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Rangkaian Perhitungan Daya AC dan Kompensasinya
(Tugas Pengganti WORKSHOP RPP).

No	V (volt)	$I_1=I_2$ (A)	R (Ω)	L (H)	I_1 (A)	I_2 (A)	I_3 (A)	$\cos \phi_2$
1	220	0,41	963	3,92	0,75	0,41	0,35	0,3
2	200	0,45	800	3,24	0,76	0,45	0,31	0,33
3	180	0,50	648	2,63	0,78	0,51	0,28	0,36
4	160	0,56	512	2,08	0,81	0,56	0,25	0,39
5	140	0,64	392	1,59	0,86	0,64	0,22	0,42
6	120	0,74	288	1,17	0,93	0,74	0,19	0,45
S_{off} (tanpa C)					S_{on} (dgn C) . Kompensasi			

Diket :

$$P = 50W$$

$$\cos \phi_1 = 0,56$$

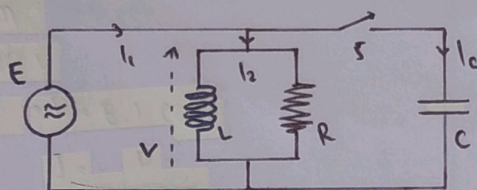
$$C = 5 \cdot 10^{-6} F$$

$$f = 50 Hz$$

$$X_C = \frac{1}{2\pi f \cdot C}$$

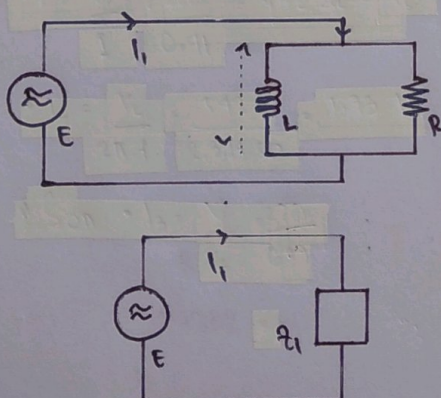
$$= \frac{1}{2\pi \cdot 50 \cdot 5 \cdot 10^{-6}}$$

$$= 637 \Omega$$

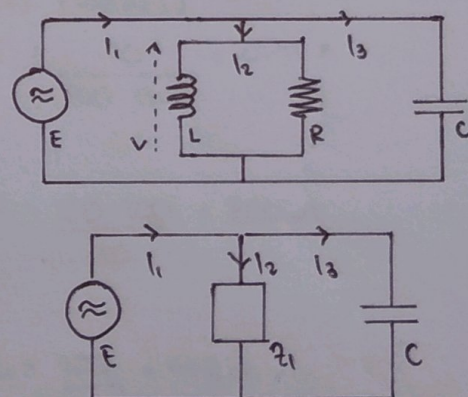


Gambar Rangkaian.

Rangkaian S_{off} (tanpa C).



Rangkaian S_{on} (dengan C)



$$1. V = E = V_R = V_L = V_C = 220 \text{ volt}$$

* S_{off} (tanpa C) :

$$\rightarrow P = E \cdot I \cdot \cos \phi$$

$$I = \frac{P}{E \cdot \cos \phi}$$

$$= \frac{50}{220 \cdot 0,56}$$

$$= 0,41 \text{ A}$$

$$\rightarrow P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

$$= \frac{220 \cdot 220}{50}$$

$$= 968 \, \Omega$$

$$\rightarrow Z_1 = \frac{V}{I}$$

$$= \frac{220}{0,41}$$

$$= 542 \, \Omega$$

$$\bullet \frac{1}{Z_1} = \frac{1}{R} + \frac{1}{X_L}$$

$$X_L = \frac{Z_1 \cdot R}{R - Z_1}$$

$$= \frac{542 \cdot 968}{968 - 542}$$

$$= 1232 \, \Omega$$

$$\bullet X_L = \omega \cdot L$$

$$L = \frac{X_L}{2\pi \cdot f}$$

$$= \frac{1232}{2 \cdot 3,14 \cdot 50}$$

$$= 3,92 \text{ H}$$

* S_{on} (dengan C)

$$\rightarrow I_2 = \frac{V}{Z_1}$$

$$= \frac{220}{542 \, \Omega}$$

$$= 0,41 \text{ A}$$

$$\rightarrow I_3 = \frac{V}{X_C}$$

$$= \frac{220}{637}$$

$$= 0,35 \text{ A}$$

$$\rightarrow I_1 = I_2 + I_3$$

$$= 0,41 + 0,35 = 0,76 \text{ A}$$

$$\rightarrow P = E \cdot I_1 \cdot \cos \phi_2$$

$$\cos \phi_2 = \frac{P}{E \cdot I_1}$$

$$= \frac{50}{220 \cdot 0,76}$$

$$= 0,3$$

$$2. V = E = V_R = V_L = V_C = 200 \text{ volt}$$

* S_{off} (tanpa C)

