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TAP-4

On-Load Tap Changers (OLTC) Analyzer

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An OLTC is a part of a high-voltage transformer, which enables setting the voltage according to the network load, without interrupting service.

An OLTC is the hardest-working part of the transformer: it will operate several times a day. This equipment is responsilble for 40% of all transformer failures. Thus, it is essential to maintain OLTCs. Poor maintenance can cause consequences and large revenue losses.

Vibro-acoustic analysis

Thanks to an innovative measurement method based on the recording and analysis of vibro-acoustic signals, the TAP-4, like a stethoscope will perform a complete check-up of the internal mechanical state of the OLTC, **WITHOUT OPENING IT !**

The vibro-acoustic method was developed and tested by Hydro-Québec in the field for over fifteen years. The potential of this diagnosis method has been recognized in two transformer maintenance guides: IEEE.PC57.143 and Cigré A2.34

The instrument can reveal a wide variety of mechanical and electrical problems:

- Contact wear
- Drive and synchronization problems
- Brake failure
- Abnormal arcing
- Coking
- Misaligned contacts
- Loose contacts
- Contact bounce

	Thermography	Dissolved gas analysis	Dynamic resistance	Motor current	Vibro-acoustic and motor current (TAP-4)
Drive				x	X
Synchronisation			x		X
Selector				x	X
Motor				x	X
Brake					X
Lubrication				x	X
Alignment				x	X
Arcing		x			X
Contact carbonization	x	x			X
Contact wear					X
Switch			x		X
Transition			x		X (R) / (L+N/A)

Diagnosis methods comparison

OPENZEN the core of the solution

FEATURES AND BENEFITS

Test set-up and testing sequence are quick and easy: by installing an accelerometer and a current clamp sensor on the on-line (or off-line) transformer, one is able to evaluate the test results and produce a diagnosis in less than 15 minutes.
The OpenZen software drives the Tap-4 through an intuitive interface. Thanks to the vibro-acoustic analysis and interpretation tools available with it. It is possible to do effective and targeted maintenance on tap changers.
A stable OLTC always shows consistent signatures. Any degradation of the OLTC introduces changes in the vibro-acoustic signature.
DB-TAP, a database which identifies and classifies healthy and unhealthy OLTCs vibro-acoustic signatures, is integrated with OpenZen. Healthy signatures are used as references, and unhealthy ones help to recognize and list OLTC problems.
The vibro-acoustic analysis method, despite its apparent complexity of interpretation, consists of extremely simple steps: Envelope extraction of motor drive current signal, patented envelope extraction (Hydro-Québec) of high and low frequencies of the vibro-acoustic signal (HF & LF), (Fig.1) and finally nterpretation of the results.
Example of contact wear by missing impacts: Figure 2 shows signatures of current in blue, of vibro-acoustic HF in red and LF in green. By superimposing the time-expanded signals before and after repair, figure 3 shows a missing impact. Signals should be almost identical, but they greatly differ reporting contact wear. This has been confirmed by opening up the tap changer and replacing the arcing contacts.
Asynchronism example: certain types of signal analysis may be easily performed without a reference signature. This example demonstrates a switching operation signal delayed by 120 milli-seconds after the end of the current envelope. The repair was simply to uncouple the drive motor in order to adjust it so the switching occurs before the motor current drops (fig.4 before repair, fig.5 after repair)

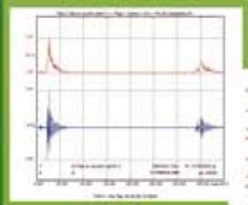
Fig.1

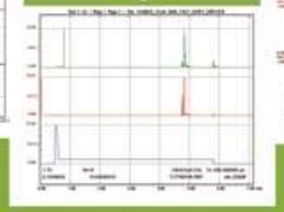
Fig.2

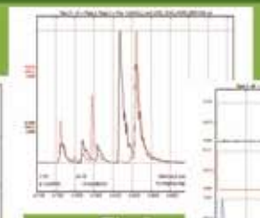
Fig.3

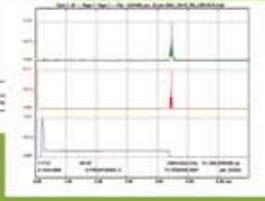
Fig.4

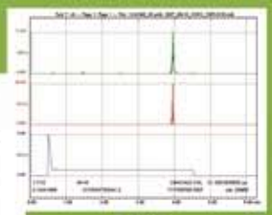
Fig.5