

Single phase

→ 230V

→ 2 wires

Phase → Brown.

Neutral → Blue

Earth → Yellow, green

→ single coil

Three phase

→ 400V

3 → L_1 → Brown

+ L_2 → Black

L_3 → Green.

N → Light Blue.

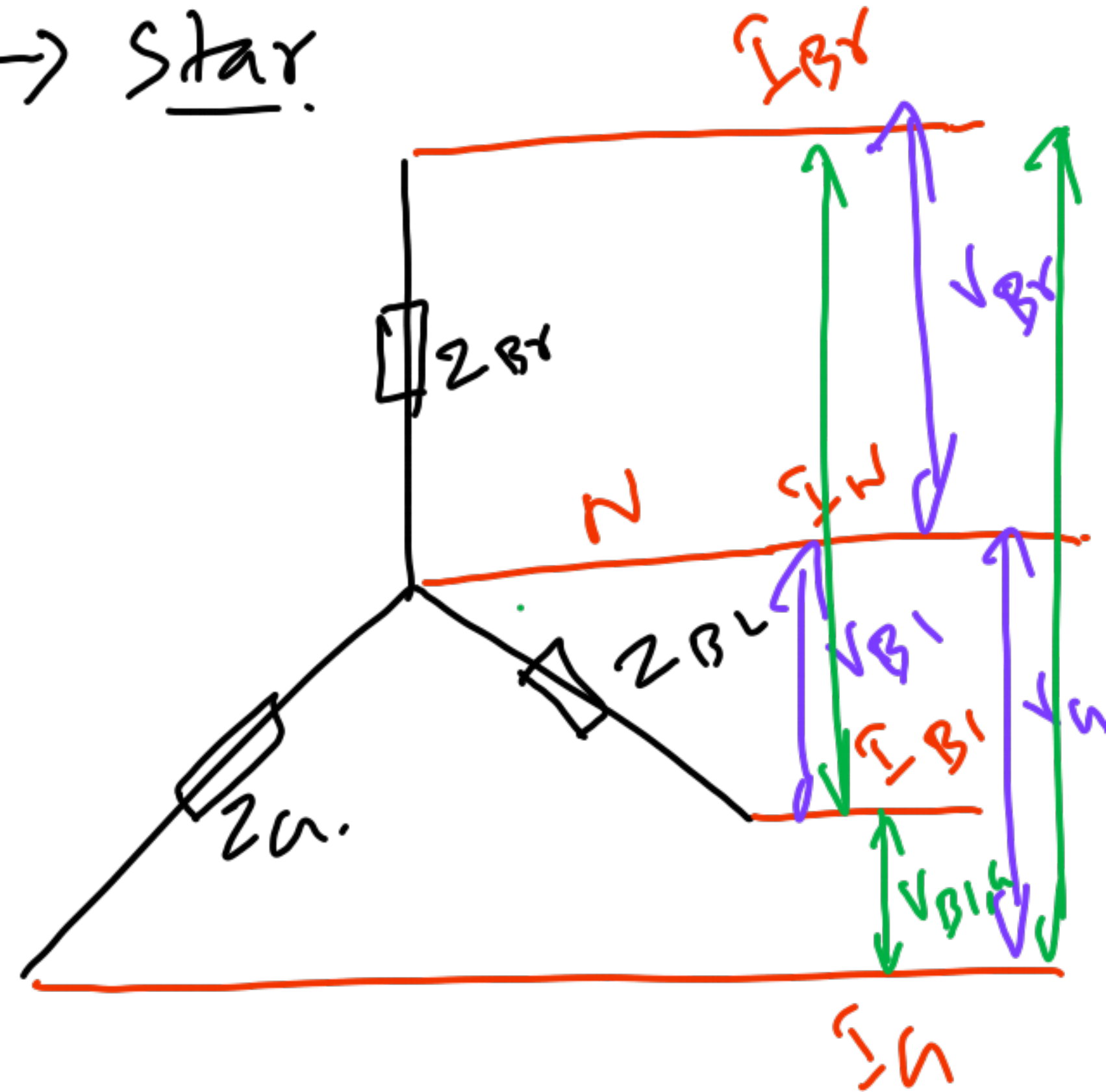
Earth → Yellow green.

→ 3 coils, 120° phase difference

6 → wire,

→ Star, Delta.

