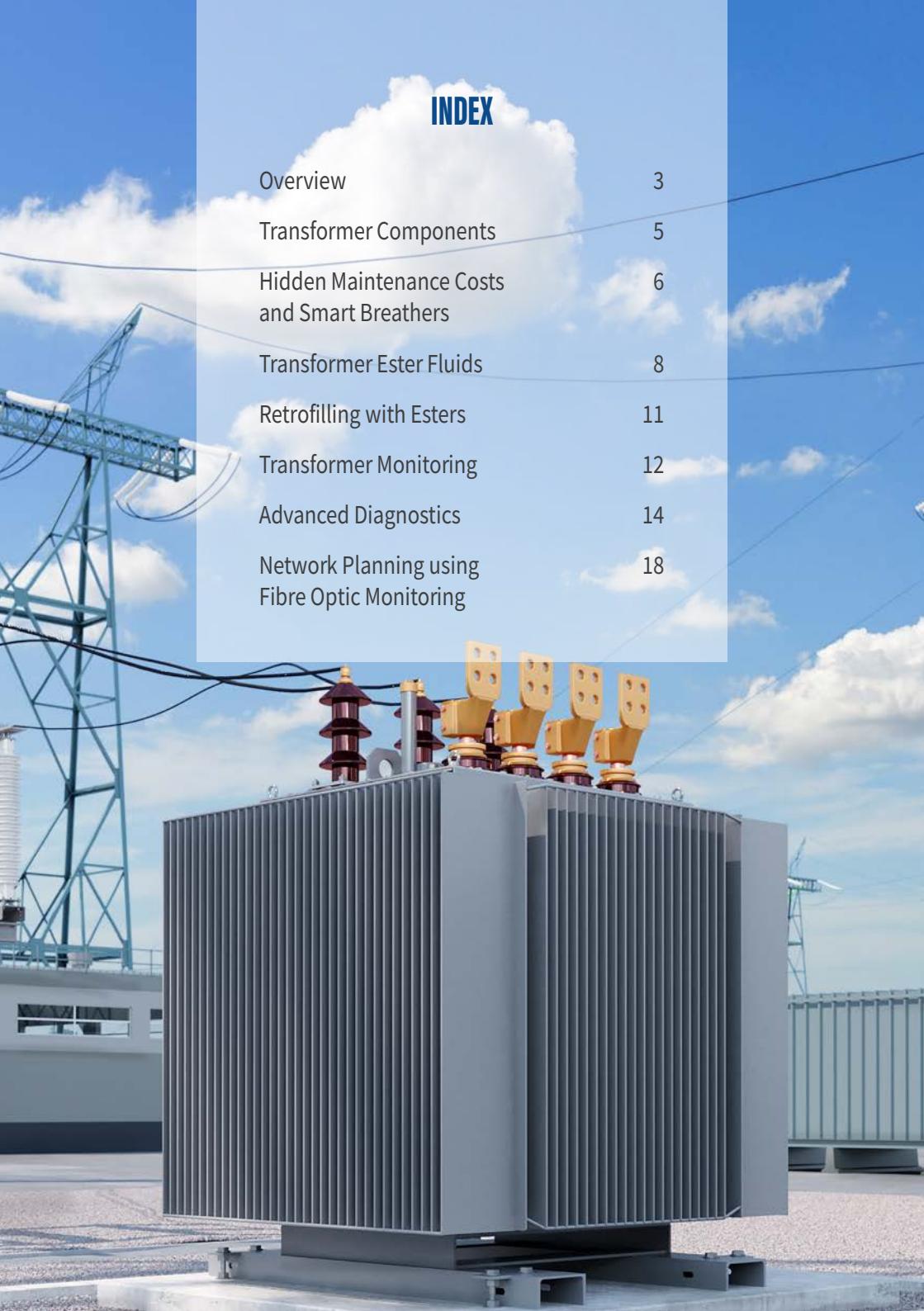
TRANSFORMER CARE

insulect
VERSATILITY VIA COLLABORATION

INDEX



Total transformer care, from small industrial to large power

For over 25 years Insulect has been the most trusted supplier of components to leading OEMs and Transformer Service businesses.

