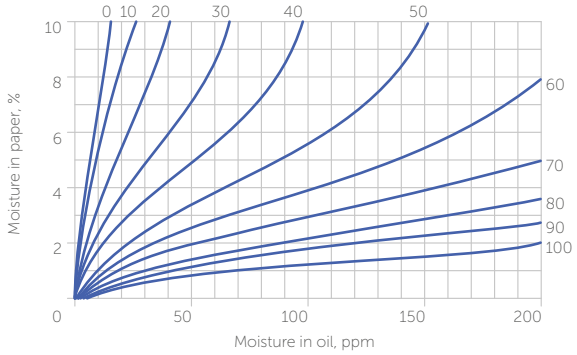


Figure 4. Moisture Equilibrium curves* (Oomen)

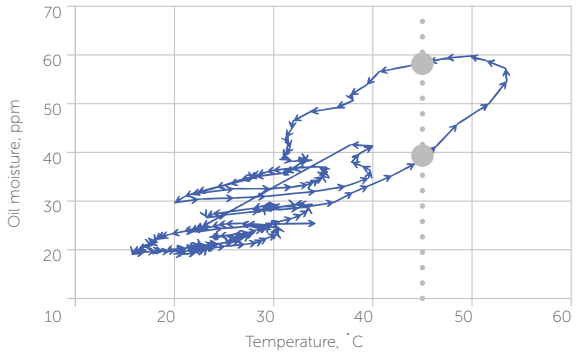


Figure 5. Moisture dynamics: hysteresis**

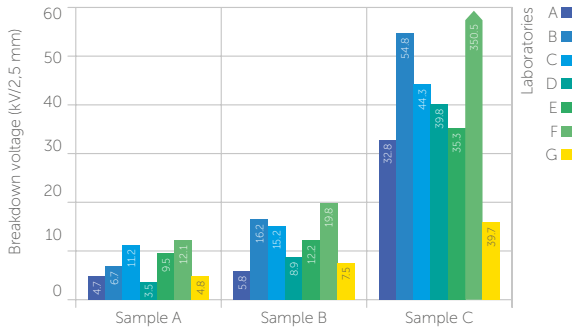


Figure 6. Reliability and Improvements of Water Titration*** by the Karl Fischer Technique

M. Koch*, S. Tenbohlen, J. Blennow, I. Hoehlein

* CIGRE Moisture measurement and assessment in transformer insulation — evaluation of chemical methods and capacitive moisture sensors, page 74

** Moisture in transformer Oil Behaviour, page 14

*** Reliability and Improvements of Water Titration by the Karl Fischer Technique, page 4

THE SOLUTION: CONTINUOUS MOISTURE ASSESSMENT

MOISTURE AND TEMPERATURE SENSORS WITHIN THE OIL

TRANSEC Online Moisture Monitoring system uses moisture and temperature sensors to monitor the relative saturation, the PPM, and the temperature of the oil flowing through the TRANSEC. This data is transferred to the TRANSEC monitoring cabinet for analysis. As the sensors are immersed in oil, there is no risk from external contamination, and as the sensors are not changing, repeatability is ensured.

Moisture
& temperature sensor

CONTINUOUS CHECKING

Thanks to the constant sampling from the TRANSEC sensors, the relative saturation, the moisture PPM and temperature can be followed remotely on the webserver which allows assessment of the moisture level in the transformer and to observe the effect of the TRANSEC filtration.

Based on the Oomen curve calculation, the trend of the water content in paper can be followed (see figure 7).

Monitoring the relative saturation vs Temperature hysteresis enables observation of its shape. A narrow shape below 20% moisture shows a healthy transformer while a broad hysteresis exceeding 20% relative saturation (TR P1) on the picture below is a sign of a moist and unsafe transformer.

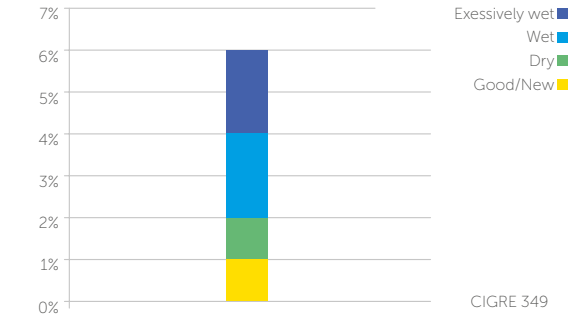


Figure 7. Water content in paper in %

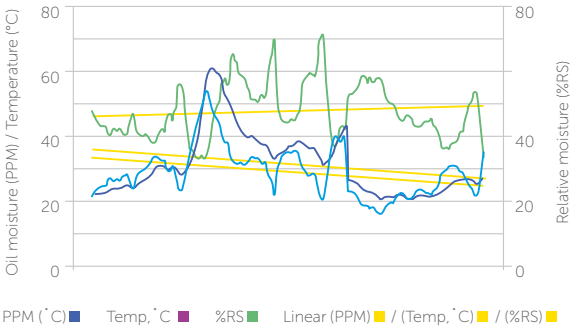


Figure 8. %RS, calculated water content and temperature with time in a 10 MVA moist aged transformer*

