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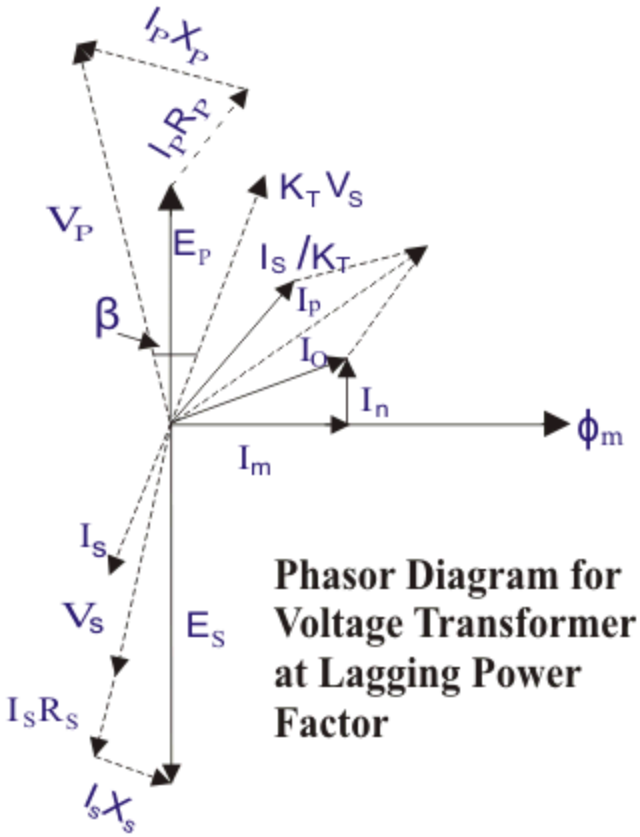
Error in PT or Potential Transformer or VT or Voltage Transformer

I_s - Secondary current.
E_s - Secondary induced emf.
V_s - Secondary terminal voltage.
R_s - Secondary winding resistance.
X_s - Secondary winding reactance.
I_p - Primary current.
E_p - Primary induced emf.
V_p - Primary terminal voltage.
R_p - Primary winding resistance.
X_p - Primary winding reactance.
K_T - Turns ratio = Numbers of primary turns/number of secondary turns.
I_0 - Excitation current.
I_m - Magnetizing component of I_0.
I_w - Core loss component of I_0.
Φ_m - Main flux.
β - Phase angle error.



Phasor Diagram for Voltage Transformer at Lagging Power Factor

As in the case of current transformer and other purpose electrical power transformer, total primary current I_p is the vector sum of excitation current and the current equal to reversal of secondary current multiplied by the ratio $1/K_T$.

$$Hence,\ I_p = \frac{I_0 + I_s}{K_T}$$

If V_p is the system voltage applied to the primary of the PT, then voltage drops due to resistance and reactance of primary winding due to primary current I_p will come into picture. After subtracting this voltage drop from V_p, E_p will appear across the primary terminals. This E_p is equal to primary induced emf. This primary emf will transform to the secondary winding by mutual induction and transformed emf is E_s. Again this E_s will be dropped by secondary winding resistance and reactance, and resultant will actually appear across the burden terminals and it is denoted as V_s. So, if system voltage is V_p, ideally V_p/K_T should be the secondary voltage of PT, but in reality; actual secondary voltage of PT is V_s.

Voltage Error or Ratio Error in Potential Transformer (PT)

The difference between the ideal value V_p/K_T and actual value V_s is the voltage error or ratio error in a potential transformer, it can be expressed as,

$$\% \text{ voltage error} = \frac{V_p - K_T.V_s}{V_p} X\ 100\ \%$$

Phase Error or Phase Angle Error in Potential or Voltage Transformer

The angle 'β' between the primary system voltage V_p and the reversed secondary voltage vectors $K_T.V_s$ is the phase error.

Burden of Current Transformer

Whatever is connected externally with the secondary of a current transformer is called burden of current transformer. In electrical power transformer the secondary is connected with load, but in case of current transformer, electrical consumer load is not connected to the secondary. In electrical power transformer we loaded the secondary of the transformer by connecting consumer's one by one to the secondary side. But in case of current transformer or other instrument transformer, we connect, metering instrument and protection relays to the secondary, which obviously behave like load of the instrument transformer but do not have any direct relation with the load of the electrical power system. That is why, all the instruments, wires etc connected with the secondary of the instrument transformer or IT is called burden rather load. In this way, we distinguish the secondary circuit of a current transformer or voltage transformer from other purpose electrical transformer. Although literally, load and burden carry nearly same meaning in English language. Rated burden of current transformer is the value of the burden to be connected with the secondary of CT including connecting load resistance expressed in VA or ohms on which accuracy requirement is based. Similarly rated burden of resistance expressed in VA or ohms on which accuracy requirement is based.