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VOLTAGE MEASURING TRANSFORMER

Introduction. It is difficult to take measurements at high voltages, because high-voltage devices are expensive and usually bulky; their accuracy is subject to static electricity, and they are also unsafe. When the current exceeds 60 A, it is not easy to ensure high accuracy of ammeters due to large wires and significant errors and because of the parasitic field of the terminal leads. In addition, ammeters and current coils in high voltage circuits are dangerous for the operator. Nowadays, oil-insulated voltage transformers, which are used for voltage 6–1150 kV of indoor and outdoor switchgears, are more popular than others.[3] The main representatives of this type are single-phase double-winding transformers NOM-6,

NOM-10, NOM-15, NOM-35.[3] In such transformers, the windings and the magnetic circuit are filled with oil, which serves for insulation and cooling.

Unfortunately, oil transformers have a number of disadvantages, such as:

1. Oil is not an environmentally friendly product;
2. The risk of fire is several times greater than that of other measuring voltage transformers (since oil is a highly flammable substance);
3. Quite a large mass and dimensions;
4. Economic factor. A constant oil change leads to an increase in the cost and repair of the transformer.

Therefore, all over the world there are looking for a replacement for this type, and one of these options is an optical voltage transformer (OVT).

Optical voltage transformer. OVT is intended for an accurate high voltage measurement with a frequency of 50 Hz in electrical networks and electrical installations. OVT provides connection to the Smart Grid system as well as measuring and protective systems. The principle of operation of an optical measuring voltage transformer is based on the linear Pockels effect[1]. The OVT measures the change in the ellipticity of the optical signal polarization in the sensing element of the measuring column under the influence of an electric field, which is created by the voltage supplied to the high-voltage output.[1]

Construction. The device consists of two parts: a measuring column and an electron-optical processing unit. Generation and receipt of an optical signal is carried out in an electron-optical unit. It also processes the signal received from the sensing element, converts it, and transmits the measured voltage value in digital form to the rest of the secondary equipment: commercial meters, telemetry devices, power quality control, relay protection and automation. Measured values are transmitted via the digital interface in the IEC \ IEC LE standard.[2] Using a digital channel allows you to quickly receive and process information, which is a prerequisite for the transition to a new generation of digital substations and Smart Grids grids.

Scope of application. Optical measuring voltage transformer is used as a voltage data source for relay protection systems, process control systems, electric energy metering, electric power quality control at the following facilities in the above areas: Power stations; High voltage power lines.

Advantages and disadvantages of OTN:

1. Complete galvanic isolation, lack of copper secondary circuits;
2. Ten times smaller weight, no oil or gas filling, compared to current transformers, which are filled with oil or gas and weigh 1.5 tons.
3. Ability to connect an unlimited number of consumers of measurement information; [2]
3. Smaller dimensions and weight, lower transportation and installation costs;
4. No need to constantly monitor and maintain the column;

5. High explosion protection and fire safety.

6. Environmental friendliness.

Unfortunately, as any other equipment, an optical voltage transformer is not ideal. Its main disadvantage is the economic factor. Due to the use of expensive materials, a large number of electronics and the complexity of assembly, the cost and repair, compared to an oil transformer, is several times greater.

Conclusion. Based on this information, it can be assumed that in a few years the optical voltage transformer will go into mass production and replace dangerous and bulky oil or gas transformers.

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