Condition Monitoring of Transformers

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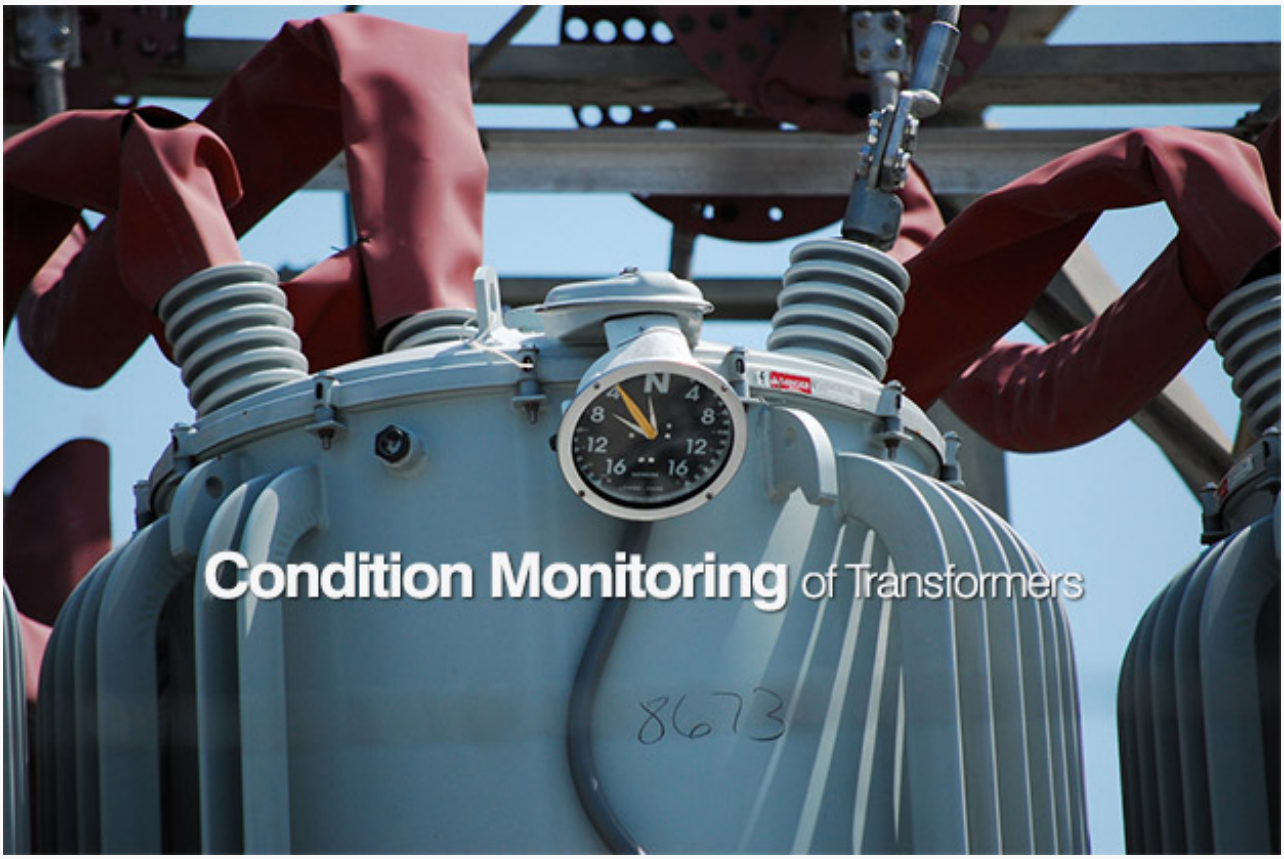

Condition Monitoring of Transformers (on photo: distributive tranformer; by Gazoogleheimer via Flickr)

Detecting early signs of deterioration

It is possible to provide transformers with measuring devices to ***detect early signs of degradation*** in various components and provide warning to the operator in order to avoid a ***lengthy and expensive outage*** due to failure.

The technique, which can be applied to other plant as well as transformers, is called ***condition monitoring***, as the intent is to provide the operator with regular information on the condition of the transformer.

By reviewing the trends in the information provided, the operator can make a better judgement as to the ***frequency of maintenance***, and detect ***early signs of deterioration*** that, if ignored, would lead to an internal fault occurring.

Such techniques are an enhancement to, but are not a replacement for, the protection applied to a transformer.

The extent to which ***condition monitoring*** is applied to transformers on a system will depend on many factors, amongst which will be the policy of the asset owner, the suitability of the design (*existing transformers may require modifications involving a period out of service – this may be costly and not justified*), the importance of the asset to system operation, and the general record of reliability.

Therefore, it should not be expected that all transformers would be, or need to be, so fitted.

A typical condition monitoring system for an oil immersed transformer is capable of monitoring the condition of various transformer components (bushings, tank, tap changer, coolers and conservators) as shown in ***Table 1***

below.

There can be some

Monitored Equipment	Measured Quantity	Health Information
Bushings	Voltage	Insulation quality
	Partial discharge measurement (wideband voltage)	
	Load current	Loading
		Permissible overload rating
		Hot-spot temperature
	Oil pressure	Insulation quality
Tank	Oil temperature	Hot-spot temperature
		Permissible overload rating
	Gas-in-oil content	Oil quality
		Winding insulation condition
	Buchholz gas content	Oil quality
	Moisture-in-oil content	Winding insulation condition
Tap changer	Position	Frequency of use of each tap position
	Drive power consumption	OLTC health
	Total switched load current	OLTC contact wear
	OLTC oil temperature	OLTC health
Coolers	Oil temperature difference	Cooler efficiency
	Cooling air temperature	
	Ambient temperature	
	Pump status	Cooling plant health
Conservator	Oil level	Tank integrity

Table 1 - condition monitoring for transformers

overlap with the measurements available from a digital/numerical relay.

By the use of software to store and perform trend analysis of the measured data, the operator can be presented with information on the state of health of the transformer, and alarms raised when measured values exceed appropriate limits. This will normally provide the operator with early warning of degradation within one or more components of the transformer, enabling maintenance to be scheduled to correct the problem prior to failure occurring.

The maintenance can obviously be planned ***to suit system conditions***, provided the rate of degradation is not excessive.

As asset owners become more conscious of the ***costs of an unplanned outage***, and electric supply networks are utilised closer to capacity for long periods of time, the usefulness of this technique can be expected to grow.

Reference: *Network Protection & Automation Guide – Areva*

Source: http://electrical-engineering-portal.com/condition-monitoring-of-transformers