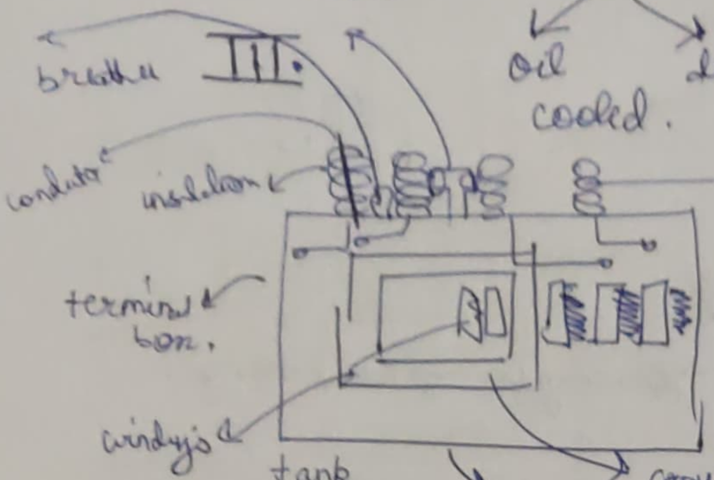
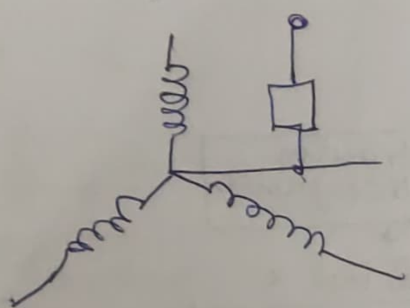
Conseration tank → oil cooled. / dry



→ bushings
(as per to terminals)
→ phase
→ neutral

earthed → grounded.
as 2 points
|← as if one doesn't work →|
binding current

4 terminals
single phase



HV → delta connected
LV → star, connected
binding.

$$\boxed{\text{phase voltage} = \frac{\text{line voltage}}{\sqrt{3}}}$$

oil → cooling
→ insulation

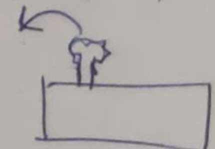
conservator tank. → oil volume (↑) main tank. expand. → cool → main tank.

---

area (↑) → cooling fings.
air cool. [cool air]

→ breather : absorb moisture from air.

|← breather →|



→ Mag → core
→ elect - bindings

cooling methods.

dry (oil absence) so spilling oil

→ oil

(ONAN)

ON Oil natural air natural

Airforce
ONAF

oil natural hot bahar ayega
fan installed
cooling efficient

(OFAF)

pump (radiator) used to vacuate oil from transformer.

loses

core → depends

copper → depends

load (↑) upto ratings I (↑)

$P = VI$

fan: $\frac{70}{220} = \cos\phi \Rightarrow 0.8$

$I = 0.38$ A.

I^2R loses → heat → heat dissipate. kar payega. less than easily

insulation damage × dissipate / current bahar aayega.

Ratings :- 10 KVA, KVA, MVA

(OFAF) → more heat dissp. transformer ko zyada than 10KVA

$B = \boxed{\frac{\phi}{A} = \frac{\text{web}}{m^2}}$

M.M.F. : N × I

flux density (↑)

(no. of turns) N

N (↑)   I (↑),

AT
Ampere turn.

$$H = \frac{mmf}{l} \therefore A/m$$

$$B = \frac{\phi}{A} \therefore wb/m^2$$

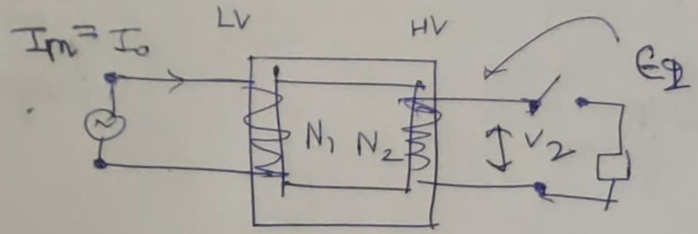
assumptions

no leakage flux — no resistance of the winding

...re
...s
...near

no eddy current loss
no hysteresis loss.