Our products have helped build modern transformers and keep existing network assets operating at their best. From transformer insulation and ester oils, to safety and protection components, through to complete transformer condition monitoring systems and fleet management.

EXPERT ADVICE

TECHNICAL SUPPORT IS JUST A PHONE CALL AWAY.

Our customer service and engineering teams understand transformers inside and out. They can guide you to the right product, answer installation and maintenance queries and solve technical problems.

THE MOST TRUSTED BRANDS

THE WIDEST RANGE OF LEADING PRODUCTS.

We are your local stockist of the brands that have safeguarded transformers for decades and continue to be the preferred choice of asset owners and operators, including the AKM OTIWTI, Buchholz Relay, Qualitrol RPRR, Comem RIS, 208 LPRD and plenty more.

YOUR LOCAL PARTNER

FOR TRANSFORMER REPAIR, REFURB, RETROFILL

Whether you need to replace a single transformer component, complete a transformer refurbishment, or customise a unique solution, we are your one-stop shop for all transformer maintenance needs.

Transformer Components

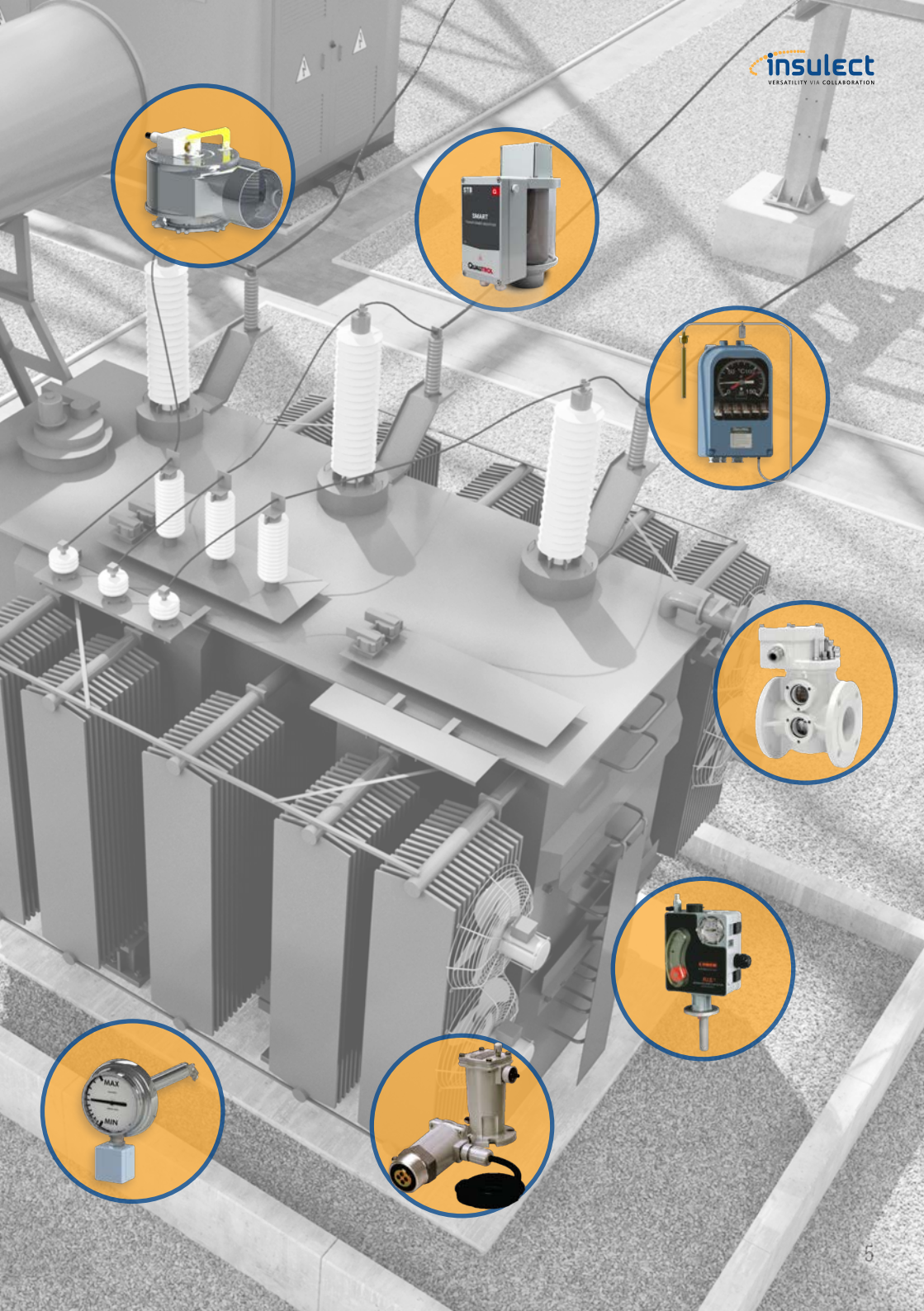
MEASUREMENT AND PROTECTION DEVICES

We've got the most comprehensive range of transformer safety devices available. These products are built to take a beating in harsh outdoor environments and ours set the benchmark for ruggedness and reliability, performing year after year with minimal maintenance.

SAFEGUARD YOUR ASSETS

We help you to see inside your transformer and understand how it is performing, by selecting the right combination of measurement devices to suit your transformer size and application - from robust mechanical gauges, to smart devices that communicate with a central software system.

- **Temperature** devices, analogue and fibre optic
- **Oil Level** indicators
- **Pressure** relief devices, relays
- **Moisture** capture and smart breathers
- **Gas** measurement, Buchholz, DGA
