TEMPERATURE MEASUREMENTS TO OHTL FROM TPG

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Abstract - This paper presents methods for operational analysis of OHTL elements. The OHTL, which were taken in consideration, are very old. The active conductor, the clamps and the fittings are with defects. The technical difficulties for operate the power grid and their resolutions are presented in the paper. The analysis methods taken in consideration are based on the operational reliability, the technical parameters of equipments and their variations in operation periods, the importance of the equipments parameters, the statistic and the reliability, and the specific parameters. In this paper is presented a specific example for this application, on an OHTL from an important zone. The system used for study is RITHERM RIBE type. The results of the analysis were applied on some OHTL of NPGC "Transelectrica"-SA, which is the National Power Grid Operator, and are presented in this paper.

Keywords: OHTL, Operation, RITHERM, Temperature.

1. INTRODUCTION

We studied the operational behaviour of OHTL from the Power Grid.

The equipments are old and are near limits of their life cycle. Their parameters need to be verified to conclude that they correspond, compared with the requirements from the Power Grid about the parameters: safety, economics and quality.

The tasks of European Power Networks are to develop their structure and to operate on their safety limits. In the case of failure of some OHTL, the study achieved of the Energetic Companies from Europe shows that on remaining OHTL, the loads grows till 180%.

To operate with OHTL to their safety limits needs to be known the exact conditions of the active conductor and the fittings and, of course, the value of their parameters.

The methods chosen to measure the OHTL parameters are present in this paper.

We used the equipment from RIBE Germany [1].

2. REQUIREMENTS FOR MONITORING SYSTEMS COMPATIBILITY

In the substations are connections of the information for monitoring and control equipments from substations and the OHL. The information flow in a substation consists of technical data acquired, especially on-line, from the equipments with monitoring systems, SCADA and other systems.

The monitoring systems are operated by the existing computer networks in which they may or may not be separated from other systems.

The data existing in these systems are used by a large number of users, which are very different.

In the substation we found systems with a single function or systems with several functions. Thus, SCADA has many functions, but the main one being the command function and the second are the surveillance functions of the equipment, especially at the transformers units and the circuit breakers.

From operational experience gained it's shown that systems which meet several functions have given the lowest safety for TPG and highest risk of failure. On the other hand, they provide a more complete picture of the supervisory equipment. Also, too many information makes the operation difficult and decreases the accuracy of actions and the response.

Therefore maintaining a high level of safety information, in terms of actions taken by operators, can be achieved by creating, for each category of users, the different access levels, and various loads by software.

Also for the safety of operational systems is recommended to function in different networks, protected from each other. It is recommended that, for correct operation and real-time, SCADA to contain only the command-control functions and the overall technical parameters of the grid and general signs of operation of equipment. The proper technical parameters for the functioning of equipments should belong to the monitoring system. In the same idea and other systems would be advisable to include only their specific functions. The specific technical parameters for the functioning of equipments, managed by those systems should belong to the monitoring system. Those monitoring systems must contain a network of high speed data transmission and network management with a large number of terminals [2].

So, all systems will be separate, for safety reasons, and will have the multiple functions. But there are users who need information from multiple systems and with different degrees of access from one system to another.

Those are some of the reasons for achieve a management plan appropriate for these goals.

A solution could be the using of the software for each type of system (preferably with the same software), with separate screens for each level of authorization/access, and use a central server, which can be accessed by each operator. The central server will play the role of manager.

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3. DESCRIPTION OF EQUIPMENTS

In the transport of the electric energy are many factors influencing: the safety condition of the Power Grid, the quality of the electric energy, the economic factors and their normal operation. Those factors also have influence on the life time of the equipments (their wear).

The RITHERM system offers the optimum monitoring of the OHTL conductor temperature. The RITHERM system measures the OHTL parameters on-line.

The RITHERM system can makes the measurements of following parameters of the OHTL:

-The temperature of the active conductor

-The load on OHTL

The system also has sensors for:

-The temperature of air (ambiance)

-The wind speed

The system calculates the limits of parameters and corrects the erroneous measurements of parameters (load, temperature). The factors taken in consideration by the system are: the ambient temperature, the wind speed, the load on OHTL and the conditions of operation of the active conductor and the fittings.