→ Star.



$$I_L = I_{\phi}$$

Phase Voltage

$V \rightarrow$ line & neutral

V_{Br}, V_{B1}, V_G

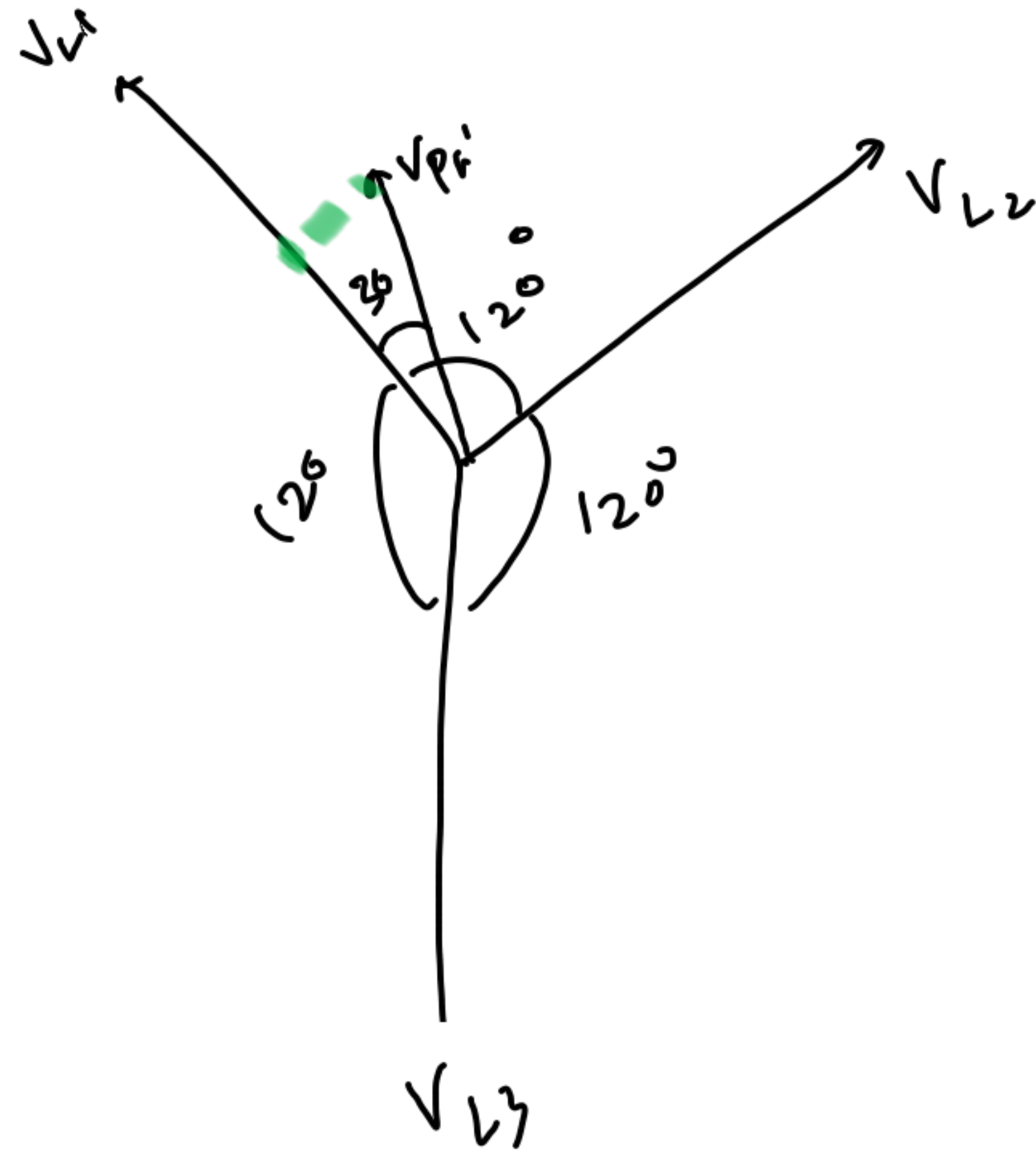
[Phase voltage - V_p]

