EE 3PI4
Lab 1
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A. Measuring Starting Current

Machine ratings

$P_{rated} = 0.37kW$

$f_{rated} = 60Hz$

$N_{rated} = 1650\ 1/min$

$U = 208/360V$

$IP: 20$

$I = 1.8/1.05A$

$cos = 0.76$

Rated Torque Calculation

$$\tau_{rated} = \frac{P_{rated}}{\omega_{rated}}$$

$$\omega_{rated} = \frac{N_{rated}}{60} \cdot 2\pi = \frac{1650}{60} \cdot 2\pi = 55\pi\ \frac{rad}{s}$$

$$\tau_{rated} = \frac{P_{rated}}{\omega_{rated}} = \frac{0.37kW}{55\pi\frac{rad}{s}} = \frac{370W}{55\pi\frac{rad}{s}} = 2.14Nm$$

Δ *Connection*

Torque (Nm)	0	0.20	0.41	0.61	0.82
Rotation Speed (rpm)	1792	1779	1769	1758	1746
Line Voltage (V)	208.7	208.7	209	208.9	208.3
Line Current (A)	0.74	0.77	0.81	0.88	0.95

Y Connection

Torque (Nm)	0	0.20	0.41	0.61	0.82
Rotation Speed (rpm)	1768	1735	1693	1640	1561
Line Voltage (V)	120.6	120.9	120.9	120.8	120.8
Line Current (A)	0.26	0.34	0.45	0.59	0.78
Phase Power (W)	16.9	29.9	44.4	60.6	79.9
Power Factor Cosθ	0.528	0.724	0.812	0.845	0.848

C. Reactive Power Compensation

***2**μF*

Torque (Nm)	0	0.20	0.41	0.61	0.82
N (rpm)	1772	1736	1695	1644	1564
I_{phase} (A)	0.18	0.28	0.40	0.54	0.72
P_{phase} (W)	14.6	28.5	43.1	59.3	78.5
Cos(θ)	0.667	0.85	0.9	0.91	0.899

***8**μF*

Torque (Nm)	0	0.20	0.41	0.61	0.82
N (rpm)	1773	1736	1695	1642	1563
I_{phase} (A)	0.2	0.28	0.38	0.5	0.66
P_{phase} (W)	14.3	29	43.4	59.5	78.6
Cos(θ)	0.575	0.838	0.939	0.98	0.989

Question

When comparing all 3 scenarios, we can see that the power factors seen in the 2μ*F* is larger than the power factors seen in the case without any capacitors. The case with 8μ*F* capacitors have a larger power factor than both of the previous cases. This is because we are introducing more capacitance into the system. This increased capacitance counteracts the primarily inductive loads in the system, thus reducing apparent power in the system, but keeping the real power the same. This means that the system has a much higher concentration of usable power, thus increasing the power factor. The picture below shows us how the power triangle changes with capacitive loads. Since Power factor = P/S, we can see that keeping P the same and lowering S will increase the power factor