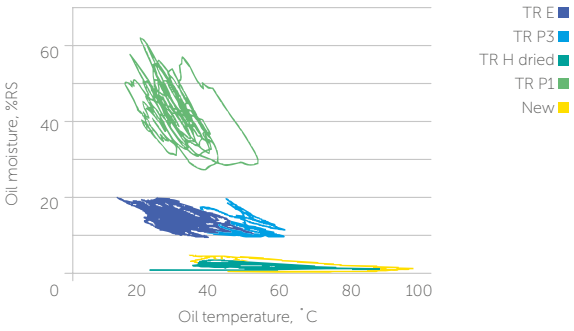
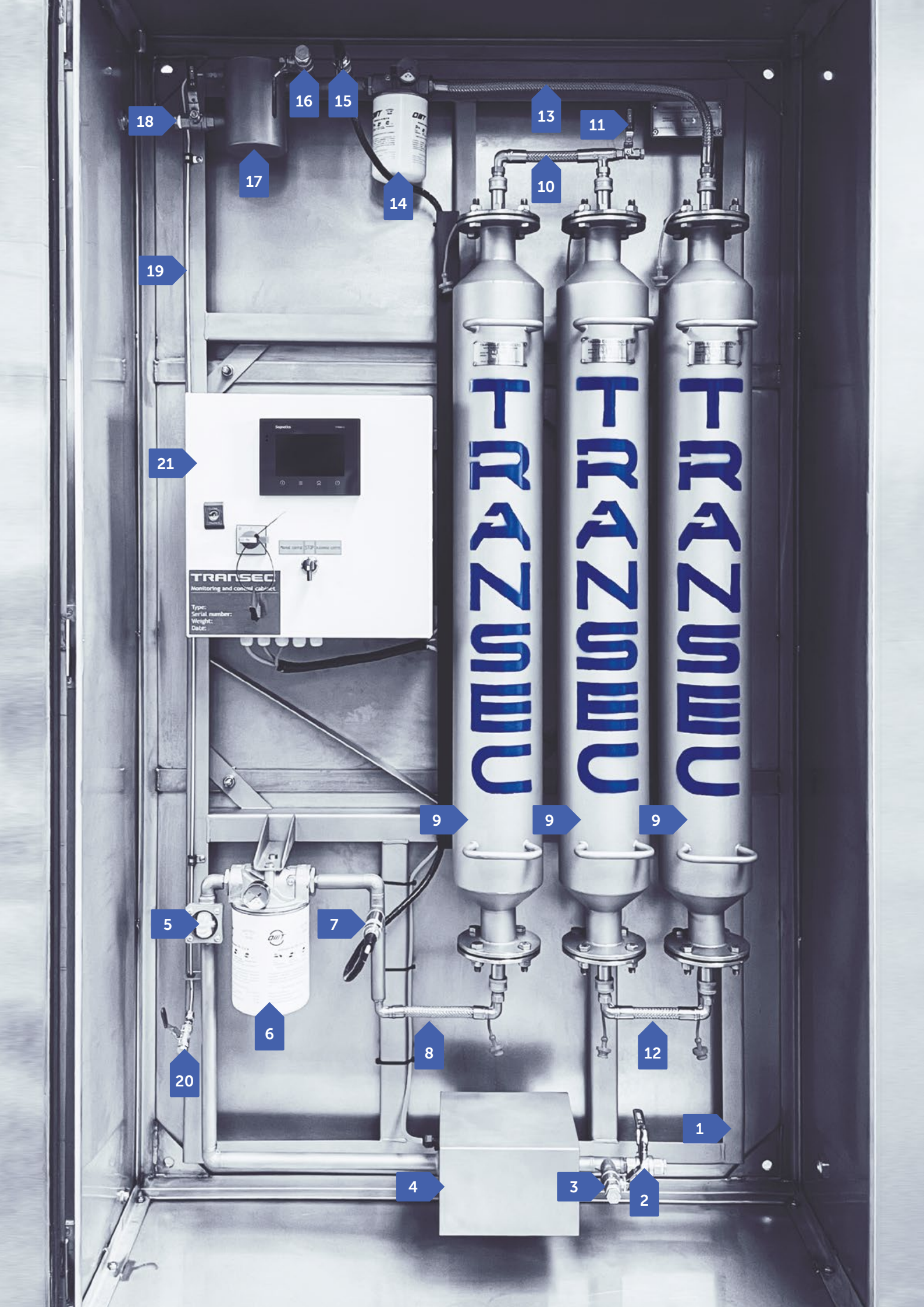


Figure 9. Hysteresis loops of %RS vs temperature in transformers with different moisture level*

* CIGRE Moisture measurement and assessment in transformer insulation — evaluation of chemical methods and capacitive moisture sensors, page 100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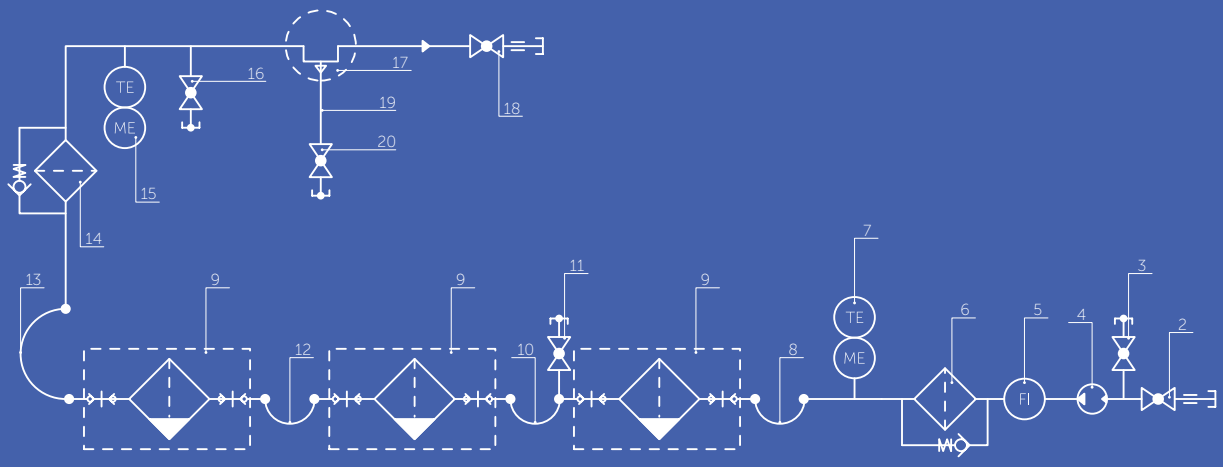
TRANSEC
CL1i, CL2i, CL3i
ONLINE DRYING SYSTEM

PRINCIPLE OF OPERATION



Oil from the transformer tank through inlet ball valve 2 enters the unit. Pump 4 pushes the oil through inlet filter 6 and put it into cylinders 9. While the oil flows through the cylinder, the adsorption process takes place, moisture is adsorbed by zeolite. The oil is returned to the main tank of the transformer through outlet filter 14, deaerator 17 and outlet ball valve 18.

1. Frame
2. Inlet ball valve
3. Inlet sampling valve
4. Pump
5. Flow indicator
6. Inlet filter
7. Inlet moisture and temperature sensor
8. Bottom interconnection pipeline between cylinder and sensor/inlet filter
9. Cylinders
10. Top interconnection pipeline between cylinders
11. Air bleed valve between cylinders
12. Bottom interconnection pipeline between cylinders
13. Top interconnection pipeline between cylinder and outlet filter
14. Outlet filter
15. Outlet moisture and temperature sensor
16. Outlet sampling valve
17. Deaerator
18. Outlet ball valve
19. Bleed pipe
20. Deaerator air bleed valve
21. AMi monitoring and control cabinet (MCC)

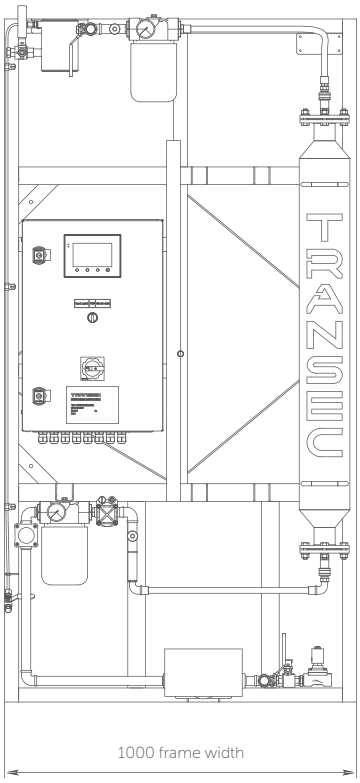
TRANSEC CL UPGRADABLE VERSION: CL1i, CL2i, CL3i