line voltage

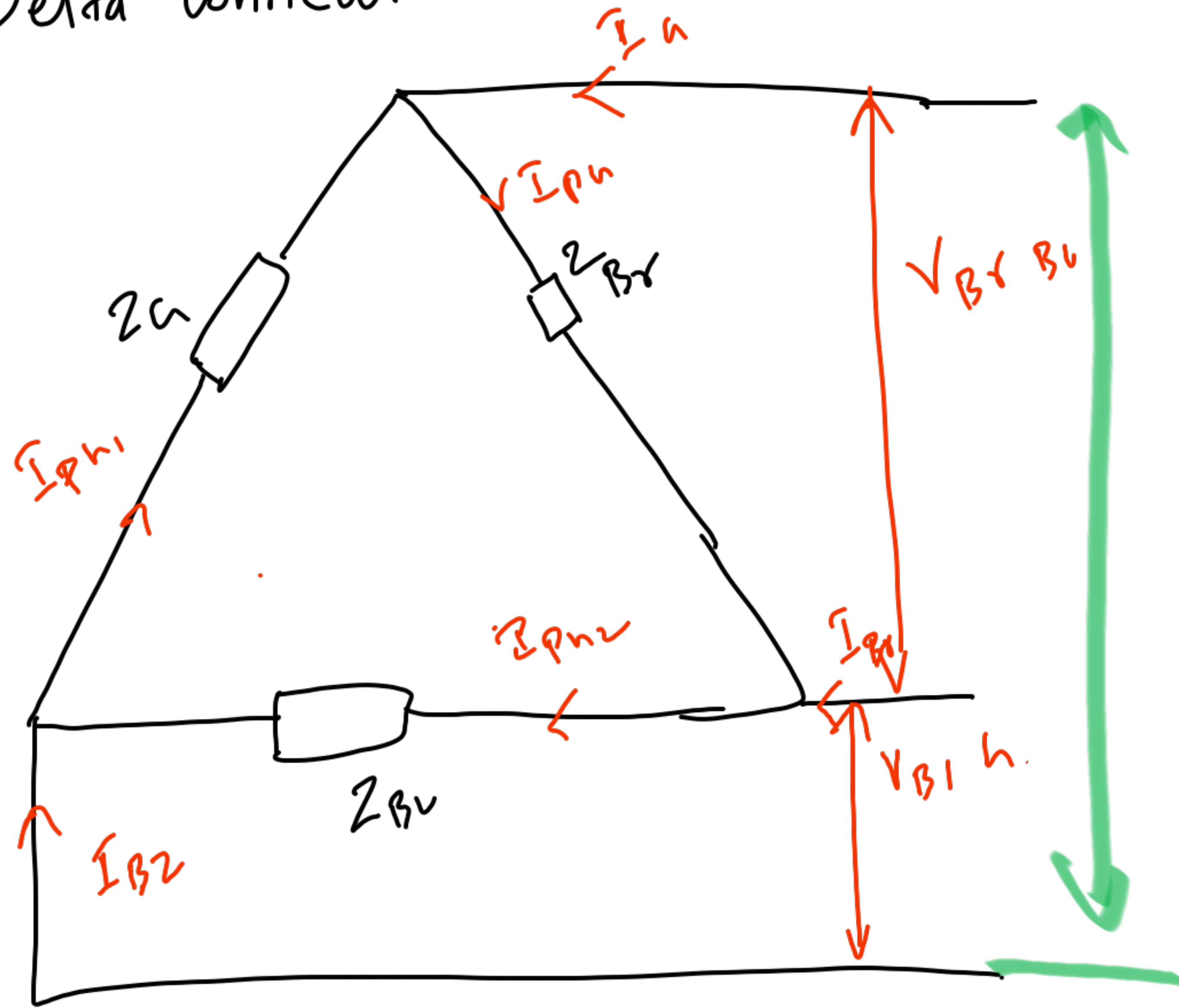
$V_{Br.B1}, V_{B1.G}, V_{G.Br}$

(V_L - Voltage)

$$V_L = \sqrt{3} V_p$$



Delta connect.



