CT & PT

1. CT = Current Transformer (used to measure high current)
2. PT = Potential Transformer (" " high voltage)
3. CT & PT is always used in AC
4. Current ratio in CT = 1000/5
   PT = 1000/1
5. CT & PT are installed in grid in substation.

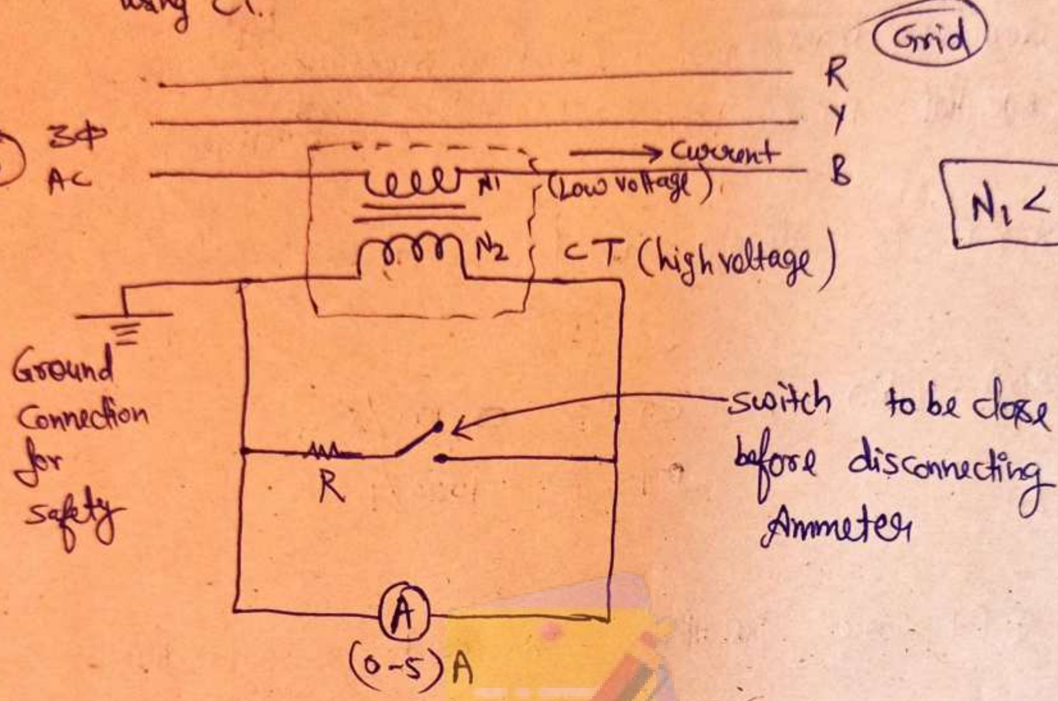
CT

Current Transformer – 1. It is an instrument transformer used for measurement of high curr.

2. Rating:- ~~500/5~~, ~~500/4~~, ~~200/5~~, $\boxed{1000/1}$ mostly used
3. Step up transformer is used for CT. ($I_1N_1 = I_2N_2$)
4. (i) Why we use CT:- if we go on design a Ammeter to measure that (1000A) large current the size & cost of (A) will very large & expensive so we ~~[illegible]~~ we use CT.

(5) Calibrated Ammeter are used to measure current using CT.

(6)



$$\boxed{N_1 << N_2}$$

Let $\boxed{\frac{N_1}{N_2} = \frac{5}{1000}}$ then $\boxed{\frac{I_1}{I_2} = \frac{1000\,A}{5\,A}}$

↓

this rating is rated on CT

☆ Calibration → $\boxed{200 * \text{Reading}}$

☆ why switch is used?

Ans) Ammeter behave as short Circuit. so To remove ammeter the swith should ON otherwise CT will blast.