- **Surge** Arresters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SMART
MAX
MIN

Unlocking hidden maintenance costs

TRANSFORMER BREATHERS

Many transformer owners – utilities and industrial alike – are looking for new ways to reduce operational costs or free up capital for use elsewhere. Often the simplest solutions to implement can also be the hardest to find.

Smart Transformer Breathers are one such area, where the maintenance costs are often significantly underestimated and hence overlooked. We open the lid on these costs and provide some comparative data using self-dehydrating breathers.

CONVENTIONAL VS SMART BREATHERS

Conventional breathers are generally quite basic in design, resulting in a low capital cost for the device. However, the maintenance costs are a different story.

Conventional breathers needs regular inspection to determine how saturated the gel is. When it nears saturation point, the gel needs replacing and disposal. Depending on the climate and operating conditions, this is commonly every 3 to 12 months (1 to 4 times per year).

Smart Breathers, by comparison, self-regenerate their store of silica gel, thus eliminating the need to inspect or change the gel, greatly reducing maintenance costs. Similarly, they are designed to be highly reliable and rugged, and generally can be monitored remotely, further reducing the need for maintenance.

In short, they are a more efficient and effective solution for the protection of a transformer from moisture.

RUNNING THE NUMBERS

On a single transformer, the breather maintenance costs are negligible - possibly a few thousand dollars annually.

Across a regionally dispersed fleet of transformers, these costs quickly escalate.

We built a calculator to help asset owners calculate the cost impact on their network. And how this compares to running smart breathers in the place of their conventional breathers - in terms of the capital cost and over the life of these components.