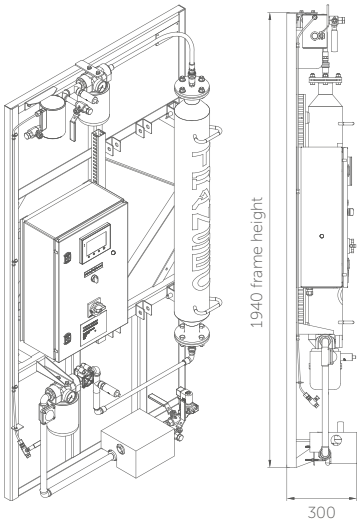
CL1, CL2, CL3 TECHNICAL DATA

Parameter	CL1	CL2	CL3
Water extraction capacity before cylinder change	3 to 4 litres	6 to 8 litres	10 to 12 litres
Flow rate with Grundfos UPS2 pump	70 to 90 litres per hour		
Flow rate with TC500 pump	400 to 500 litres per hour		
Particle filter	10 microns on inlet & outlet. Optionally the unit can be fitted with an additional 3 microns pre-filter. Optionally the unit can be fitted with an additional 5 microns pre-filter for heavily sludged transformers.		
Material	Stainless steel 304 Grade		
Oil temperature range	0°C to 105°C		
Acceptable environment condition	-40°C to +60°C		
Altitude	up to 2000 m		
Protection class of the unit enclosure	IP55		
Protection class of the MCC enclosure	IP65		
Power Supply	240 V 50 Hz or 110V 60 Hz		
Pump Grundfos UPS2 Power	140 W		
Pump Midland TC500 Power	250 W		
Number of cylinders	1	2	3
Oil drying adsorbent	zeolite with 3 Angstrom bead size		
Monitoring	Available in option		
Size	1940 x 1000 x 300		
Installation weight without MCC	128 kg	164 kg	200 kg
MCC weight	00	AMi	WSi
	0.4 kg	12 kg	20 kg
Installation time	5 to 6 hours with 2 people		
Manufacturing type test	3 bar pressure at 110°C for 1 hour		
Manufacturing routine test	Cyclic 3 bar pressure at 60°C for 24 hours		
Enclosure	Optional. In stainless steel		
Fixation	On the wall or the ground		