7. CT is designed upto I for shortckt Load (max^m I passed)
as CT depend on Load (current varies per load)

CT will measure 0 if Load = 0

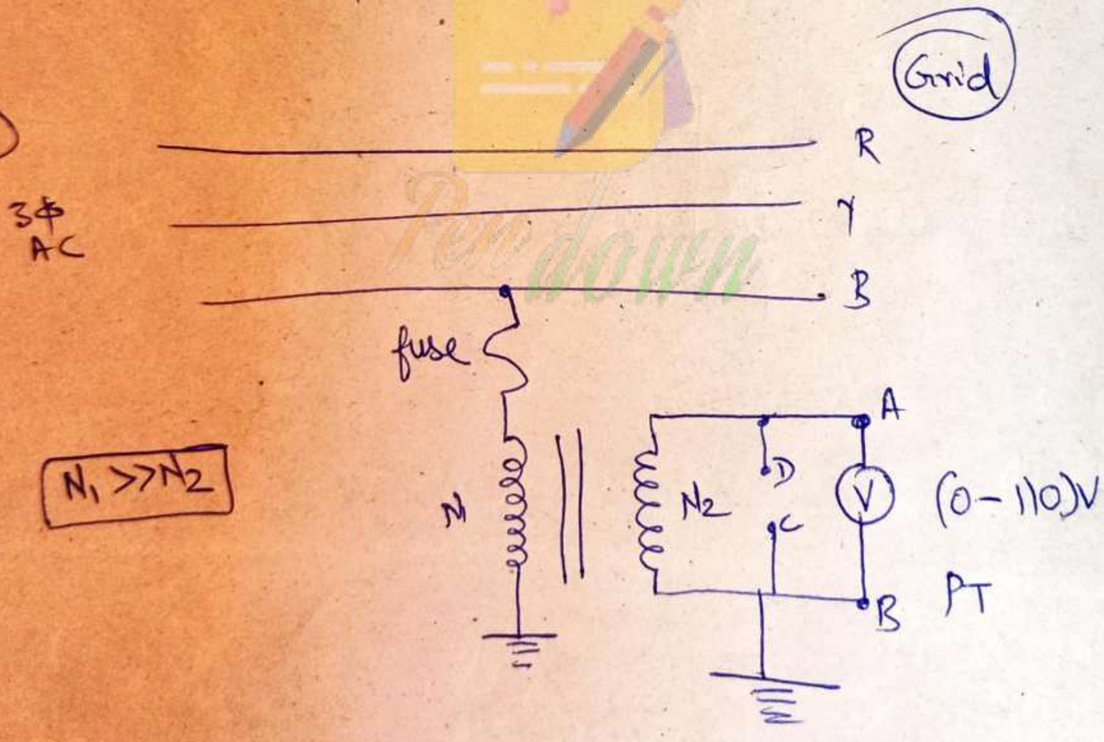
8. CT is series to load.

~~Rating of CT~~

PT

1. It is a instrument Transformer used to measure high voltage
2. Rating - 1000/5 , 500/1 , 500/5 , 1000/1 (ratio of turns or voltage)

   as $\left(\frac{V_1}{V_2} = \frac{N_1}{N_2}\right)$

3. step down Transformer is used.
4. Connected in parallel to load.
5. 