$$V_P = V_L$$

$$I_L = \sqrt{3} I_P$$

Power

$$P = \sqrt{3} V_L I_L \cos \phi$$

$$P = 3 I_p^2 R_p$$

$$Q = \sqrt{3} V_L I_L \sin \phi$$

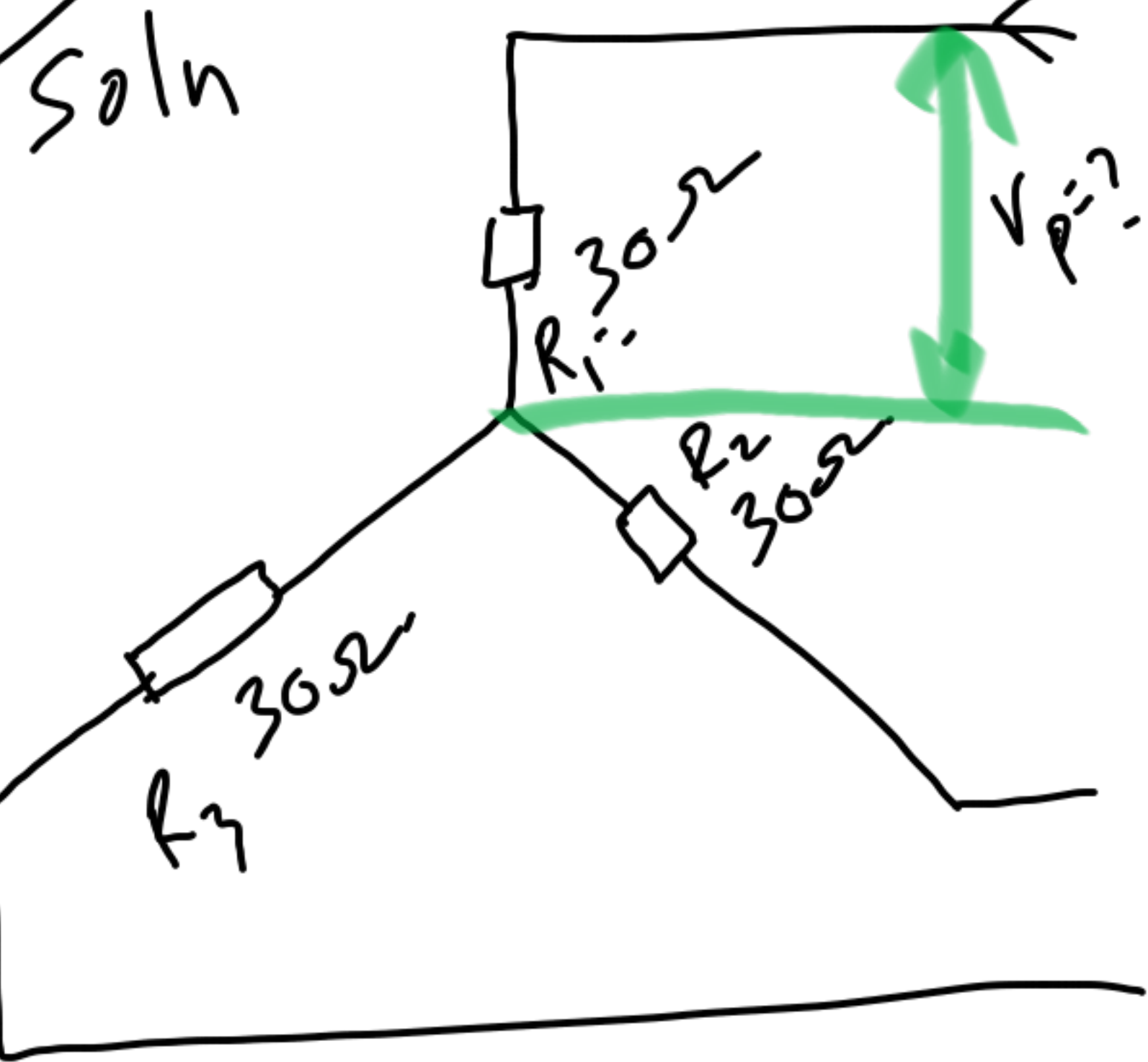
$$S = \sqrt{3} V_L I_L$$

2) Three loads each of Resistance 30Ω is connected in star to a three phase $400V$ supply. Calculate the following.

a) System phase Voltage

b) phase current

c) Line Current.



