Example- For an AC motor, we measure the line voltage to be 120 V_{RMS} and the line current to be 12 A_{RMS} using a multimeter while the power is measured to be 1150 W using a wattmeter. Determine the apparent power, power factor, complex power, reactive power, and load impedance. [Hint: Motors are resistive-inductive loads.]

Apparent Power $S = V_{rms} I_{rms} = 120(12)$

$$S = 1440 \text{ VA}$$

Power Factor $pf = \frac{P}{S} = \frac{1150}{1440} = 0.7986$ lagging

↑ Resistive – inductive

$\theta_v - \theta_i = \theta_z = \theta_s = \cos^{-1}(pf) = \cos^{-1}(0.7986)$

$$\theta_z = \theta_s = +37.002^\circ$$

Complex Power $\bar{S} = S\angle\theta_s = 1440\angle 37.002^\circ \text{ VA}$

$$\bar{S} = 1150 + j\,866.66 \text{ VA}$$

Reactive Power $Q = Im(\bar{S}) = 866.66 \text{ VAR}$

$Z_L = \frac{V}{I} = \frac{120}{12} = 10\,\Omega$ ← Magnitude of impedance

$\bar{Z}_L = Z_L\angle\theta_z = 10\angle 37.002^\circ\,\Omega = 7.986 + j\,6.018\,\Omega$