To access this calculator and read the full article, go to insulect.com/transformer-breathers

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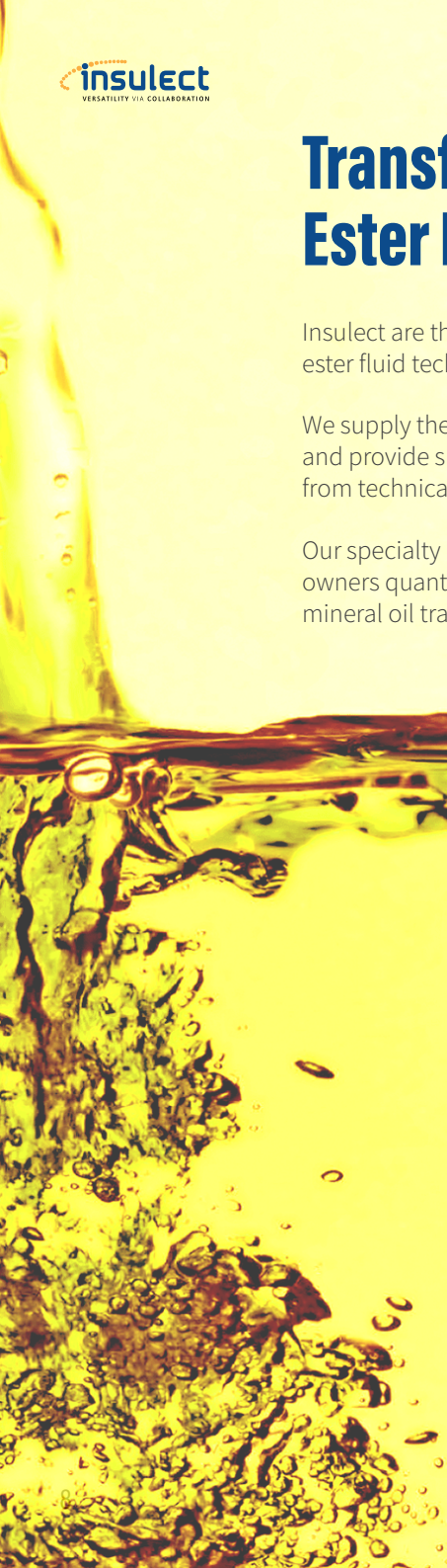
Transformer Ester Fluids

Insulect are the local partner for the world's #1 name in ester fluid technology since the 1970s: MIDEL.

We supply the MIDEL range of ester-based transformer fluids and provide support to transformer asset owners and OEMs from technical evaluation through to installation.

Our specialty is retrofilling applications - helping asset owners quantify the advantages of changing existing mineral oil transformers to an ester fluid.



TECHNICAL ADVICE

We support transformer asset owners of all shapes and sizes through technical evaluation, product comparison and selection, project planning and retrofilling stages.

LOCALLY STOCKED

Insulect maintain local stock holdings of MIDEL ester fluids in Melbourne and Perth to accomodate the needs of the local market - to support our contract clients and facilitate urgent fluid requirements.

MIDEL eN 1204 NATURAL ESTER

With a pour point of -31°C (much lower than soya-based fluids), eN 1204 is the premier natural ester transformer fluid. Made from sustainable rapeseed/canola oil, it is readily biodegradable, non-toxic and is FM and UL approved.

MIDEL 7131 SYNTHETIC ESTER

The only synthetic ester with FM approval, 7131 is used in power and distribution transformers, including sealed and free-breathing designs, to deliver fire safety, environmental protection and cost savings.

	Mineral Oil	MIDEL eN 1215 Soy	MIDEL eN 1204 Canola	MIDEL 7131 Synthetic
Fire Safety Class	O	K2	K2	K3
Biodegradable	✗	✓	✓	✓
Breakdown Voltage	70 kV	>75 kV	>75 kV	>75 kV
Moisture Saturation (20°c)	55 ppm	1100 ppm	1100 ppm	2700 ppm
Oxidation ASTM D2112	300 min	<20 min	<40 min	397 min
Pour Point	< -50°C	- 18°C	- 31°C	-56°C
Temperature Performance	Poor	Good	Good	Excellent

ESTERS: NATURAL vs SYNTHETIC

The standout differences between MIDEL natural and synthetic ester fluids are **oxidation stability** and **temperature performance** inherent in 7131.