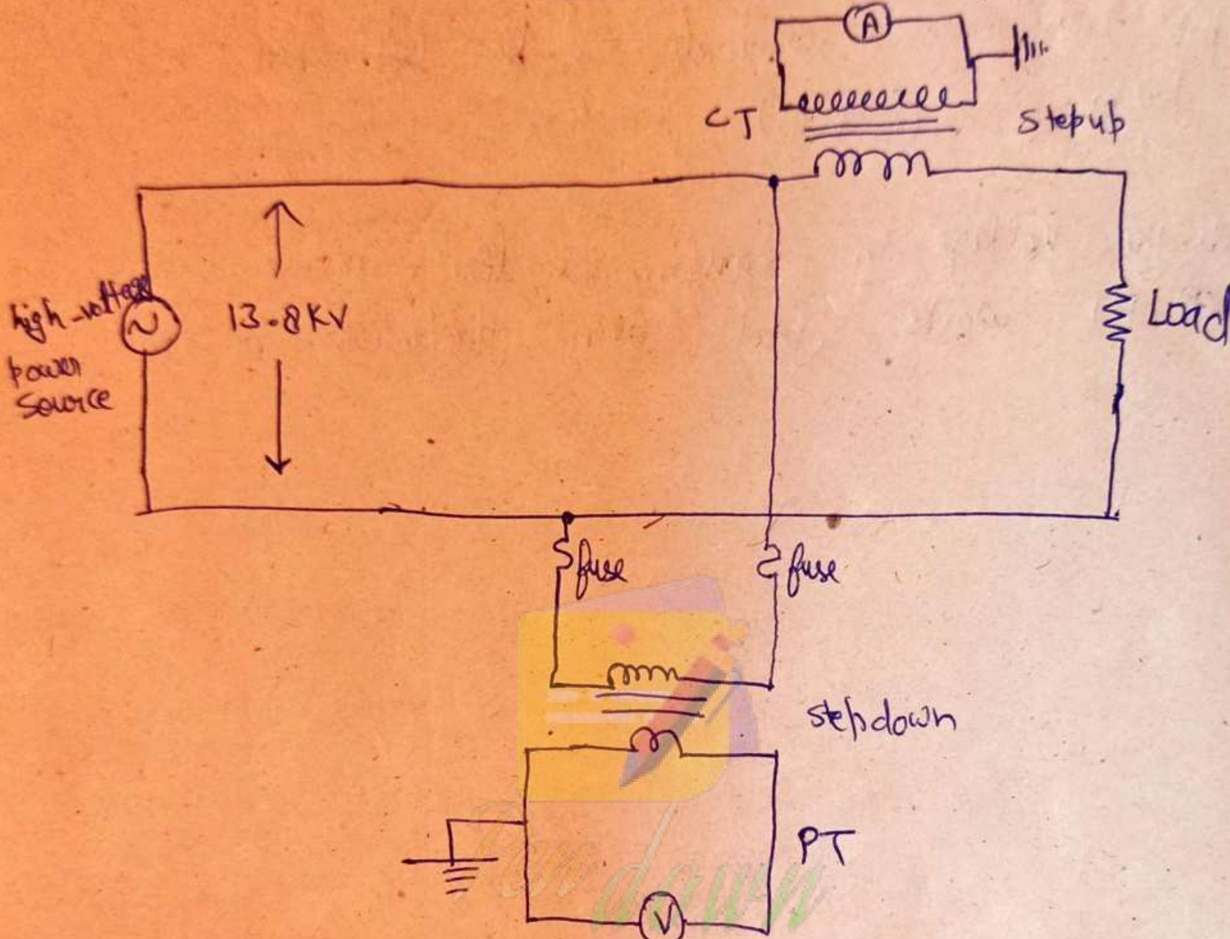
As the internal resistance of V = ∞ so terminal pot. can be measured by proper calibration.

~~why [illegible]~~

* pot. transformer terminals can be left open no harm (C & D)

* As the voltage in transformation line remains constant so PT works good even fluctuations in load