This system uses the SAW technology, with radar wave for measurement. Comparing the other similar systems, the RITHERM system no needs to feed from external sources. The RITHERM system parameters are continuously measured with an SAW sensor, which are no need to be powered, being mounted on the active conductor. The RITHERM system reads the parameters from the sensor/central unit, then transmit the information to the server and finally at the users. For this task the RITHERM system is used an independent source [1].

The communication between receiver and central unit is achieved by optical support and the communication between central unit and user's server are routed by GPRS systems [1].

The software, which was installed on user's PC at his headquarter, offers the values of the OHTL parameters on-line on PC screen. The software offers the on-line viewing of the parameters in graphics mode.

The GPRS transmission by the RITHERM system is optimum, reducing the open time of the system to minimum [1].

The energy source of the RITHERM system is based on the solar energy system.

4. OPERATION METHOD FOR THE EQUIPMENT

The RITHERM system is functional on an OHTL from Romanian Power Grid System: OHTL Fântânele-Gheorgheni 220kV, from Sibiu Transmission Subsidiary. The RITHERM system is in function, for measure the temperature of the active conductor.

The OHTL Fântânele-Gheorgheni 220kV is in function from 1960. Their components are original. So, both the conductor and the fittings are very old.

That temperature measurement of the OHTL's active conductor is necessary to monitor behaviour of this OHTL in operational time.

The OHTL's active conductor is the ACSR 400/93 mm^2 type. The electric resistances of the splices are very high, because of their components, which are aging.

The values of the temperature recorded from the OHTL Fântânele-Gheorgheni 220kV with the RITHERM system shows that the temperature of fittings and splices are higher than the active conductor and this fact need to be changed in the future.

The values of the temperature of the fittings were verified using the infrared systems. The apparatus used for infrared measurement is the Fluke type.

The values of the OHTL's parameters obtained from the RITHERM system were analyzed and the results were compared with the theoretical calculus. The limits for the difference between the theoretical calculus and the practical results were established at an error coefficient of 2.3%.

For analyze the data, provided by the system, the authors have chosen the method based on the probabilistic models [2]. Was used the specific data from this OHTL for promote acquisition of new equipments for supervisory the others OHTL considered.

However, the system chosen proved to be reliable.

The conclusions of this study on the OHTL are:

-The OHTL needs to be rehabilitated (especially the fittings)

-The measurements achieved with the RITHERM system was successfully

The measurements of OHTL's fittings in the infrared are shown in the Fig. 1.:

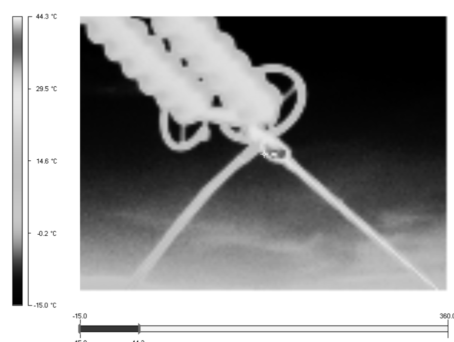

Fig. 1. The infrared graphic of the OHTL's fittings

The values of the temperature recorded by the RITHERM system are presented in the Fig. 2.:

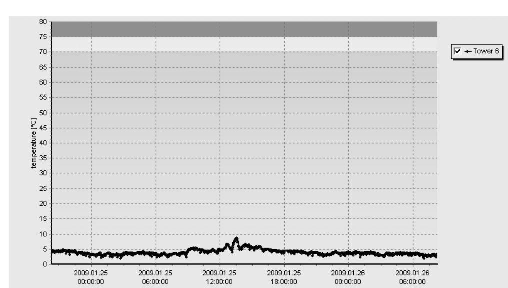

Fig. 2. The temperature of the active conductor

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The values of the ambient temperature recorded by the RITHERM system are presented in the Fig. 3.:

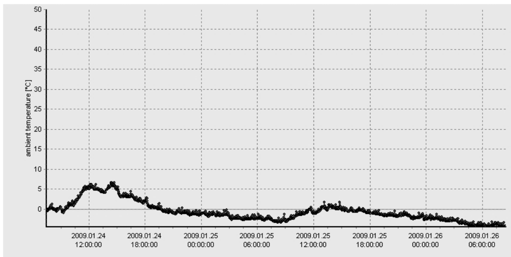

Fig. 3. The temperature of air

The OHTL was evaluated about its reliability and the reliability of each component, taking into account the number of failures of the equipment. The result of this evaluation is shown in table 1.