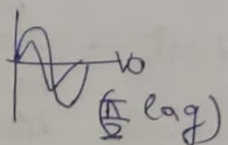
I.

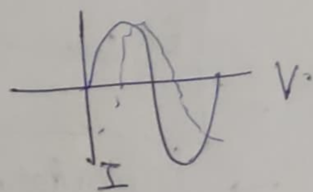


$I_o \to$ only primary magnetic flux.

$\to$ no losses.

Inductors $\to$ coils





$$e_1 = -N \frac{d\phi}{dt}$$

instanteous,

$$\phi = \phi_m \sin \omega t.$$

$$e_1 = -N_1 \frac{d(\phi_m \sin \omega t)}{dt}$$

$$-N\frac{d\phi_1}{dt} = -N \phi_m \cos \omega t \, \omega$$

$$\boxed{-N\frac{d\phi_1}{dt} = N \phi_m \omega \sin\left(\omega t - \frac{\pi}{2}\right)} = e_1$$

e_1 lag Kar rha h from flux

E_{max} $N_1 \phi_m \omega$

rms $\frac{N_1 \phi_m \omega}{\sqrt{2}}$

avg $\frac{2}{\pi} N_1 \phi_m \omega$

$$\frac{2\pi f N_1 \phi_m}{\sqrt{2}} = \frac{E_{max}}{\sqrt{2}}$$

$$E_1 = \sqrt{2}\pi f N_1 \phi_m$$

emf.

$$\boxed{E_1 = 4.44 f N_1 \phi_m} = V_1$$

~~no~~

$V_1 \rightarrow$ supply voltage.

$$\boxed{E_2 = 4.44 f N_2 \phi_m} = V_2$$

$I_0 = 0$

so $|E_1| \approx |V_1|$

direction opposite.

$$I_0 = \frac{V_1 - E_1}{Z_L} = 0.$$

rated.

2% current = I_0.

~3%.

$$\Rightarrow \underbrace{\frac{E_1}{E_2} = \frac{N_1}{N_2} = \frac{V_1}{V_2}}_{\text{same for ideal transformers}}.$$