$$R = Z = 30 \Omega.$$

$$V_L = 400 \text{ V}$$

a) System phase voltage

$$V_p = \frac{V_L}{\sqrt{3}} = \frac{400}{\sqrt{3}}$$

$$V_p = 230 \text{ V}$$

b) phase current

$$\hat{I}_p = \hat{I}_L$$

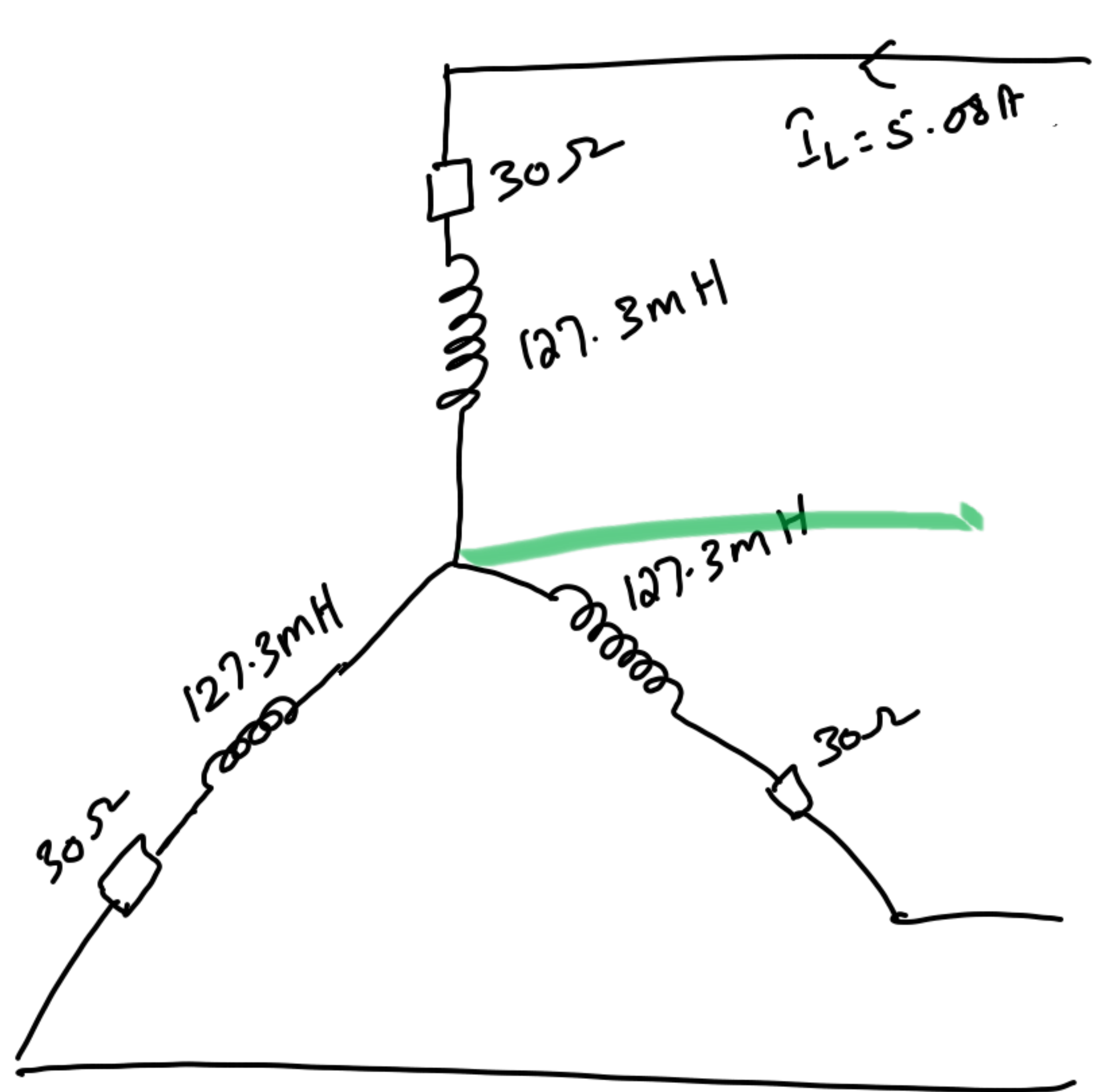
$$\hat{I}_p = \frac{V_p}{R_p} = \frac{230}{30} = 7.69 \text{ A}$$

c) line current

$$\hat{I}_L = \hat{I}_p = 7.69 \text{ A}$$

2) A star connected network consist of three identical coils each of resistance 30Ω and inductance 127.3mH . If the line current is 5.08A and the supply frequency is 50Hz . Calculate the line voltage.

Soln..



$$X_L = 2\pi fL$$

$$= 2\pi \times 50 \times 127.3 \times 10^{-3}$$

$$X_L = 40 \Omega$$

$$Z = \sqrt{R^2 + X_L^2}$$

$$= \sqrt{30^2 + 40^2}$$

$$Z = 50 \Omega$$

$$I_L = I_P = 5.08 A$$

$$V_P = I_P \cdot Z$$

$$= 5.08 \times 50$$

$$V_P = 254 V$$

$$V_L = \sqrt{3} V_P$$

$$= \sqrt{3} \times 254$$

$$V_L = 440 V$$

3) A balanced three wire
Star connected, three phase
has a phase voltage of 240V
a line current of 5A and a lagging
power factor of 0.966. Draw the
complete phasor diagram.

Star.