Th oxidation stability broadens MIDEL 7131 suitability to a wider range of applications, including free breathing transformers.

The higher temperature performance lends 7131 to more demanding applications in Renewable Energy, Traction, Mining, Marine and Underground.

Why Ester Fluids?

Natural and synthetic ester-based fluids deliver several distinct advantages over mineral oil, whether for new transformers or retrofill applications.

LIFE EXTENSION BY RESISTING MOISTURE AND PROTECTING THE PAPER

Using MIDEL will give new life and delay investment in a new replacement transformer.

The superior water tolerance properties of MIDEL significantly increase the life of solid insulation, thereby extending the life of the transformer.

MIDEL has also been successfully used to enable wet transformers to be brought back into service.

REDUCE YOUR RISK

Transformers are often cited as one of the top five high-risk assets. Accordingly, MIDEL fluids meet the needs of transformer OEMs, Utilities and asset owners in ever more demanding applications. Their fluids enable assets to work harder, for much longer and provide unrivaled risk mitigation through their high fire points and superior moisture tolerance.

4 Reasons to Retrofill

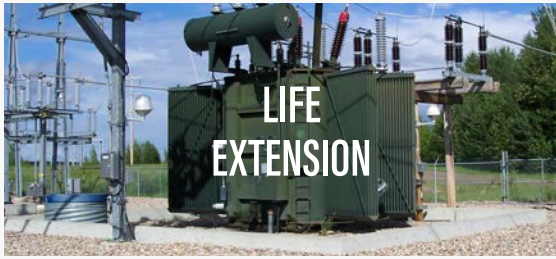
When retrofilling mineral oil transformers, every situation is unique: from an urgent need on a single asset, to rolling out a network-wide program. Operational factors can also vary considerably such as load, asset design, age, location, and environment.

In many situations, a compelling case can be made for using a natural or synthetic ester fluid instead of mineral oil. Here are the top 4 reasons. For the full list, go to **insulect.com/transformer-retrofill**

Reduced risk through much higher fire point and flash point. Over 1 million installations. Zero reported fires.

Minimise impact and facilitate compliance. Readily biodegradability. Lower clean-up costs.

AS2067 Compliance. Allows transformers to be located closer together and near buildings without blast walls.



Significant life extension beyond what is possible with mineral oil. Run transformers hotter without reducing life.

Transformer Monitoring

INTEGRATED CONDITION MONITORING SYSTEMS

We help turn static transformer data into actionable asset management information.

Our transformer condition monitoring systems put the power in your hands to reliably monitor transformer health in real time, make informed decisions and take timely action to ensure the optimal performance and life of your assets.

We have the hardware to capture critical data and the software to translate data into actionable insights.

- Temperature and Cooling
- Oil Level and Flow
- Pressure and Vacuum
- Loading and Performance
- Partial Discharge
- Dissolved Gas
- Moisture
- Transformer Control

QUALITROL SMARTSUB

The SmartSub software platform provides multi-function, condition-based monitoring capability for substation assets.

Through a combination of Intelligent Electronic Devices (IEDs), smart sensors, fully secure communication, open protocols, and 'intelligent' user-friendly software, operators can view trending and actual data for informed decision making.

QUALITROL QTMS

On-line Transformer Monitoring System

Completely modular and flexible for new or retrofit applications, QTMS brings DGA, PD, Fibre Optic, Bushing and Smart Sensor technology onto a single platform.

SERVERON DGA

On-line Gas Chromatography Dissolved Gas Monitors

QUALITROL QPDM

UHF Partical Discharge Monitoring System

QUALITROL T/GUARD

Fibre Optic Temperature Monitors

QUALITROL QBMS

On-line Bushing Monitoring System

Traditional Vs advanced transformer diagnostics

In the last several decades, there has been a notable change in the way transformers are viewed. Their importance together with their obvious value to the network has been recognised.

