

INFLUENCE OF CURRENT TRANSFORMER ERRORS ON THE CALCULATOR INDICATOR

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Abstract: This article describes the principle of operation of the current transformer, the factors that cause measurement errors, the connection diagram, the formula for determining the error that occurred during the operation of the current transformer, and the ways to eliminate the error that occurred.

Keywords: current transformer, transformation coefficient, current error, angular error, primary current, secondary current.

As the need for electricity increases, it is necessary to accurately and fully account for its production and consumption.

It is not possible to calculate the electricity produced and consumed with sufficient accuracy by replacing induction meters with meters made on the basis of semiconductor elements with a higher accuracy class [1-5].

If we take into account that the calculation of electricity passing through high-voltage electrical devices is carried out with the help of current transformers and voltage transformers, it is known that errors in them also affect the meter reading.

Current transformers (CA)- are used to isolate measuring devices and protective devices from high-voltage circuit and to supply the protective circuit with current from the network [6-9].

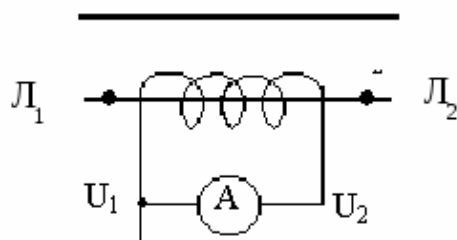


Figure 1. Current transformer connection diagram



Current transformer errors consist of current and angle errors. The causes of these errors are described in the analysis of the operating modes of high-voltage current transformers [10-12].

The origin of current transformer errors depends on the following factors:

1) The load current exceeds the rated current of the current transformer or the rated current decreases by 20%.

2) As a result of the passage of short-circuit currents, the core of the current transformer becomes saturated.

3) Exceeding the specified norm of the load connected to the secondary circuit of the current transformer.

This article analyzes the reasons for the load current exceeding the nominal value and its sharp decrease, as well as the causes of current and angle errors for various characteristic conditions of the load connected to the secondary circuit [13-19].

The primary current of current transformers consists of the current in the secondary circuit and the current used to transform it from the primary circuit to the secondary circuit. In this case, the current error occurring in the current transformer is explained by the following expression;

$$f_{\text{ТТ}} = \left(\frac{I_2 \times n_{\text{H}}}{I_1} - 1 \right) \times 100\%$$

Here:

I_1 – is the primary current of the current transformer.

I_2 – the secondary current of the current transformer.

n_{H} – current transformer transformation coefficient.

$f_{\text{ТТ}}$ – is the current error of the current transformer.

If the secondary current brought to the primary is greater than the value of the primary current, the error on the current is positive, if this value is less than the error, the error is negative.

The angular error in a current transformer represents the angle by which the current in the secondary circuit differs from the current in the primary circuit.

If the current vector in the secondary circuit of the current transformer, turned by 180° , is ahead of the current vector in the primary circuit, then the error has a positive character, otherwise it has a negative character.



The current and angle error increases with increasing secondary circuit load, where the secondary circuit voltage increases and correspondingly the magnetizing current also increases [20-21].

The angle error reaches its maximum value when the primary current is from 0 to 5% of the nominal value of the load current, the angle between the current and voltage in the secondary circuit also reaches its highest value, that is, the current and voltage in the primary and secondary circuits are equal. As a result, the angle between the meters is different, the difference between the electricity measured by the meter and the electricity passing through the primary circuit.

As the primary current of the current transformer increases by 5% of the nominal value of the current of the load, the angular error also decreases, and it is observed that the angular error increases at values exceeding 100% of the nominal value.

It is clear from this that the power consumption of the load connected to the secondary circuit of current transformers does not exceed the value specified in the passport of the current transformer and depends on the nature of the connected load.

1. The measuring current transformer has a small power reserve on the secondary circuit, a small change in the load on the secondary circuit causes the error to deviate from the norm.

2. At a small amount of primary current up to 5%, the error in current and angle increases rapidly.

3. Exceeding the primary current of the current transformer from the rated current leads to an increase in the current and angle error.

4. In order to carry out accurate and complete calculation of the transferred electric energy, the load current and the load of the secondary circuit should not exceed the norm.

5. To reduce the current transformer load, two current transformers can be connected in series, i.e. they are installed in one phase and have the same transformation coefficient n_T

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