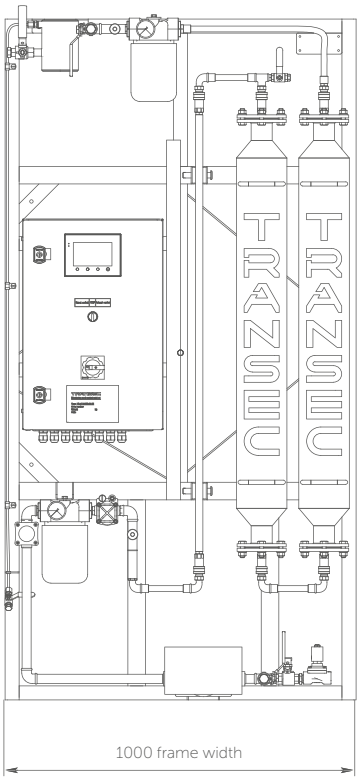
TRANSEC
CL1i, CL2i, CL3i
DIMENSIONS

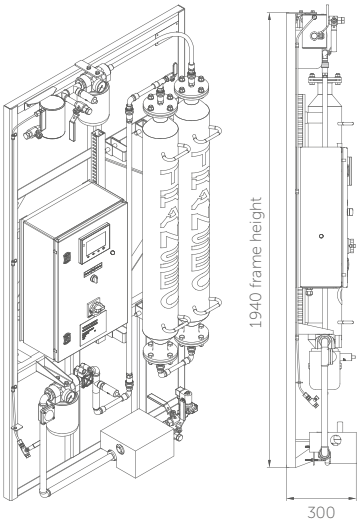
CL1 WSi



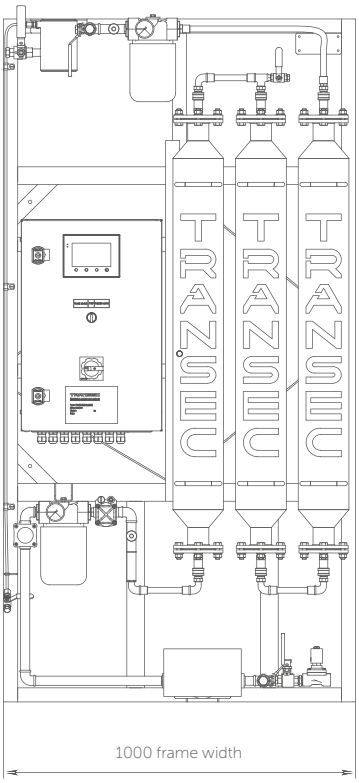


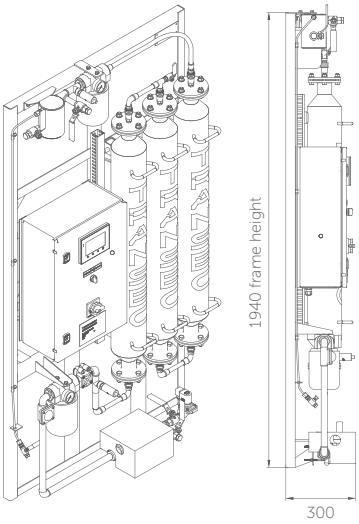
CL2 WSi





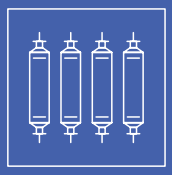
CL3 WSi





TRANSEC CL4

THE COMPACT & MOVABLE VERSION

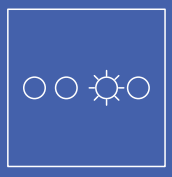


4 CYLINDERS TO ABSORB MOISTURE

LIGHTER CYLINDERS — 25 KG EACH SATURATED WEIGHT

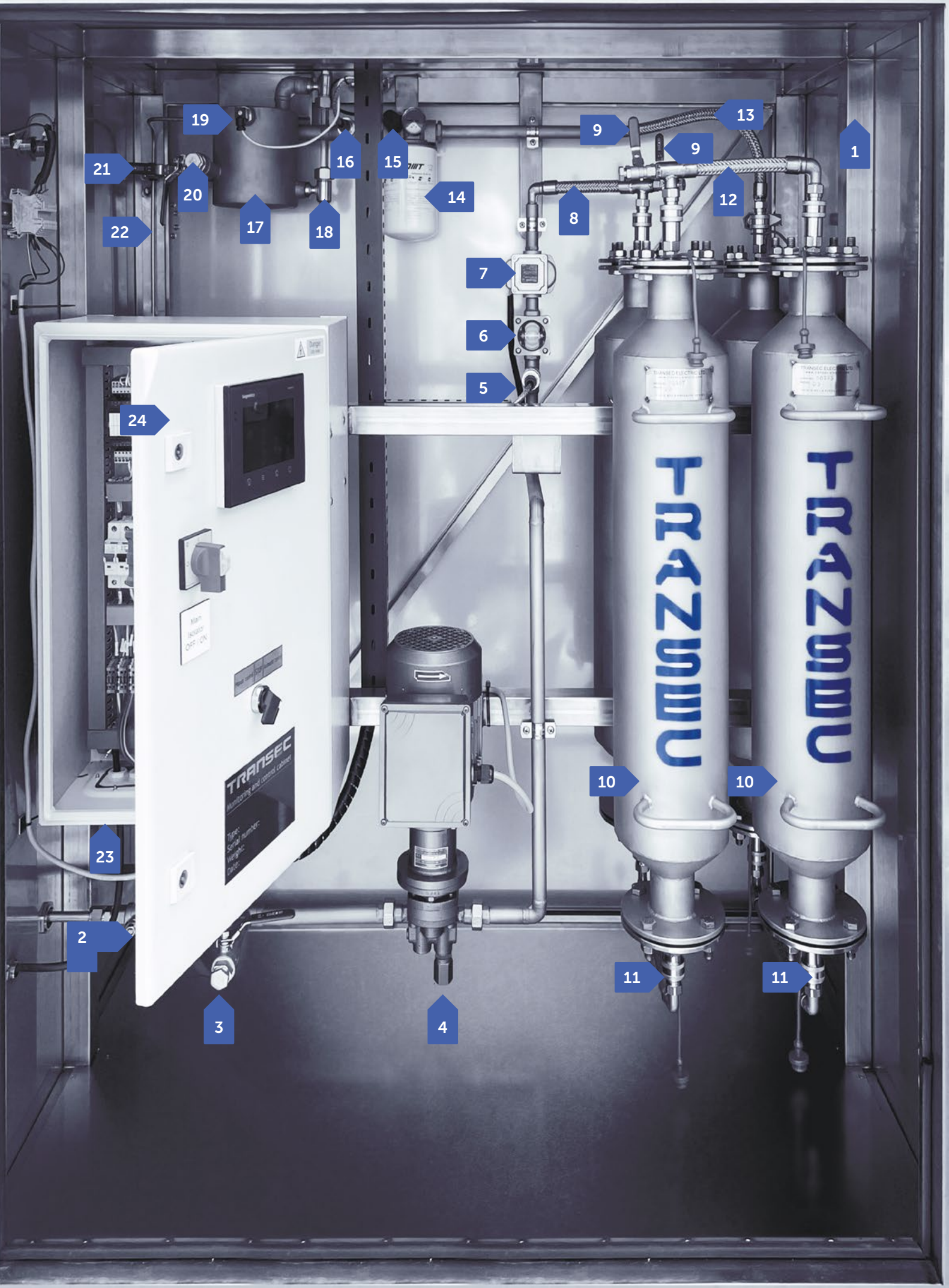
MOVABLE VERSION OF TRANSEC

IP 56 ENCLOSED UNIT



DAYLIGHT VISIBLE LED INDICATOR LIGHTS TO PROVIDE INFORMATION ABOUT THE UNIT STATUS


TRANSEC
TRANSEC CL4 - Online Moisture Monitoring & Drying System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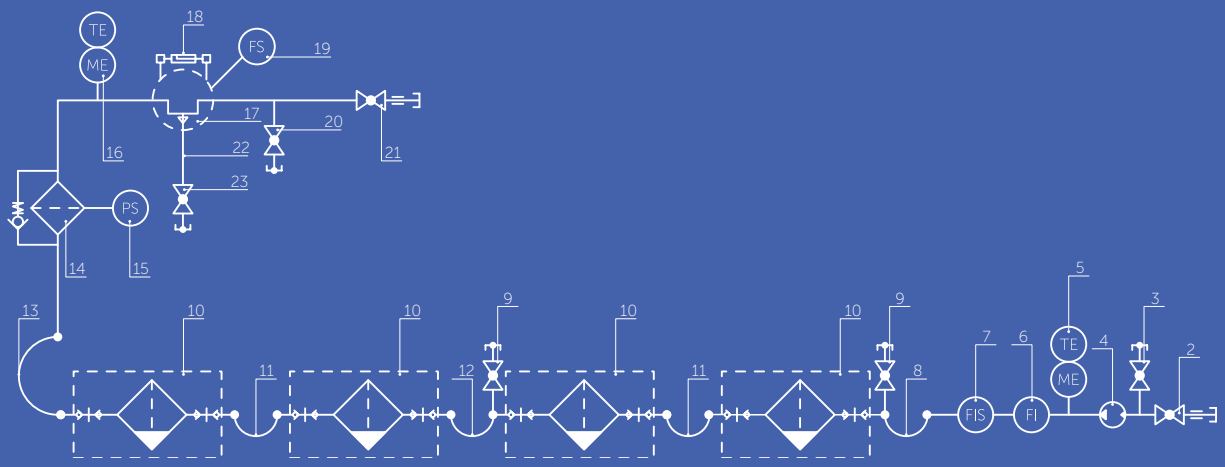
TRANSEC CL4 ONLINE DRYING SYSTEM

PRINCIPLE OF OPERATION



Oil from the transformer tank through inlet ball valve 2 enters the unit. Pump 4 pushes the oil through the pipelines into cylinders 10. While the oil flows through the cylinder, the adsorption process takes place, moisture is adsorbed by zeolite. The oil is returned to the main tank of the transformer through outlet filter 14, deaerator 17 and outlet ball valve 21.

1. External enclosure
2. Inlet ball valve
3. Inlet sampling valve
4. Pump
5. Inlet moisture and temperature sensor
6. Flow indicator
7. Flow meter
8. Top interconnection pipeline between cylinder and sensor
9. Air bleed valve on the first cylinder and air bleed valve between second and third cylinders
10. Cylinders
11. Bottom interconnection pipelines between cylinders
12. Top interconnection pipeline between cylinders
13. Top interconnection pipeline between cylinder and outlet filter
14. Outlet filter
15. Particle filter sensor
16. Outlet moisture and temperature sensor
17. Deaerator
18. Glass gauge
19. Float switch
20. Outlet sampling valve
21. Outlet ball valve
22. Bleed pipe
23. Deaerator air bleed valve
24. WSi monitoring and control cabinet (MCC)

