Instrument Transformer – Part 3
Current Transformers – Metering Accuracy

NCEES® PE Power Reference Handbook doesn't contain specific details on this topic

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Accuracy of a CT is expressed as a combination of accuracy class and burden as shown below

Accuracy Class (0.3%, 0.6%, 1.2% etc.) + **Burden** (0.1, 0.2, 0.5 etc.) = 0.3B0.1, 0.6B0.5 etc.

0.3B0.1 means that CT has 0.3% accuracy at 100% rated current for burden < 0.1 Ohm.

0.6B0.5 means that CT has 0.6% accuracy at 100% rated current for burden < 0.5 Ohm.

More about accuracy classes…

- ❑ At < 100% rated current, 2X error is allowed for 0.3, 0.6, 1.2 accuracy class CTs.
- ❑ 0.15 accuracy class CTs maintain 2X (0.3%) accuracy between 5% and 100% rated current.
- ❑ 0.15S accuracy class CTs maintain 0.15% accuracy between 5% and 100% rated current.

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Current Transformers – Protection/Relaying Accuracy

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- Standard Relay Accuracy is expressed as follows:

C or T 100, C or T 200, C or T 400, C or T 800

- 'C' indicates that CT has low leakage flux and accuracy can be 'calculated' before manufacturing.
  Applies to bushing, window and bar type CTs.
- 'T' indicates that CT can have high leakage flux and accuracy must be 'tested' in factory .
  Applies to wound type CTs.
- 100/200/400/800 identifies the max. secondary voltage at 20X rated current without exceeding 10% ratio error at rated burden.
- C100/200/400/800 have standard burden ratings of B-1 (1Ω), B-2 (2Ω), B-4 (4Ω) and B-8 (8Ω).
- If a CT is used at lower tap, its (new) max. secondary voltage can be calculated as follows:

$$V_{s-new} = \frac{lower\ tap}{rated\ tap} \times C - rating$$

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Instrument Transformers - Errors

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Instrument transformer errors are broadly classified as ratio and phase errors.

Ratio Error – Results in actual transformer ratio being higher or lower than rated ratio.

Ratio error exists due to losses in iron core of non-ideal transformers.

Ratio Error$= (K_N - K)/K$ K = Actual Ratio K_N = Nominal Ratio

Phase Error – Results in a phase shift between primary and secondary measurements.

Phase error exists due to exciting current I_e required for magnetization of non-ideal transformers.

Ratio and phase errors depend on burden.

Ratio Correction Factor (RCF) - Corrects ratio error. Mathematically, RCF $= K/K_N$

RCF > 1.0 means meter is reading lower than actual and vice versa.

Transformer Correction Factor (TCF) - Corrects both ratio and phase errors.

How can we reduce these errors?

Use instrument transformers with high magnetic permeability, large core cross-section, compact windings.

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Current Transformers – Metering Accuracy

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