* ideal transformer *

→ efficiency 100%

→ no core losses

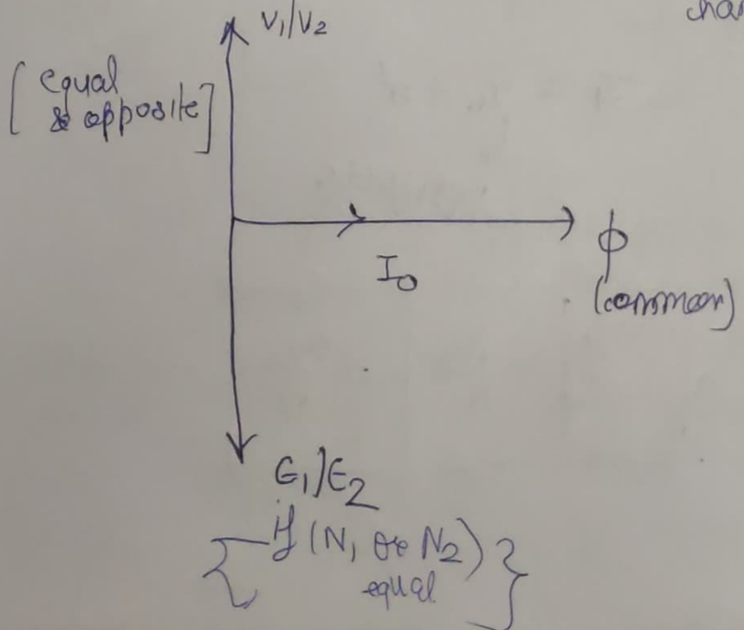
→ No binding resist

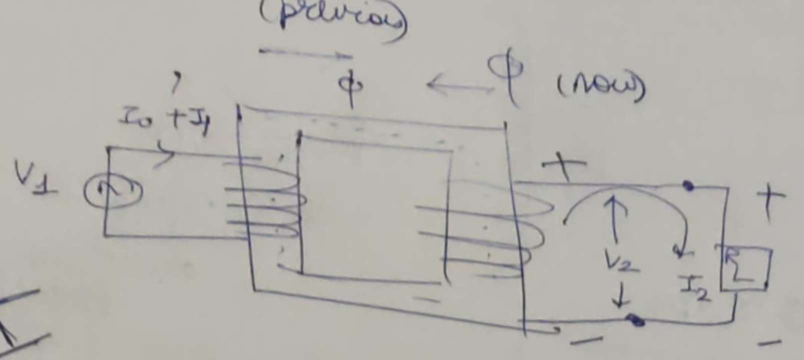
power ≈ charge

freq. same range

phasor diagram

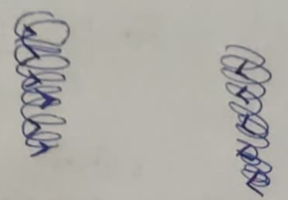
[no load condition]





RL
Load
ideal.

II



[ϕ_{now} oppose magflux]

I_1' neutralise ϕ (now)

mmf $= N_2 I_2 \longrightarrow$ flux (now) set up karega.

utna hi I_1' hona chaiye

$N_1 I_1' = N_2 I_2$

Answer $\boxed{I_1' = \frac{N_2 I_2}{N_1}}$

additional flux by I_1 → neutral, ϕ_{now}

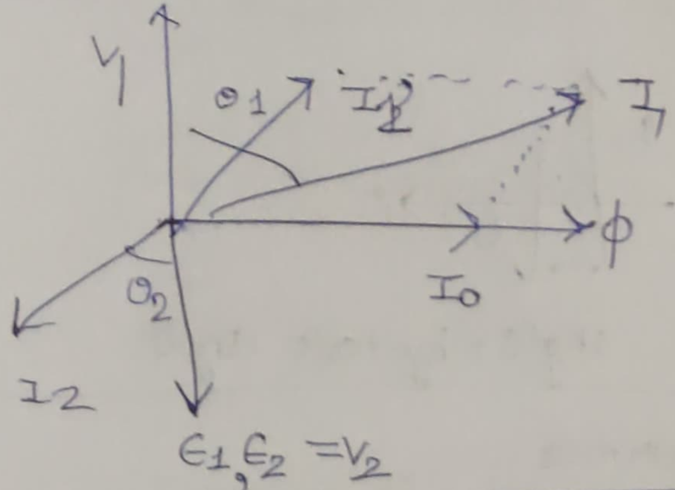
leakage flux is such flux which has no use and produced only in 1 section. && hence no link b/w LV && HV.

$I_2 = 100\ A$

$I_0 = 2A$

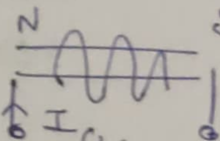
$I_1 = I_0 + I_1'$
→ negligible

Ans: $\boxed{\frac{I_1}{I_2} = \frac{N_2}{N_1}} \boxed{= \frac{V_2}{V_1}}$

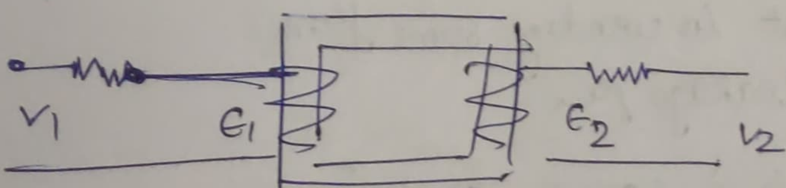


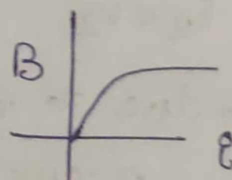
BH. curve : considering solenoid for generaly curve

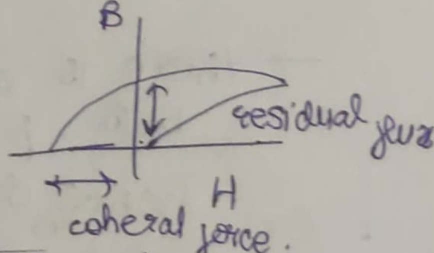
in starting current (↑) ∝ mag flux (↑)



after saturation iron piece becoz (mag. property) No further inc (↑) of flux happen.