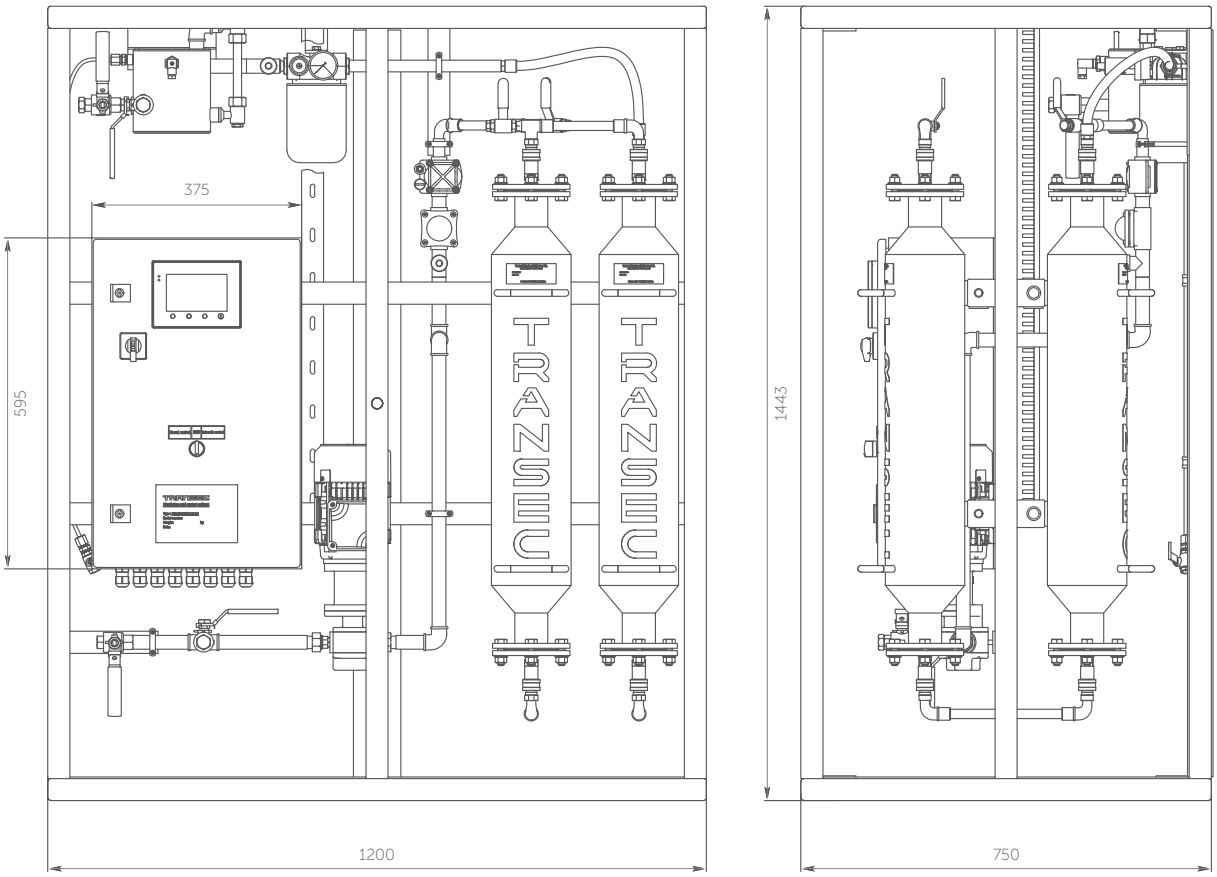
TRANSEC CL4 ONLINE DRYING SYSTEM

CL4 WSi TECHNICAL DATA

Parameter	CL4
Water extraction capacity before cylinder change	6.5 litres
Flow rate with TC500 pump	400 to 500 litres per hour
Particle filter	10 microns on inlet & outlet. Optionally the unit can be fitted with an additional 3 microns pre-filter. Optionally the unit can be fitted with an additional 5 microns pre-filter for heavily sludged transformers.
Material	Stainless steel 304 Grade
Oil temperature range	0°C to 105°C
Acceptable environment condition	-40°C to +60°C
Altitude	up to 2000 m
Protection class of the unit enclosure	IP56
Power Supply	240 V 50 Hz
Pump Midland TC500 Power	250 W
Number of cylinders	4
Oil drying adsorbent	zeolite with 3 Angstrom bead size
Monitoring	WSi only
Size	1443 x 1200 x 747
Installation weight	350 kg
Installation time	5 to 6 hours with 2 people
Manufacturing type test	3 bar pressure at 110°C for 1 hour
Manufacturing routine test	Cyclic 3 bar pressure at 60°C for 24 hours
Enclosure	304 Grade Stainless steel
Fixation	Self-standing

TRANSEC CL4 DIMENSIONS

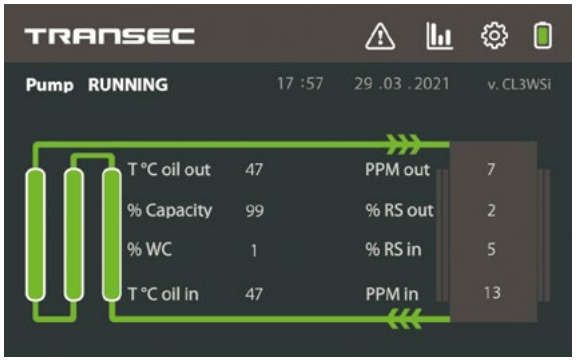
CL4 WSi



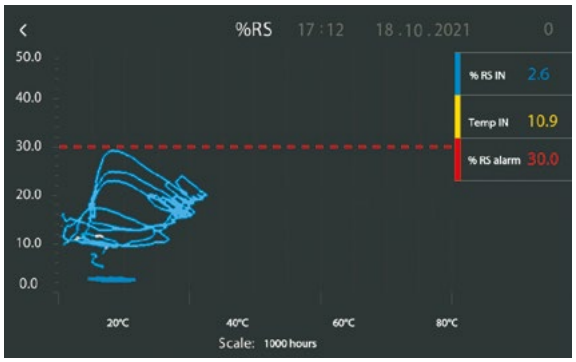
CONTINUOUS MOISTURE ASSESSMENT WITH THE TRANSEC MONITORING

MONITORING CABINET WSi

The WSi TRANSEC monitoring cabinet provides continuous monitoring of the temperature and the moisture dissolved in the oil entering and exiting the TRANSEC and allows to take action on it. The pump can be stopped under certain conditions. Also, other analyses are provided which will help to better understand the current moisture situation of the transformer and to take action.



Picture of HMI

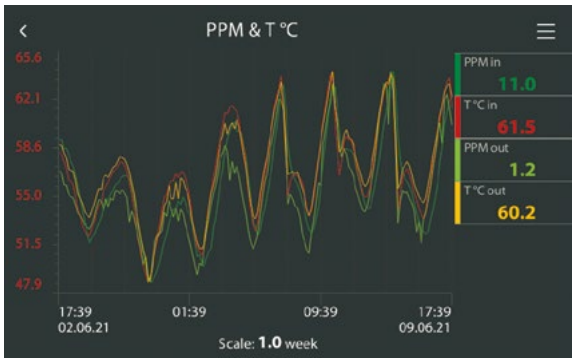


Relative Saturation versus temperature hysteresis graph

MONITORING CABINET AMi

The AMi TRANSEC monitoring cabinet continuously monitors the temperature and moisture dissolved in the oil entering and exiting the TRANSEC. This allows monitoring the good water extraction for the TRANSEC but also the moisture level of the transformer. Alarms can be set, and reports of all data collected can be downloaded.

Picture of HMI



PPM and temperature trends on the AMi HMI

CONTINUOUS MOISTURE ASSESSMENT WITH THE TRANSEC MONITORING

MONITORING CABINET AMi, WSi TECHNICAL DATA

Parameter	AMi	WSi
Local display	- Oil temperature IN&OUT - PPM Moisture IN&OUT - Relative Saturation in - Pump and sensor status or alarm - Settings - Reports - Trends	- Oil temperature IN&OUT - PPM Moisture IN&OUT - Relative Saturation IN&OUT - Water content in paper - Pump and sensor status or alarm - Settings - Reports - Trends - Cylinder saturation level - Total water volume extracted
Data logging	- Temperature IN&OUT - PPM IN&OUT - Relative saturation IN - Alarms	- Temperature IN&OUT - PPM IN&OUT - Relative saturation IN&OUT - Water content in paper - Cylinder Saturation - Alarms
Alarms	- SensorInDown - SensorOutDown - Overheat - %RS Alarm - AlarmReset - %CapacityAlarm - T°C IN - T°C OUT - PPM IN - PPM OUT	- Pump status - SensorInDown - SensorOutDown - OverheatCab - LowFlow — Oil flow rate, l/h - Leakage - OverheatOil - Paper overdry - Alarm reset - FreezeOil — Oil temperature below the setpoint - %CapacityAlarm - %RS Alarm - T°C IN - T°C OUT - PPM IN - PPM OUT - Water Content — %WC alarm setpoint
Cylinders saturation	Saturation estimated based on the PPM IN&OUT difference	Calculated based on PPM and oil flow
Sensors	2x high accuracy moisture and temperature sensors	
Remote control	Alarm settings	Alarm settings, Pump stop & restart conditions
Communication	Via 3G/4G network or Ethernet: TCP/IP (VNC, HTTP, FTP/SFTP, MODBUS), USB stick	

MOLECULAR SIEVES

TRANSEC Online Drying System uses molecular sieves to extract moisture from the oil. These granules (non-chemical) contain many pores of 3 Angstrom diameter which is the exact size to catch water molecules. That way other components like gases molecules with larger or smaller diameter are not filtered by these sieves.