Table 1. Representative data obtained by RITHERM.

no.	date	conductor temperature [^{0}C]	ambient temperature [^{0}C]	load [MW]
1	12.12.2008 11:14	5,8	1,7	8
2	12.12.2008 11:15	5,4	2,1	8
3	12.12.2008 11:17	5,3	1,7	8
4	12.12.2008 11:18	5,6	1,7	8
5	09.12.2010 19:43	6,0	3,3	22
6	09.12.2010 19:44	6,1	3,2	21,5
7	09.12.2010 19:45	6,0	3,2	21,5
8	29.12.2010 22:07	3,4	-6,6	14,4
9	29.12.2010 22:10	3,6	-6,5	14,4
10	29.12.2010 22:14	3,6	-6,7	14,4
11	29.12.2010 22:15	3,7	-6,6	16,3
12	29.12.2010 22:20	3,7	-6,9	16,3
13	29.12.2010 22:25	4,0	-6,5	16,3
14	30.12.2010 09:18	0,3	-12,3	11,5
15	30.12.2010 09:19	0,2	-12,3	11,5
16	30.12.2010 09:20	0,1	-12,2	11,5
17	30.12.2010 09:23	-1,2	-12,4	11,5
18	04.01.2011 05:28	0,9	-4,4	37,3
19	04.01.2011 05:29	0,8	-4,6	37,3
20	04.01.2011 05:30	0,7	-4,6	44,4
21	04.01.2011 05:31	0,7	-4,7	44,4
22	05.01.2011 07:14	7,1	-10,1	21,9
23	05.01.2011 07:15	7,0	-10,1	24,3
24	03.03.2011 09:14	9,2	1,8	10,8
25	03.03.2011 09:15	9,2	1,8	11,1
26	03.03.2011 09:16	9,5	1,7	11,1
27	06.06.2011 23:43	17,9	16,9	6,5
28	06.06.2011 23:44	17,9	17,0	6,5
29	06.06.2011 23:45	18,1	16,9	5,7
30	06.06.2011 23:46	18,0	17,1	5,7
31	05.06.2011 16:57	40,4	26,3	16,7
32	05.06.2011 16:58	40,7	26,3	16,7
33	05.06.2011 16:59	41,222	26,263	11,2
34	08.08.2011 21:59	26,0	22,7	1,2
35	08.08.2011 22:00	25,5	22,9	2
36	21.08.2011 15:41	40,5	25,9	4,4
37	24.08.2011 14:46	50,743492 13	31,581581 12	6,8

From this data were resulted the following conclusions:

- The periods were recorded with power losses in the LEA
- The periods in which the LEA had the corona losses
- The periods when on LEA was recorded the values of power below the natural power
- Periods when on LEA was recorded the values of power over the natural power or overload
- Changes in climatic parameters in the area during these years
- Components of the LEA that had some flaws
- Events in the LEA that resulted in damage to components
- Solutions for adjusting the TPG parameters to reduce power losses

5. CONCLUSION

As far as the reliability offered by the OHTL, the work was focused mainly on the great achievements, achieved quite recently and putted into operation. Other systems were also analyzed, but because there were not obtained the satisfactory results, none comment was given here.

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We will extend the surveillance on OHTL with new monitoring systems, which will have other functions, such as: the loads supervision, climatic parameters for determination of power losses (active power losses, corona losses, and other reactive power losses), swings, sags and gaps of the conductors.

REFERENCES

[1]. Lemke Diagnostics GmbH – RITHERM. User manual LD-SAW-OHTL, Schwabach, Germany, 2008

[2]. Morar D. – Metode performante de exploatare a stațiilor şi rețelelor de înaltă tensiune, Ph.D. thesis, The "Politehnica" University from Bucharest - PUB, Power Generation & Use Chair Dept., Faculty of Power Engineering, Bucharest, 2011

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