Against this backdrop, the advent of transformer monitoring has emerged and continues to develop at a rapid pace. Now firmly established as a mainstay of power transformer monitoring, online Dissolved Gas Analysis (DGA) is one of the most powerful tools in protecting against unexpected asset failures.

THE NEED FOR EXPERT ANALYSIS

Prior to the emergence of online DGA monitoring, the traditional technique was manual sampling and laboratory DGA.

As online DGA monitors have evolved, new technologies are reaching the market at an ever-increasing rate. However, the quiet revolution is in the analysis of the data coming from the monitor. Whereas traditionally a laboratory DGA report would be accompanied by recommendation and expert analysis, this same facility is not inherent with an online monitor.

As more and more monitors are installed, the burden of data analysis becomes increasingly large and falls on the asset management team to diagnose. Yet there are fewer specialists with deep subject matter expertise in the industry.

INCREASED RELIANCE ON SOFTWARE

Innovative ways of extracting value from this data are required and are now being integrated into software platforms accompanying monitors.

One important approach is the use of Artficial Neural Networks (ANN) for DGA data analysis.

Additionally, traditional ratio based diagnostic tools, such as the Duval Triangle, have evolved, with the addition of more refined triangles and a concise set of pentagons.

It is important to understand however that the key element of online DGA is not the technology used, or the specifications of the device, but rather the user's ability to formulate meaningful information from the DGA results. Today this is generally provided by software platforms from device manufacturers, such as Serveron's TM View™ software suite. The analytics within TM View, can be broken down into two categories; traditional, ratio based diagnostics and advanced neural network algorithms.

Article continues over the page

ANN ENHANCED DIAGNOSTICS

Artificial Neural Networks are a computational model based on the structure of the human brain and have been used for over 50 years in weather and stock forecasting as well as process controls.

ANNs are excellent classifiers for use in pattern recognition tasks where the relationship between input and output is complex and so are well suited to “big data” analytical problems.

The only commercially available example of an ANN being employed for DGA is found in TOAN (Transformer Oil Analysis and Notification). Originally developed by Arizona Public Service (APS) company, TOAN is now available to users of Serveron multigas online DGA equipment in the form of a plug-in within Serveron’s TM View™ software suite.

THE NEED FOR EXCEPTION-BASED REPORTING

The development of TOAN stemmed from the fact that APS has over 170 Serveron 8-gas monitors on their most critical transformers. Each monitor was set to sample the transformer oil every 4 hours, reporting data on individual gas concentrations for Carbon Monoxide (CO), Carbon Dioxide (CO_2), Hydrogen (H_2), Methane (CH_4), Ethane (C_2H_6), Ethylene(C_2H_4), Acetylene(C_2H^2), Oxygen(O_2).

The volume of data obtained from these monitors was huge, at over 350,000 samples annually with most of the data being repetitive. APS considered that what they needed was to develop an analysis engine employing highly accurate algorithms that would also allow them to incorporate an exception based reporting system. This system would only alarm on real faults, without any need for an individual to review large volumes of data.

IDENTIFYING CRITICAL FAULT CONDITIONS

APS identified four fault conditions that should trigger investigation: Over Heating (OH), Low Energy Discharge or arcing (LED), High Energy Discharge or Arcing (HEDA) and Cellulose Decomposition(CD).

Further investigation indicated that not only could the type of fault be identified, but an accurate scale of severity could be employed to define whether immediate action is required at any given time.

To this end the ANN was expanded to define a severity of fault between 1 and 6, where 1 is most severe. Added to that was a notification engine to generate messaging appropriate for the severity of fault.