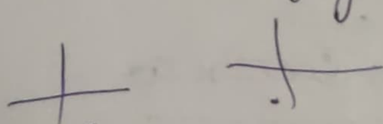


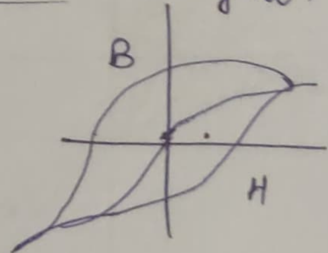




$V_1 > E_1$ → induced emf
$E_2 > V_2$

leading power factor · $E_2 < V_2$ ↙ ↘ lagging



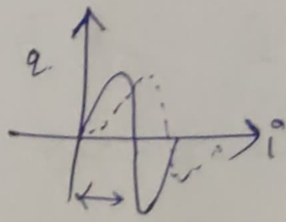


↙ ↙ ↘

now to reduce coheral force we gain

to make mag. property 0 we flow I in revers

due to retentivity due the current will not make flux change totally 0 hence there is some mag. - prop



angle = hysteric angle.

Actual transformer.

in actual transformers
current loses due to
resistance of bindings

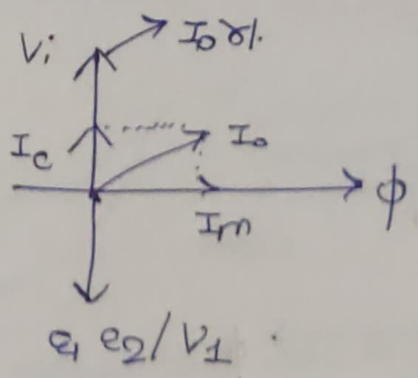
$E_1 > V_1$ due to r_1 loss
$E_2 < V_2$ due to r_2 loss

→ due to resist in winding some flux
occur → leakage flux

→ there is also resist drop in
both p & s winding
hence, drawn external inductance
in our transformer

E cos $= x I_0$

Now induced emf after
all loses and flux $= V_1$.