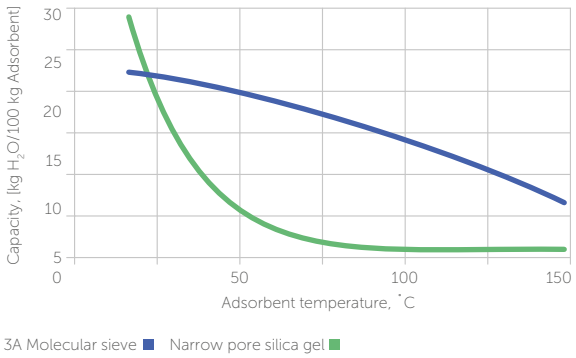


Figure 10. A stable adsorption for transformer oil temperatures

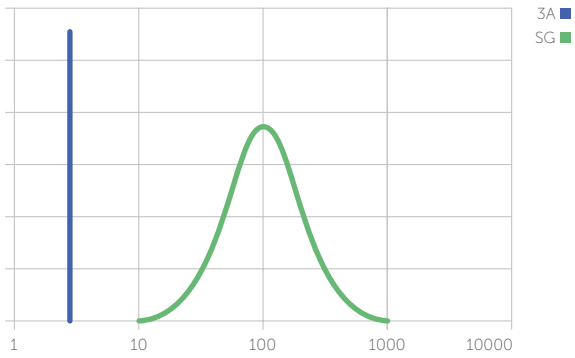


Figure 11. Pore size distribution

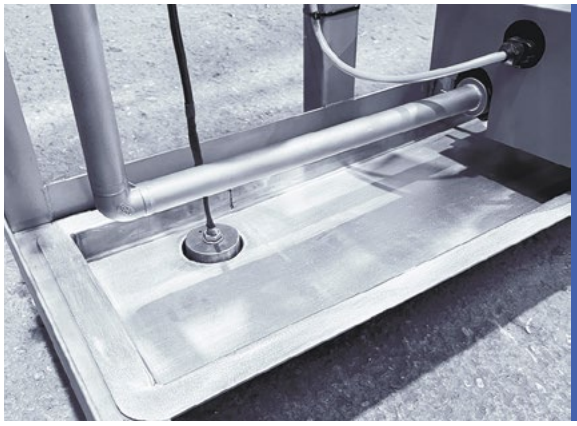
OPTIONS AVAILABLE WITH TRANSEC

EXTERNAL ENCLOSURE

The optional enclosure for the TRANSEC unit will protect the HMI and the hardware from rain, dust, heat, direct sunlight and UV. The enclosure is made of stainless steel.

GATEWAY FOR IEC 61850 PROTOCOL COMMUNICATION

Monitoring and Control cabinet can be equipped with a gateway that allows to use fiber connectors for the Ethernet port.

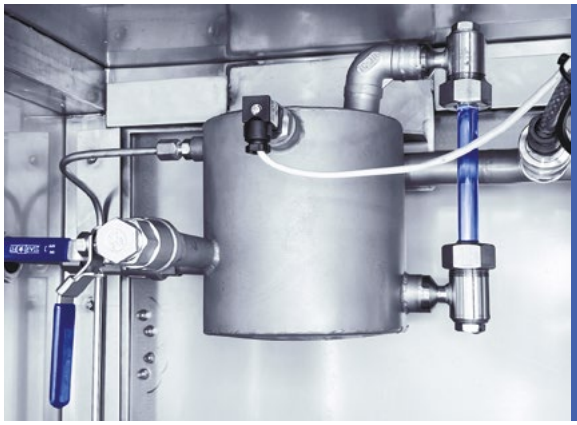


LEAK DETECTION TRAY

The accessory (only available on the WSi version) will detect any oil leak within the TRANSEC system and will provide the alarm accordingly. It is, of course, strongly advised to combine this option with an external enclosure (to protect from rain) and a solenoid inflow valve in order to block the oil circulation in case of leakage.

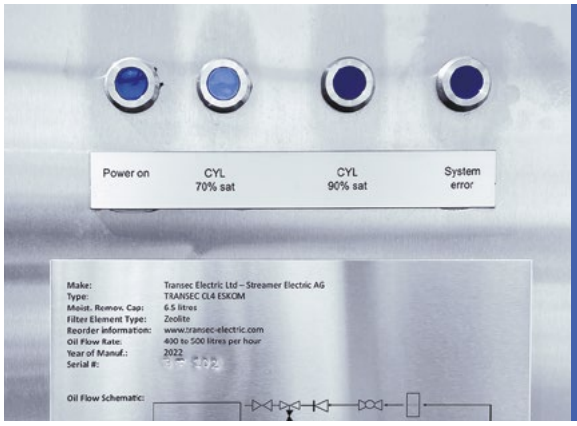
INFLOW CONTROLLABLE SOLENOID VALVE

This valve can be set remotely to operate and block the oil flow in case of leakage or rising temperature.



DEAERATOR GLASS GAUGE AND SWITCH

To be sure that no air is entering the transformer, a deaerator is placed at the end of the TRANSEC. For additional protection, it is possible to see the level of air in the deaerator with an optional glass gauge and to have a switch that will signal an alarm if the level of air reaches a dangerous level.



LED INDICATORS

They will allow you to observe:
- Power on — unit is working
- CYL 70% sat — cylinders have been saturated up to 70%
- CYL 90% sat — cylinders have been saturated up to 90%
- System error — there is a system error that you will see on the HMI screen.

EASILY REMOVABLE CYLINDER BRACKETS

CYLINDERS CAN BE EASILY REMOVED WITHOUT TOOLS AND BY ONE PERSON THANKS TO THIS INNOVATIVE SYSTEM.