Finally, the incorporation of Piecewise Linear Approximation (PLA) and harmonic regression improved the efficiency of the algorithms by eliminating the harmonic effects of time, temperature and transformer loading on gas generation.

OVER HEATING (OH)
Fault Condition Identification

LOW ENERGY DISCHARGE OR ARCING (LED)
Fault Condition Identification

HIGH ENERGY DISCHARGE OR ARCING (HEDA)
Fault Condition Identification

CELLULOSE DECOMPOSITION (CD)
Fault Condition Identification

THE RESULTS

For each fault condition, APS achieved successful fault identification 97.6% or higher. The key to TOANs success rate lies in the power of the ANN and the database used to train the system.

For more on the development of TOAN, THE APS case study and details about Serveron monitors, visit insulect.com/ann

Improved Network Planning using Hot Spot Monitoring

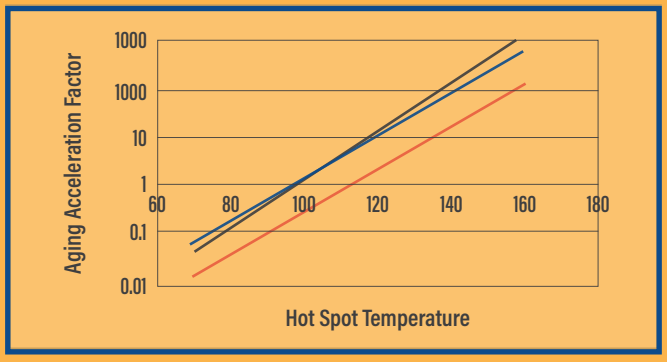
Network planning is a complex process. It involves dealing with many unknowns and uncertainties, usually with a fixed budget to further challenge decision making. And of all the assets to plan for, transformers are one of the most important and unpredictable.

With temperature being a key determinant in the life of a transformer, hot spot temperature monitoring is one of the most effective and reliable tools for introducing predictability into the trending of transformer life and optimising network planning.

TEMPERATURE IN TRANSFORMERS

That temperature dictates aging and determines transformer life expectancy is a well known fact. Traditionally hot spot temperatures are modelled using a winding temperature indicator (WTI). However this modelled approach has significant inaccuracies (±15°C with a further ±3.5°C due to the device).

To put this in context, the IEC loading guide shows that hot spot temperature increase of 20°C equates to about 90% reduction in life of the transformer and an increased risk of premature failure.



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AS/NZS STANDARDS RECOMMEND FIBRE

As a result of the high sensitivity of transformer aging and premature failure to hot spot temperature increase, the latest AS/NZS Power Transformers Standard (60076) recommends direct measurement of hot spot temperature rise through the installation of fibre optic sensors.

In making this recommendation, the standard references the "radically increased possibilities to obtain proper thermal modelling of power transformers, especially at step changes in the load current", made possible through fibre optic sensors. For three phase transformers, fibre is recommended for 20MVA and above.

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IMPROVING DESIGN, MANUFACTURE AND OPERATION

The ability to accurately monitor hot spot temperatures within a transformer opens up several new possibilities:

- Verify correctness of hot spot calculation models
- Confirm "real' ratings of new transformers via heat-run test
- Maximise loading without compromising life
- Avoid hidden overloading due to inaccurate hot spot
- Safe short-term overloading: control transformer ageing
- Reduced time lag in activating cooling mechanisms

FLEET AND NETWORK OPTIMISATION

This one tool can make a huge difference for transformer fleet and network planning managers. Reliability in the transformer monitoring function leads to fewer failures, increased operational and planning certainty, and improved asset utilisation – a better performing and more efficient network.

Read the full article at insulect.com/fibre-monitoring

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BY

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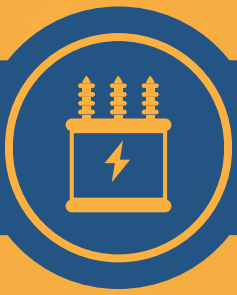

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