$$\rightarrow I = \frac{50}{200 \cdot 0,56} = 0,45 \text{ A}$$

$$\rightarrow R = \frac{200 \cdot 200}{50} = 800 \, \Omega$$

$$\rightarrow Z_1 = \frac{200}{0,45} = 448 \, \Omega$$

$$\bullet X_L = \frac{448 \cdot 800}{800 - 448} = 1018 \, \Omega$$

$$\bullet L = \frac{1018}{2 \cdot 3,14 \cdot 50} = 3,29 \text{ H}$$

$$V = E = V_R = V_L = V_C = 200 \text{ volt}$$

* S_{on} (dengan C)

$$\rightarrow I_2 = \frac{200}{448} = 0,45 \text{ A}$$

$$\rightarrow I_3 = \frac{200}{637} = 0,31 \text{ A}$$

$$\rightarrow I_1 = 0,45 + 0,31 = 0,76 \text{ A}$$

$$\rightarrow \cos \phi_2 = \frac{50}{200 \cdot 0,76} = 0,33$$

$$3. V = E = V_R = V_L = V_C = 180 \text{ volt}$$

* S_{off} (tanpa C)

$$\rightarrow I = \frac{50}{180 \cdot 0,56} = 0,5 \text{ A}$$

$$\rightarrow R = \frac{180 \cdot 180}{50} = 648$$

$$\rightarrow Z_1 = \frac{180}{0,5} = 363 \Omega$$

$$\bullet X_L = \frac{363 \cdot 648}{648 - 363} = 825 \Omega$$

$$\bullet L = \frac{825}{2 \cdot 3,14 \cdot 50} = 2,63 \text{ H}$$

* S_{on} (dengan C)

$$\rightarrow I_2 = \frac{180}{363} = 0,5 \text{ A}$$

$$\rightarrow I_3 = \frac{180}{637} = 0,28 \text{ A}$$

$$\rightarrow I_1 = 0,5 + 0,28 = 0,78 \text{ A}$$

$$\rightarrow \cos \phi_2 = \frac{50}{180 \cdot 0,5} = 0,36$$

$$4. V = E = V_R = V_L = V_C = 160 \text{ volt}$$

* S_{off} (tanpa C)

$$\rightarrow I = \frac{50}{160 \cdot 0,56} = 0,56 \text{ A}$$

$$\rightarrow R = \frac{160 \cdot 160}{50} = 512 \Omega$$

$$\rightarrow Z_1 = \frac{160}{0,56} = 287 \Omega$$

$$\bullet X_L = \frac{287 \cdot 512}{512 - 287} = 652 \Omega$$

$$\bullet L = \frac{652}{2 \cdot 3,14 \cdot 50} = 2,08 \text{ H}$$

* S_{on} (dengan C)

$$\rightarrow I_2 = \frac{160}{287} = 0,56 \text{ A}$$

$$\rightarrow I_3 = \frac{160}{637} = 0,25 \text{ A}$$

$$\rightarrow I_1 = 0,56 + 0,25 = 0,81 \text{ A}$$

$$\rightarrow \cos \phi_2 = \frac{50}{160 \cdot 0,81} = 0,39$$

$$5. V = E = V_R = V_L = V_C = 140 \text{ volt}$$

* S_{off} (tanpa C)

$$\rightarrow I = \frac{50}{140 \cdot 0,56} = 0,64 \text{ A}$$

$$\rightarrow R = \frac{140 \cdot 140}{50} = 392 \Omega$$

$$\rightarrow Z_1 = \frac{140}{0,64} = 220 \Omega$$

$$V = E = V_R = V_L = V_C = 140 \text{ volt}$$

$$\bullet X_L = \frac{220 \cdot 392}{392 - 220} = 499 \, \Omega$$

$$\bullet L = \frac{499}{2 \cdot 3,14 \cdot 50} = 1,59 \text{ H}$$

* S_{off} (dengan C)

$$\rightarrow I_2 = \frac{140}{220} = 0,64 \text{ A}$$

$$\rightarrow I_3 = \frac{140}{637} = 0,22 \text{ A}$$

$$\rightarrow I_1 = 0,64 + 0,22 = 0,86 \text{ A}$$

$$\rightarrow \cos \phi_2 = \frac{50}{140 \cdot 0,86} = 0,42$$

6. $V = E = V_R = V_L = V_C = 120 \text{ volt}$

* S_{off} (tanpa C)

$$\rightarrow I = \frac{50}{120 \cdot 0,56} = 0,74 \text{ A}$$

$$\rightarrow R = \frac{120 \cdot 120}{50} = 288 \, \Omega$$

$$\rightarrow Z_1 = \frac{120}{0,74} = 161 \, \Omega$$

$$\bullet X_L = \frac{161 \cdot 288}{288 - 161} = 367 \, \Omega$$

$$\bullet L = \frac{367}{2 \cdot 3,14 \cdot 50} = 1,17 \text{ H}$$

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* S_{off} (dengan C)

$$\rightarrow I_2 = \frac{120}{161} = 0,74 \text{ A}$$

$$\rightarrow I_3 = \frac{120}{637} = 0,19 \text{ A}$$

$$\rightarrow I_1 = 0,74 + 0,19 = 0,93 \text{ A}$$

$$\rightarrow \cos \phi_2 = \frac{50}{120 \cdot 0,93} = 0,45$$