POWER TRANSFORMERS CIRCUIT BREAKERS COMMUTATION PROCESS RECORDING USING A COMPACT DISTURBANCE RECORDER

ing. Eugen COCA[*], conf. dr. ing. Vlad CEHAN[**], prof. dr. ing. Dimitrie ALEXA[**]
*** FTDEE SUCEAVA - ROMANIA**
**** U.T. "Gh. Asachi" IASI - ROMANIA**

* Sectia PRAM
str. Stefan cel Mare, nr.24
5800 - SUCEAVA
tel: 030 - 221698
fax: 030 - 213974
ecoca@univ-sv.sorosis.ro
** Facultatea de Electronica si Telecomunicatii
Bd. Copou, nr.11
6600 - IASI
tel: 032 - 142283
fax: 032 - 211667
vlcehan@tuiasi.ro

1. ABSTRACT

High voltage transformers of medium and high power, installed in the power stations, are in most cases equipped with an "on load voltage adjustment switches" (often called "load breakers"): VEM (former GDR), RS2 and RSG2 (Bulgaria).

Beside the other measurements required on such a transformer maintenance, the producer highly recommend the recording of the switching process on the moment of the breaker movement from one stud to another. This measurement is very important because any deviation from the manufacturer specifications can cause serious damages.

A malfunction of the load breaker can produce, in the best case, a large quantity of gases into the transformer tub, and as a consequence, the turn-off of the transformer due to the gas protection. In some serious cases, even a mechanical damage of the circuit breaker can result.

So, it is very important to get accurate results of measurements, to prevent important damages caused by events as those described before.

Also, an erroneous result of a measurement (i.e.when the load breaker is declared damaged when it's not the case) could determine big and useless costs. To repair a transformer means to transport it to the factory (in most cases this means several hundreds of kilometres).

Till now, this measurement was performed by means of a radiant light waveform recorder H115 - RFT (made in the former GDR), but due its wear (moral and physical) this device can not be used in present.

The prices of the additional articles (photo-sensible paper) and of the spare parts (special lamps with ultraviolet radiation and about 100 hours of working life) have turned the solution into a prohibitive one.

An alternative solution had to eliminate the drawbacks of the old one, and to be advantageous as economic point of view.

So we used an electronic graphical-recorder named CDR - Compact Disturbance Recorder, produced by Telecomm Srl Bucharest and dedicated to other purposes.

In this paper we present the measurement principle along with a measuring scheme, more efficient adjusted to the practical situation as electromagnetic compatibility point of view.

2. THE OLD SOLUTION

In the old solution we used the scheme in Figure 1 to connect the installation to the load breaker.

To get the measurement results, the links between the main fixed contacts - odd and even for each phase - were carried out (that is 31A-32A, 31B-32B, 31C-32C). The R_5 resistors from the scheme are step variable power resistors (they are required to adapt the graphical-recorder input impedance to the measuring circuit).

It was indicated to use accumulators of 12-18VDC as the constant voltage sources.

The measurement result was delivered on the photo-sensible paper (imported) A further analysis was possible, but it is necessary to mention that the paper could become unreadable because of the natural light exposure.

3. THE NEW MEASURING SCHEME

Figure 2 presents the scheme for getting the measurements results with the CDR graphical-recorder.

The links between the fixed contact - odd and even for each phase - are also required. The R_1 resistors are high power winding resistors (16W) and their values are from 6 to 10 ohms (in accordance with the commutation resistors in the circuit breaker).

As a power supply it is used either a battery of accumulators (12VDC) or a stabilised voltage power supply (properly filtered) the measurement result is the same.

Variable resistors are not required, so that the installation weight and dimensions are diminished.

The grounding need a special attention, the electronic graphical-recorder (CDR) being extremely sensible at external electromagnetic perturbation, especially because of the small distances (8 to 10 meters) from certain parts under voltage (usually near the 110-220kV bus bars).

The shield of the link cable between the CDR and the circuit breaker is not badly necessary in all practical situations. The test results performed in both conditions (with and

without the shields) have not been much different. Nevertheless, when the measurement installation in near a part of installation under voltage, it is highly recommended to shield the link cables and to ground them on both extremities.

4. CONCLUSIONS

The main difference between the old and the new version is that in the old version we measure the voltage drop across an external resistance and in the new method we measure the current through the circuit breaker.

We can also mention the dimensions of the two apparatus: the old one is very big (and more difficult to transport to the measurement place). The new disturbance recorder scheme does not contain any movement parts and this is a great advantage.

Here are the results of the two methods and the data sheet from the breaker manufacturer. In Figure 3 is the "ideal" waveform; in Figure 4 is the waveform obtained with the older method (we apologise for its quality) and in Figure 5 is the new waveform.

All the measurements are done in accordance with the norms 3.1.RE - I53 - 91 - "Instructiuni tehnice de verificare profilactica a transformatoarelor de putere" and FT 26/1 - 82 - "Exploatarea, repararea si revizia comutatoarelor de reglaj in sarcina a transformatoarelor de medie si mare putere" (republished in 1994).

5. REFERENCES

[1] - E. NICOLAU - "Masurari electronice" - Ed. Tehnica, Bucuresti, 1979
[2] - S.RADU - "Introducere in compatibilitate electromagnetica" - Ed. "Gh.Asachi" , Iasi, 1995
[3] - P.DEGAUQUE - "Compatibilite electromagnetique" - Ed. Dunod, Paris, 1990
[4] - *** - "Instructiuni tehnologice de verificare profilactica a transformatoarelor de putere" - ICEMENERG, Bucuresti, 1982

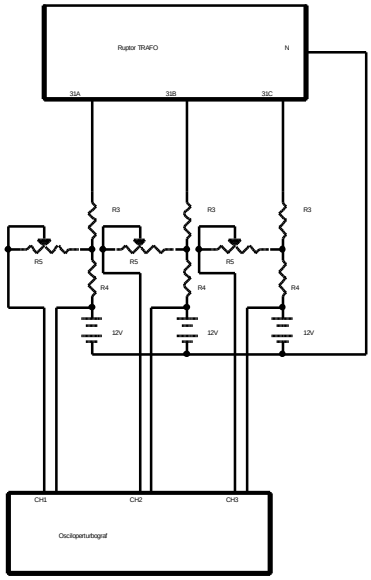

Figura 1

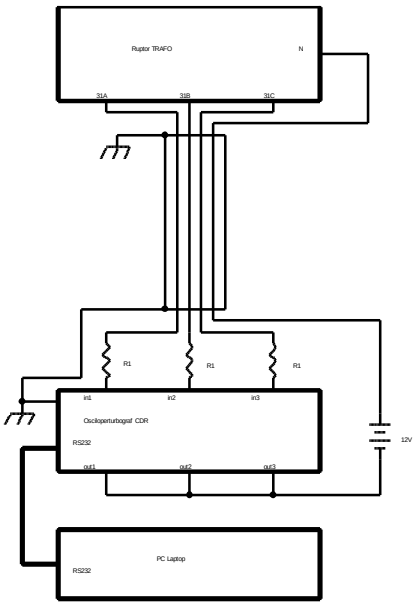

Figura 2

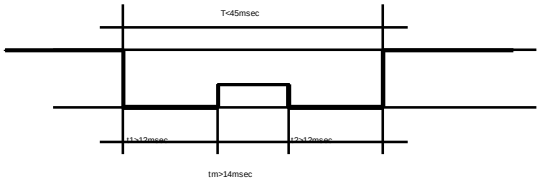

FIGURA 3

Siz	Document Number	REV
A		
Date: September 16, 1996	Sheet of	