V_L, V_P, I_L, ϕ



Given, $I_L = 5A$
 $V_P = 240V$

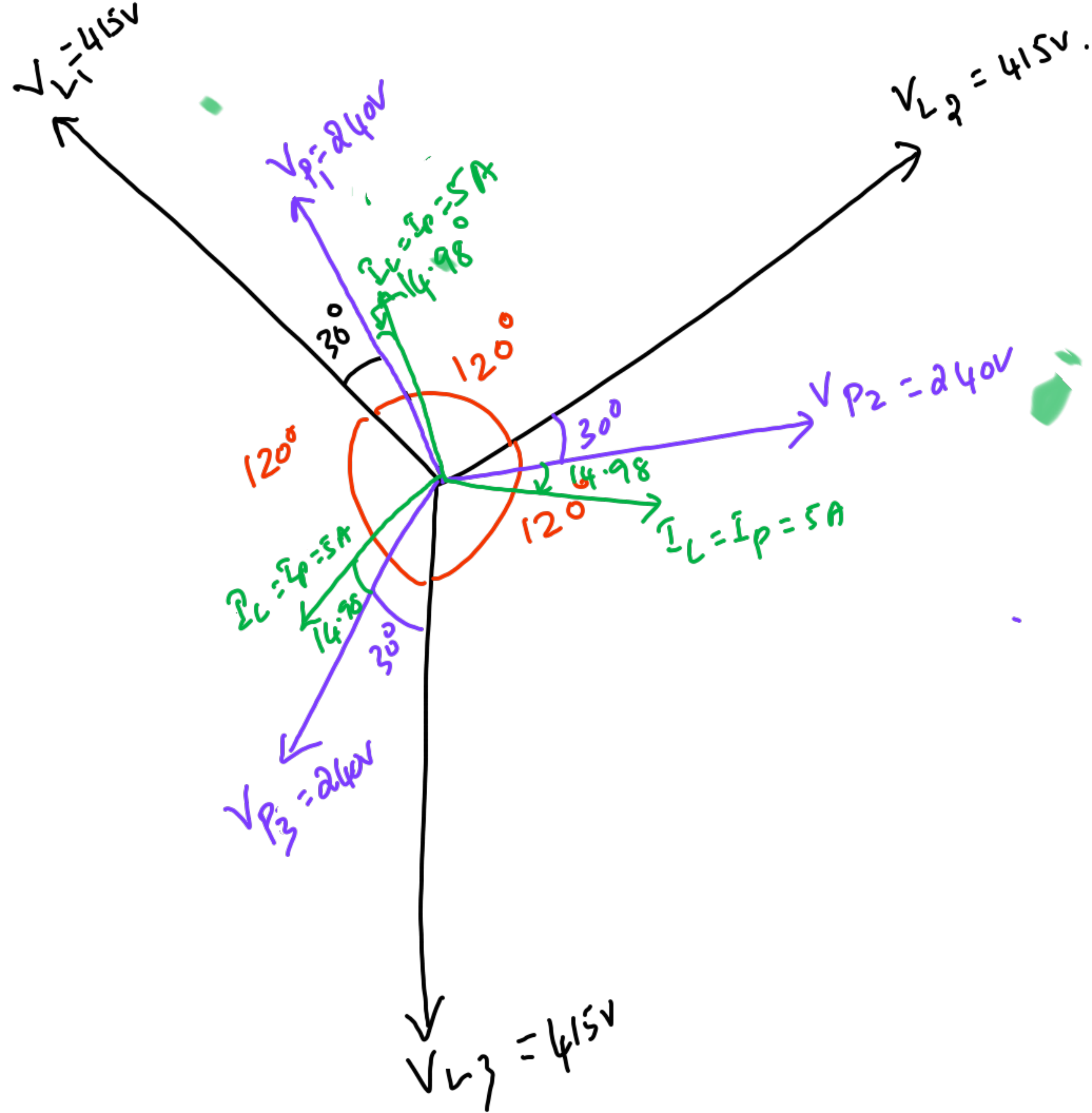
$$V_L = \sqrt{3} \times 240V$$

$$V_L = 415V$$

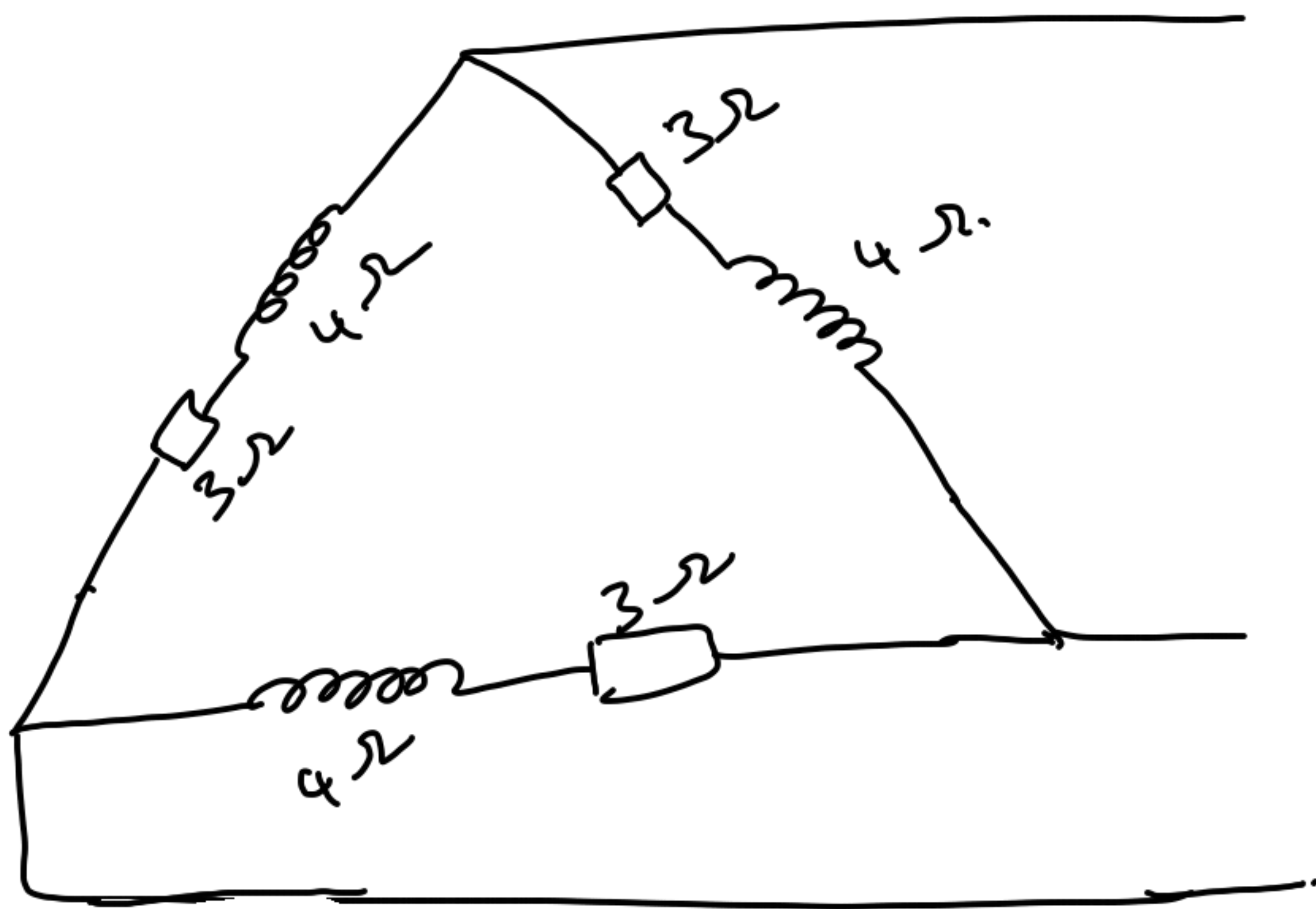
$$PF = \cos \phi = 0.966$$

$$\phi = \cos^{-1}(0.966)$$

$$\phi = 14.98^\circ \text{ (lagging)}$$



- 4) Three coils each having resistance 3Ω and inductive reactance 4Ω are connected in delta to a $415V$, three phase supply. Calculate the following
- line voltage and phase voltage
 - phase current and line current.



$$X_L = 4\Omega, R = 3\Omega.$$

$$Z = \sqrt{4^2 + 3^2}$$

$$Z = 5\Omega$$

$$V_L = 415\text{V}.$$

For delta connection.

$$V_L = V_P = 415\text{V}$$

$$b) \hat{I}_P = \frac{V_P}{Z} = \frac{415}{5}$$

$$\hat{I}_P = 83\text{A}$$

$$\hat{I}_L = \sqrt{3} \hat{I}_P$$

$$\hat{I}_L = 143.76\text{A}$$

5) Three 12Ω Resistors are connected in star to a $415V$ three phase supply. Calculate the power dissipated by the resistors.

Soln.

$$P = ?$$

$$P = \sqrt{3} V_L I_L \cos \phi$$

$$V_L = 415V$$

$$R = Z = 12\Omega$$

$$V_P = \frac{V_L}{\sqrt{3}}$$

$$V_P = \frac{415}{\sqrt{3}}$$

$$V_P = 240V$$

$$I_P = \frac{V_P}{Z} = \frac{240}{12}$$

$$I_P = 20A$$

$$I_L = I_P = 20A$$

As, Resistive load.