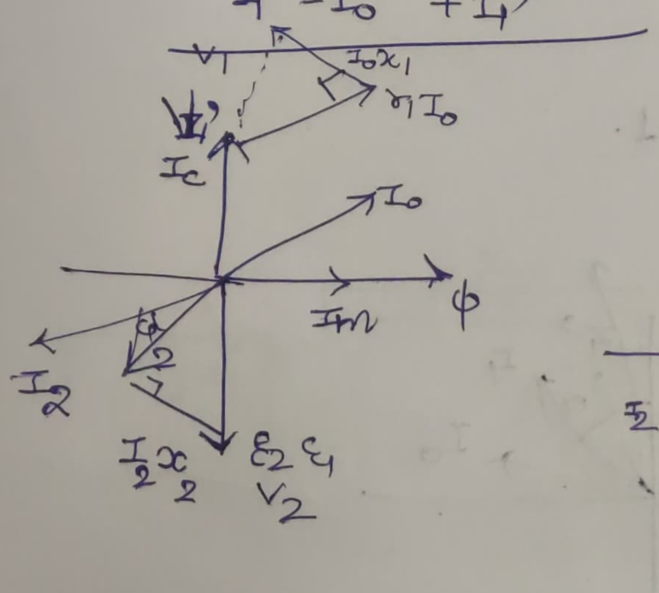
I_m = magnitizing component of current

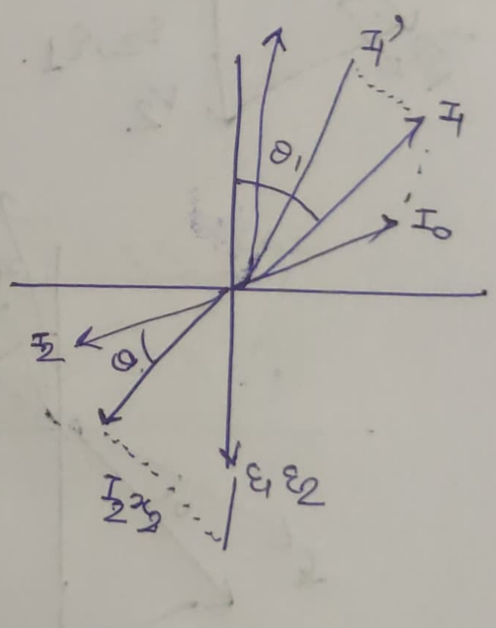
(used to setup the flux)

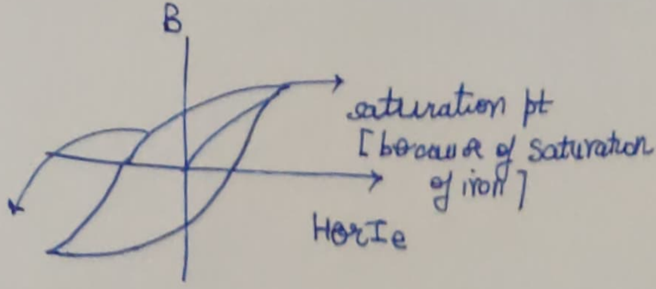
$$V_1 = V_1' + \underbrace{I_0 x_1 + I_0 r_1}_{\text{losses}}$$

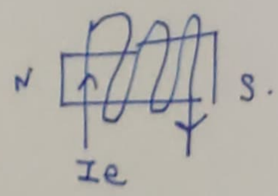
I_2 lags becoz of

$$I_1 = I_0 + I_1'$$

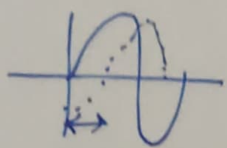






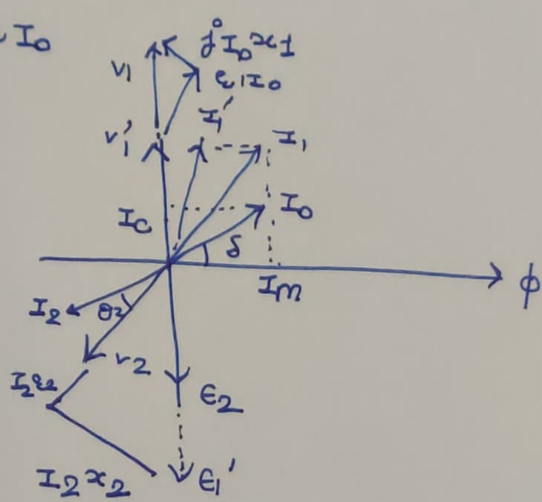


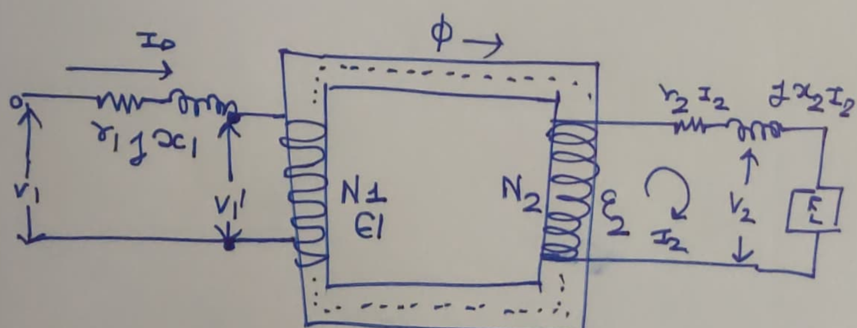
when I_e is reduced [shape wont be straight due to relentivity
ie core still holds flux even $I_e = 0$



ϕ & I not in same phase.

$E_l = x I_o$





$E_l = x I_o$

$I_1 = I_o + I_1'$

$I_1' N_1 = I_2 N_2$

$I_1 = I_o + I_1'$