PRODUCT SELECTION GUIDE CL1i, CL2i, CL3i

TRANSEC unit	TR. CL.	X	X	X	X	X	X	X	.i
Number of Cylinders	1 cylinder (4 litres of water extraction)	1							
	2 cylinder (8 litres of water extraction)	2							
	3 cylinders (12 litres of water extraction)	3							
Monitoring	No Monitoring		0						
	Monitoring with local display; PPM, Temp & %RS; Alarms		A						
	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation		W						
Pump type	Grundfos UPS2 70 to 90 litres per hour			U					
	Midland TC500 400 to 500 litres per hour			T					
Mounting	Mounting on wall or on transformer. No standing frame.				0				
	Standing frame v1 to be bolted on the ground				1				
	Standing frame v2 self standing				2				
	Enclosed in Stainless Steel IP55 fixed on the ground or on a wall				3				
Pump/Power Supply	50Hz 240VAC					5			
	60Hz 120VAC					6			
Oil inside cylinders	Un-inhibited napthynic oil IEC 60296						U		
	Inhibited napthynic oil IEC 60296						I		
	Other (please specify)						O		
Filters	2x standard filters: inlet & outlet 10 microns							0	
	Inlet 3 microns & outlet 10 microns							1	
	Inlet & outlet 3 microns							2	
	Inline stainless steel 5 microns							3	
	Prefilter Pall 5 microns & outlet 10 microns							4	
	Prefilter Pall 5 microns & Inline stainless steel 5 microns							5	
Version									i

PRODUCT SELECTION GUIDE CL1i, CL2i, CL3i

Monitoring unit	
TR.MT.00AM.0i.WW	Monitoring with local display; PPM, Temp & %RS; Alarms
TR.MT.00WS.0i.WW	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation
TR.SR.MONI.UP.WW	Service for Monitoring box installation
Communication option	
TR.MT.RTGS.00.WW	GSM Router (2G,3G and 4G(LTE))
TR.AC.GTW.61850	IEC 61850 Gateway added in Monitoring cabinet (MODBUS TCP Converting to IEC - TCP ETHERNET & FIBER OPTIC OUTPUT)
Accessories	
TR.AC.NCYL.03.0i	3 new cylinders i Version + 2x replacement particle filters (10 microns)
TR.AC.IKIT.00.WW	Installation kit: 2x Male Stud Couplings, 1x Reducing tee, 1x Brass stud coupling, 3m copper tube, 1x Non return valve, 2x 2m tube SS 15mm cold annealed
TR.AC.IKIT.01.WW	Installation kit with flexible pipes stainless steel braided (7m & 10m)
TR.AC.ENCL.S1.0i	Stainless Steel Enclosure with insulation for CL1
TR.AC.ENCL.S3.0i	Stainless Steel Enclosure with insulation for CL3
TR.AC.ENCL.P3.0i	Powder Coated Enclosure with insulation for CL3
TR.AC.FLAN.15.WW	Flanges for installlation DN15
TR.AC.FLAN.25.WW	Flanges for installlation DN25
TR.AC.FLAN.50.WW	Flanges for installlation DN50
TR.AC.FLAN.00.WW	Flanges for installlation (size to be specify)
TR.AC.LEAK.00.WW	Leak tray & sensor*
TR.AC.GGAU.00.WW	Glass Gauge on dearator
TR.AC.RLVL.00.WW	Dearator level alarm switch*
TR.AC.SLSV.0i.WW	1x inflow controllable solenoid valves *
TR.AC.HTCA.00.WW	Heater for monitoring cabinet

* only available for the WSi version

Services	
TR.SR.REGE.03.WW	Regeneration of 3 cylinders (EXW UK)
TR.SR.SINS.00.WW	Installation Supervision
TR.SR.INSP.00.WW	Transformer inspection
TR.SR.MONI.UP.WW	Service for Monitoring box installation
TR.SR.MODI.00.WW	Product modification service

PRODUCT SELECTION GUIDE CL4i

TRANSEC unit	TR. CL.	X	X	X	X	X	X	X	.i
Amount of Cylinders	4 cylinders (6.5 litres of water extraction)	4							
Monitoring	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation		W						
Pump type	Midland TC500 400 to 500 litres per hour			T					
Mounting	Enclosed in Stainless Steel IP55. Self Standing.				3				
Pump/Power Supply	50Hz 240VAC					5			
	60Hz 120VAC					6			
Oil inside cylinders	Un-inhibited napthynic oil IEC 60296						U		
	Inhibited napthynic oil IEC 60296						I		
	Other (please specify)						O		
Filters	2x standard filters: inlet & outlet 10 microns							0	
Version									i

Communication option	
TR.MT.RTGS.00.WW	GSM Router (2G,3G and 4G (LTE)
TR.AC.GTW.61850	IEC 61850 Gateway added in Monitoring cabinet (MODBUS TCP Converting to IEC - TCP ETHERNET & FIBER OPTIC OUTPUT)
Accessories	
TR.AC.NCYL.04.0i	4 new cylinders short i Version for CL4
TR.AC.IKIT.00.WW	Installation kit: 2x Male Stud Couplings, 1x Reducing tee, 1x Brass stud coupling, 3m copper tube, 1x Non return valve, 2x 2m tube SS 15mm cold annealed
TR.AC.IKIT.01.WW	Installation kit with flexible pipes stainless steel braided (7m & 10m)
TR.AC.FLAN.15.WW	Flanges for installlation DN15
TR.AC.FLAN.25.WW	Flanges for installlation DN25
TR.AC.FLAN.50.WW	Flanges for installlation DN50
TR.AC.FLAN.00.WW	Flanges for installlation (size to be specify)
TR.AC.LEAK.00.WW	Leak tray & sensor*
TR.AC.GGAU.00.WW	Glass Gauge on dearator & level switch
TR.AC.SLSV.0i.WW	1x inflow controllable solenoid valves*
Services	
TR.SR.REGE.03.WW	Regeneration of 4 cylinders short iVersion (EXW UK)
TR.SR.SINS.00.WW	Installation Supervision
TR.SR.INSP.00.WW	Transformer inspection
TR.SR.MONI.UP.WW	Service for Monitoring box installation
TR.SR.MODI.00.WW	Product modification service

FINANCIAL BENEFIT EXAMPLE OF USING TRANSEC

We can see that the amount saved can be even more than the actual cost of a new transformer and, of course, cover several times the price of a TRANSEC unit and its installation. The benefit mentioned above is just one among a batch of gains provided by applying TRANSEC on power transformers. Furthermore, as TRANSEC always maintains a high oil breakdown voltage, it makes the transformer much safer to use and drastically reduces the risk of failure and explosion. Therefore, it would be possible also to lower the user's insurance premium, which will represent significant savings.

Among all solutions, the TRANSEC Online drying system offers the best extraction price per litre of water. The Low-Frequency Heating (LFH) method can quickly extract a large amount of water, but the operation requires a transformer shut down and is relatively expensive. On the other hand, the oil circulation method is easy to implement and affordable. Still, it extracts only a minimal amount of water (basically only the water dissolved in oil, representing less than 2% of the total volume).

In the table below, we considered a transformer 40 MVA, 25'000 litres of oil with 20 PPM of moisture. It would require the extraction of 40 litres of water. LFH can do such extraction within one week of the shutdown. TRANSEC will need several years to extract the same amount, but it will be done online, and the transformer will be in operation. For the oil circulation, we considered that it could remove 100% of the water from the oil in a few days, which means half a litre.

Method	Approximate price per litre of water extracted
LFH	1750 US$
Common Oil Circulation	5000 US$
TRANSEC	1000 US$

It is easy to understand that delaying a significant investment represents financial savings for a company. The amount of money not invested can generate interests. Purchasing a power transformer is one of these significant investments, and the more it can be delayed, the better it is.

By extending the life expectancy of the transformer, TRANSEC contributes to generating financial benefits to its user. Installing a TRANSEC unit on an old and wet transformer can still extend the unit's life expectancy by several years. Installed on a new transformer, TRANSEC can push the transformer to its total life expectancy.

