Current Transformer Accuracy Ratings

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Revised edition released June 2006

Original edition released November 2005

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Current transformer accuracy is specified by the standards *IEEE Std C57.13, IEEE Standard Requirements for Instrument Transformers* and *IEC-60044-1, Instrument Transformers— Part 1: Current Transformers.*

Accuracy is specified by a percent ratio error ε that is not to be exceeded when the CT is subjected to a stated burden and limit current. For IEEE, the ratio error is 10 percent. The IEC has ratings of 5 and 10 percent where 5 percent is the preferred rating.

I. LIMIT CURRENT

The limit in the IEEE standard is 20 times the CT primary current rating. Twenty times is also the preferred limit in the IEC standard.

II. PROTECTIVE RELAY CLASSES

Classification C or K covers current transformers in which the leakage flux in the core does not have an appreciable effect on the ratio or ratios within the limit of current and burden. K classification shall have a knee-point voltage of at least 70 percent of the secondary terminal voltage rating (IEEE C57.15).

T classification covers current transformers in which the leakage flux has an appreciable effect on the ratio within the specified limits (IEEE C57.15).

Class P accuracy limit is defined by composite error ε with steady state primary current. No limit on remanent flux (IEC 60044-6).

Class TPS low leakage current transformer performance is defined by the secondary excitation characteristic and turns ratio limits. No limit on remanent flux (IEC 60044-6).

III. BURDEN

The IEEE standard burdens for relaying are 1, 2, 4, and 8 ohms, all with an impedance angle of 60 degrees. However, the CT is classified by the voltage across the burden impedance at the limit current of 100 A. Hence, the voltage standard classifications are 100, 200, 400, and 800.

In IEC, standard rated resistive burden is the rated value of the secondary connected resistive burden in ohms. However, the burden is specified in terms of VA at rated secondary current.

It is important to note that when a CT, with a standard burden having a 60-degree impedance angle, produces less than a 10 percent error at 20 times current, a resistive burden of the same value will produce less than a 5 percent error.

Figure 1 shows the ratio and secondary current of a C400, 1200:5 CT with the standard burden of 2+j3.464. Note that the magnetizing current for this case is in phase with the ratio current and causes slightly less than a 10 percent ratio error.

Figure 2 shows the same case with a 4-ohm resistive burden. In this case, the magnetizing current is out of phase with the ratio current. Although it has a higher peak, the waveform subtracts only from the lagging edge of the half cycle and causes less than a 5 percent error. Consequently, the IEEE 10 percent accuracy compares with the IEC 5P rating as shown in Table 1. The IEC accuracy designation gives the burden VA at rated input, the accuracy rating (5P), and the limit of 20 times rating.
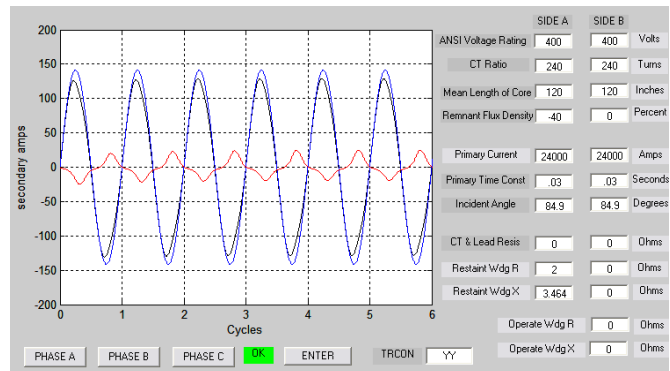

Figure 1   C400 1200:5 CT 24 kA, Burden 2+j3.464
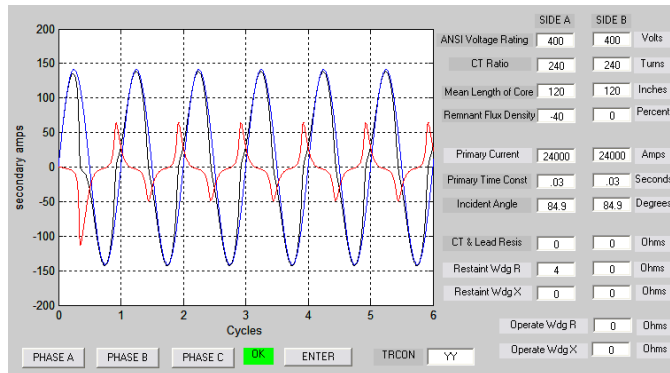

Figure 2   C400 1200:5 CT 24 kA, Burden 4-Ohm Resistive

TABLE 1   EQUIVALENT CT ACCURACY RATINGS

IEEE C57.13	IEC 60044-1
C100	25 VA 5P 20
C200	50 VA 5P 20
C400	100 VA 5P 20
C800	200 VA 5P 20

IV. REFERENCES

[1] *IEEE Standard Requirements for Instrument Transformers*, IEEE Std C57.13-1993.

[2] *Instrument Transformers— Part 1: Current Transformers*, IEC 60044-1-1992.

V. BIOGRAPHY

Stanley (Stan) Zocholl holds a B.S. and M.S. in Electrical Engineering from Drexel University. He is an IEEE Life Fellow and a member of the Power Engineering Society and the Industrial Application Society. He is also a member of the Power System Relaying Committee and past chair of the Relay Input Sources Subcommittee. He joined Schweitzer Engineering Laboratories in 1991 in the position of Distinguished Engineer. He was with ABB Power T&D Company Allentown (formerly ITE, Gould, BBC) since 1947 where he held various engineering positions including Director of Protection Technology.

His biography appears in Who's Who in America. He holds over a dozen patents associated with power system protection using solid state and microprocessor technology and is the author of numerous IEEE and Protective Relay Conference papers. He received the Best Paper Award of the 1988 Petroleum and Chemical Industry Conference and the Power System Relaying Committee's Distinguished Service Award in 1991.