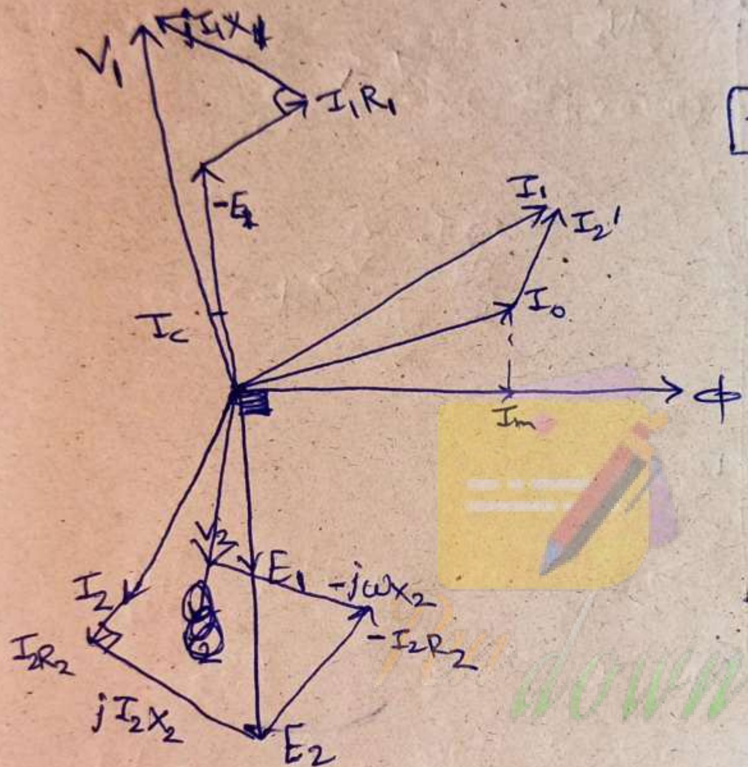
CT & PT in a Circuit



Phasor for CT

Let $\Phi = \Phi_0 \sin \omega t$

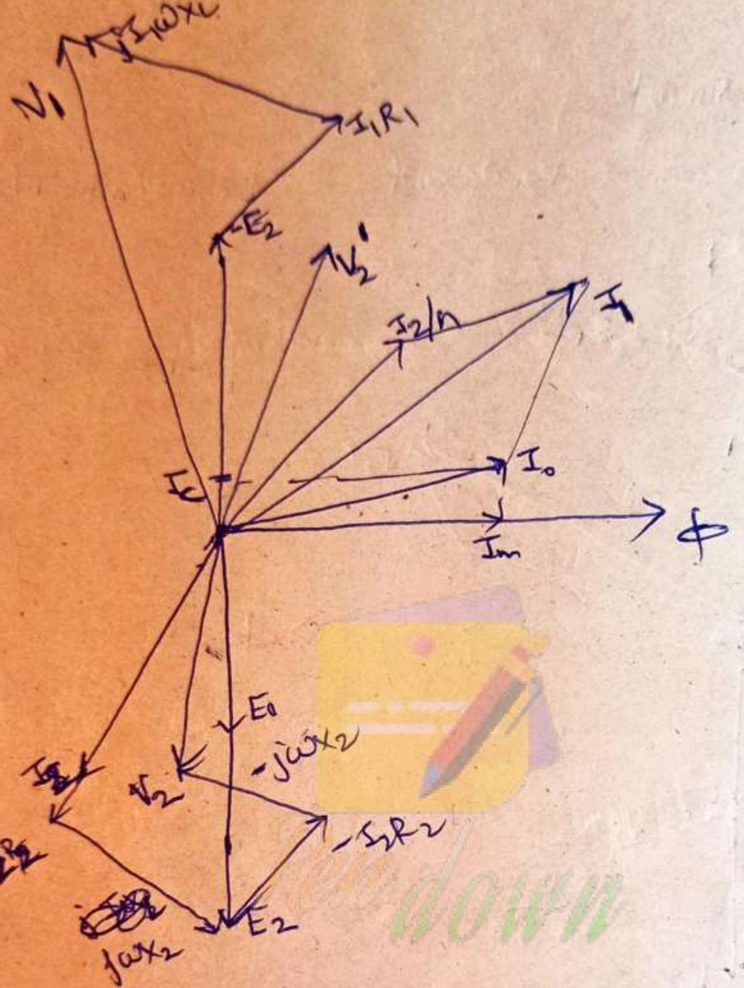
$$E_2 = \frac{-d\Phi}{dt} = -\Phi_0 \omega \cos \omega t = E_0 \sin(\omega t - \pi/2)$$



$$\boxed{I_1 = I_0 + I_2'}$$

phasor for PT

$V_2' = -nV_s$



Errors in CT & PT

① Ratio error

② Phase angle error

① CT error -

① Ratio - error:

$$\underset{(K_n)}{\frac{N_1}{N_2}} \neq \underset{(R)}{\frac{I_2}{I_1}}$$ due to magnetizing & core loss component

% Ratio error = $\frac{\text{Nominal ratio} - \text{actual ratio}}{\text{actual ratio}} \times 100$

$$= \frac{K_n - R}{R} \times 100$$

$$= \frac{\frac{N_1}{N_2} - \frac{I_2}{I_1}}{\frac{I_2}{I_1}} \times 100$$

② Phase angle error -

I_2 & I_1 has phase shift of 180° but not actually found due to magnetizing & core loss & phase angle is $\neq 180°$

phase angle error $(\theta) = \frac{180}{\pi}\left[\frac{I_m \cos\delta - I_c \sin\delta}{n I_s}\right]$ in degree

$$\boxed{\theta = \frac{I_m \cos\delta - I_c \sin\delta}{n I_s}}$$ in radians

② PT- error-

① $\frac{N_1}{N_2} = \frac{V_1}{V_2}$

(K_n) (R_n)

$$\%\ \text{ratio error} = \frac{K_n - R_n}{R_n} \times 100$$

$$= \frac{\frac{N_1}{N_2} - \frac{V_1}{V_2}}{\frac{V_1}{V_2}} \times 100$$

② Phase angle error-

Vp & Vs should not has any phase diff

but due to mag & core ~~loss~~

loss comes as phase angle in PT

$$\boxed{\theta = \frac{\frac{I_s}{n}(X_p\cos\Delta - R_p\sin\Delta) + I_e X_p - I_m r_p}{nV_s}}$$

(in radians)