The table below shows concrete examples of what these savings can represent, where n is the number of years of transformer life extension. We considered an Interest Rate (IR) of 5% and a price of new transformer (C) constant over the years.

Cost of a new transformer — 40 MVA	400'000 US$
Saving calculation formula	$C * [(1 + IR)n - 1]$
TRANSEC life extension on old transformer	5 years
Savings	110'512 US$
TRANSEC life extension on new transformer	15 years
Savings	431'571 US$

WHAT TO DO WHEN THE MOISTURE EXTRACTION CYLINDERS ARE SATURATED?

The first thing to do is to contact your local representative of Streamer Electric AG. Streamer makes an effort to find companies close to you to support you efficiently. Local representatives have a stock of ready cylinders which they can provide to you.

TRANSEC units can typically extract between 3 to 4 litres of water per cylinder before saturation. The rate of extraction is directly linked to the amount of water available in the transformer. The higher the moisture content and the warmer the oil is, the faster the extraction will be. You can find the typical saturation time below.

The cylinder saturation can be determined either by the TRANSEC monitoring system or by comparing water PPM in 2 oil samples (inlet & outlet).

A set of saturated cylinders can be removed and replaced while the transformer is online by new cylinders within 30 minutes.

Characteristics	Typical time for extraction of 10 litres of water
New transformer water content <1%	5 years
Old/Wet transformer water content >3%	6-12 months
Moderately wet transformer water content = 2%	2 years

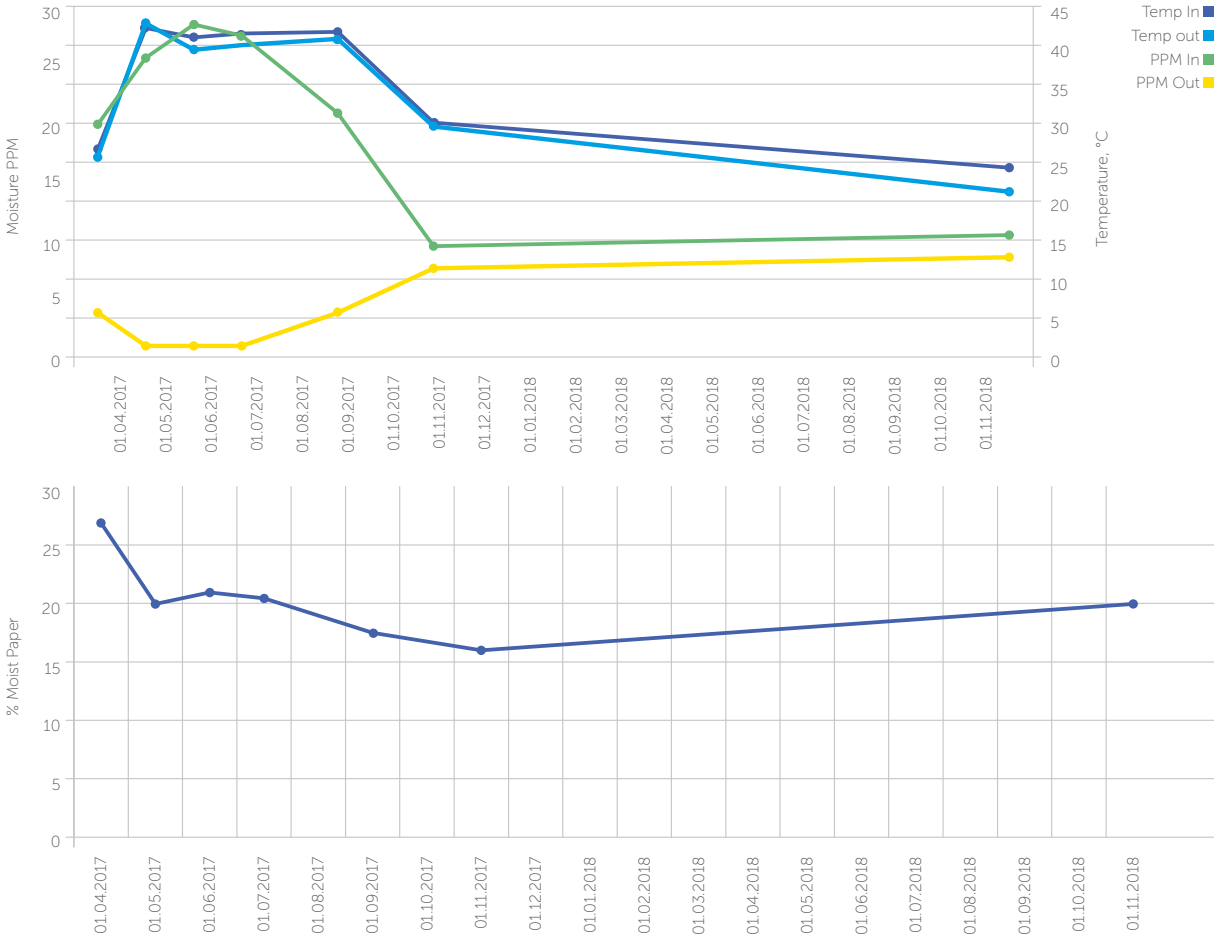

T602

MORE THAN 15 YEARS OF SUCCESSFUL EXPERIENCE

A TRANSEC unit was installed in November 2017 on 40 MVA General Electric 3 phases transformers in the Dammam region, Saudi Arabia. This 115kV/13.2kV transformer from the 1970s had reached a very high water content in the paper (above 5%) and needed urgent drying. Once installed, the TRANSEC started removing moisture from the oil immediately. It provided a positive effect on the breakdown voltage value. In a second step, water extracted from the paper as the oil dried out after a few weeks.

Over the 1st year, you can see on the 2 graphs that the PPM inflow and the water content are dropping.

Within that year, the water content in the paper went from 5% to about 3% (a much more acceptable level). We can also see that the PPM values of inflow and outflow during the second year of operation were almost matching, which is a sign of water saturation in the TRANSEC unit. This is confirmed by the water content increasing again to 4% at the end of the second year. New ones then replace the saturated TRANSEC extraction cylinders to restart the filtering process. They had extracted about 12 litres of water from that transformer within 1 year.



MORE THAN 3000 UNITS INSTALLED

UK

EDF ENERGY
Nuclear power plant
80 units in operation

UK

NNG
Wind farm offshore generation
6 units in operation

ARGENTINA

SALTO GRANDE
Hydroelectric power plant
20 units in operation

TEXAS (USA)

COVANTA
Power Generation Waste to Energy
1 unit

ZAMBIA

ZESCO
Kafue gorge hydroelectric power station
11 units in operation

UAE

EGA
50 units in operation

CAMBODIA

EDC TRANSMISSION
9 units in operation

HYDROELECTRIC GENERATION

Represa de Salto Grande

NUCLEAR POWER

EDF Energy

WIND POWER

Neart Na Gaoithe Offshore Wind

TRANSMISSION

Electricite du Cambodge

POWER GENERATION WASTE TO ENERGY

Covanta Holding Corporation

METAL INDUSTRY

Emirates Global Aluminium

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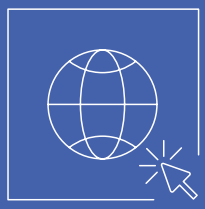
WEBSITE



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