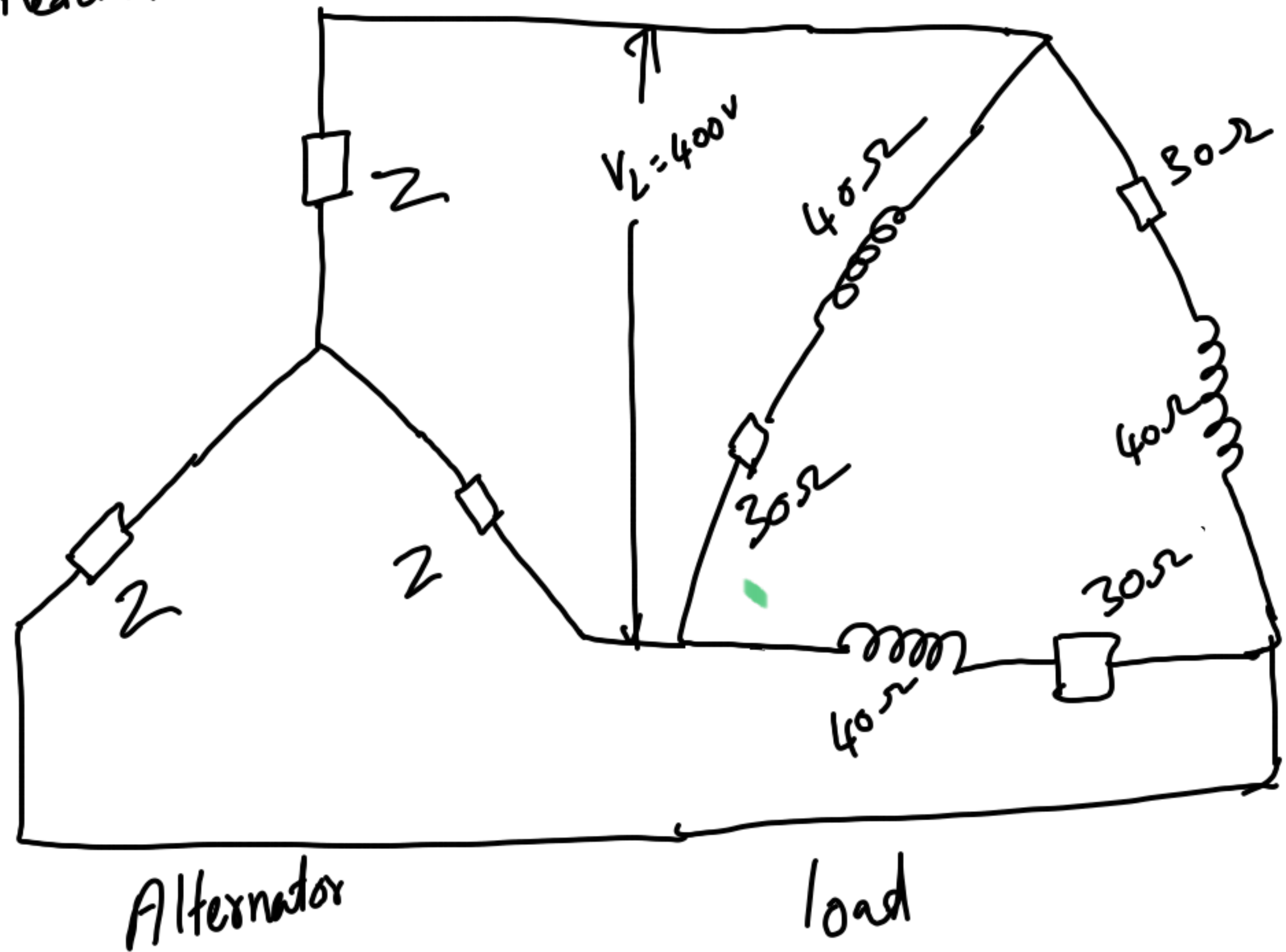
$$\cos \phi = 1$$

$$P = \sqrt{3} \times 415 \times 20 \times 1$$

$$P = 14.37kW$$

6) A 400V, Three-phase Star connected alternator Supplies a delta Connected load. each phase of which has a resistance of 30Ω and inductive Reactance 40Ω . Calculate

- Current Supplied by the alternator
- Output power and the kVA of the alternator (neglecting the losses in line between the alternator and load)



$$R = 30 \Omega$$

$$X_L = 40 \Omega$$

$$Z = \sqrt{R^2 + X_L^2}$$

$$Z = 50 \Omega$$

For delta connectn.

$$V_L = V_p = 400 \text{ V}$$

$$I_p = \frac{V_p}{Z} = \frac{400}{50}$$

$$I_p = 8 \text{ A}$$

$$\begin{aligned} a) \quad I_L &= \sqrt{3} I_p \\ &= \sqrt{3} \times 8 \\ I_L &= 13.86 \text{ A} \end{aligned}$$

b) Power,

$$P = \sqrt{3} I_L V_L \cos \phi$$

$$\cos \phi = \frac{R}{Z} = \frac{30}{50}$$

$$\cos \phi = 0.6$$

$$P = \sqrt{3} \times 13.86 \times 400 \times 0.6$$

$$P = 5.76 \text{ kW}$$

Apparent power-

$$S = \sqrt{3} V_L I_L$$

$$= \sqrt{3} \times 400 \times 13.86$$

$$S = 9.6 \text{ KVA}$$

<u>PFC</u>	P.F	ϕ
5 μ F		
10 μ F		
15 μ F		
20 μ F		
25 μ F		
30 μ F		
35 μ F		

$$C \quad V_s \quad \phi \quad \checkmark$$

$$L = P-F \quad \checkmark$$

$$\phi = \frac{t}{T} \times 360^\circ$$

$\cos \phi$

RL $\rightarrow$ Circuit. ✓

RL $\rightarrow$ o/p graph. ✓

RL-C - Circuit (PFC) ✓

RL-C $\rightarrow$ o/p graph. ✓

Phasor diagram.

$\rightarrow$ 50 Hz ✓

$\rightarrow$ Resonance ✓

$\rightarrow$ below 25 Hz (Resonance) ✓

$\rightarrow$ above 25 Hz (Resonance) ✓

Table.

C	P.F	ϕ
$\cos \phi$	$\phi = \frac{t}{T} \times 360^\circ$	

C, P.F $\rightarrow$ Graph ✓

C, ϕ $\rightarrow$ graph. ✓

Expt.

RL-C.