AC POWER

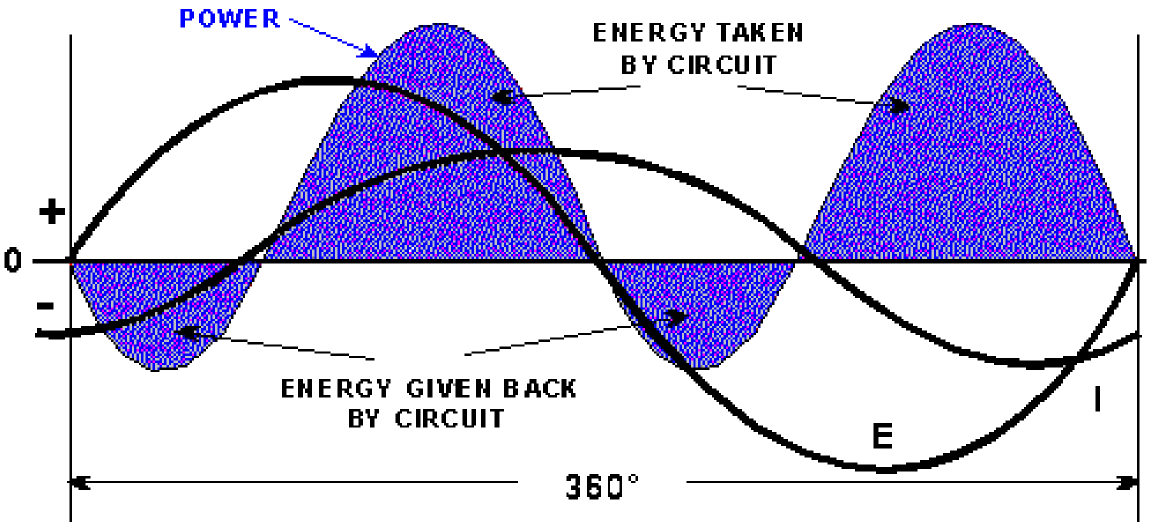

Figure C. Power Cycle with an Inductive Device

The AC power drawn from the source (e.g. line - 120VAC @ 60Hz 220VAC @ 50Hz) is the integral over one cycle of the instantaneous watts values. As shown in figure C, during a portion of each cycle power is used by the inductive device (e.g. electric motor), while during other portions of the line cycle, power is actually given back by the inductive device. The portion of the cycle where power is given back by the inductive device is called "negative power. In sinusoidal applications, Power = EI cos Ø can be seen in figure C above to reflect the true watts during a complete line cycle (360°).

Power Factor, Real Power and Apparent Power

Apparent Power is the product of the rms voltage times rms current that is:

$$\text{Apparent Power} = E_{rms} I_{rms} \qquad \text{also called (VA)}$$

The single phase (Ø) power factor of a load is a ratio of real or true power (*EI* cos Ø) to the apparent power (*EI* or volt-amperes). In sinusoidal applications, power factor is related to the phase angle between voltage and current as:

$$\text{Power Factor (PF)} = \frac{\text{True Watts}}{\text{Volts} \times \text{Amps}} = \frac{EI \cos\theta}{EI} = \cos\theta$$

As shown above Power Factor is the ratio of real power to apparent power. Apparent Power is the product of E_{rms} times I_{rms}.

$$\text{PowerFactor(PF)} = \frac{E_{fundamental}}{E_{rms}} \times \frac{I_{fundamental}}{I_{rms}} \times \cos\theta$$

Power Factor Discussion

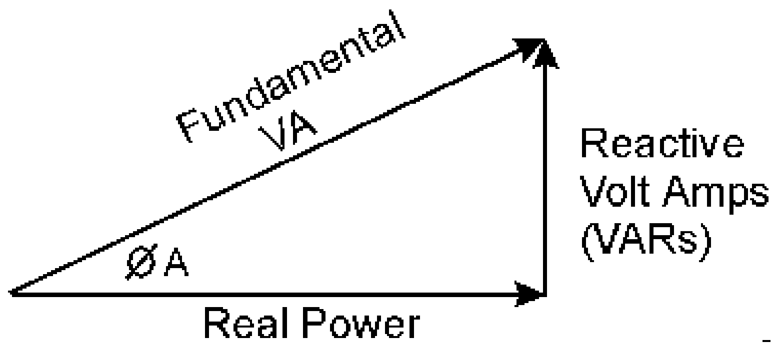

Figure A.

The figure A above shows the pythagorean vector relationship real power shares with apparent power(VA) and reactive power (VARs).

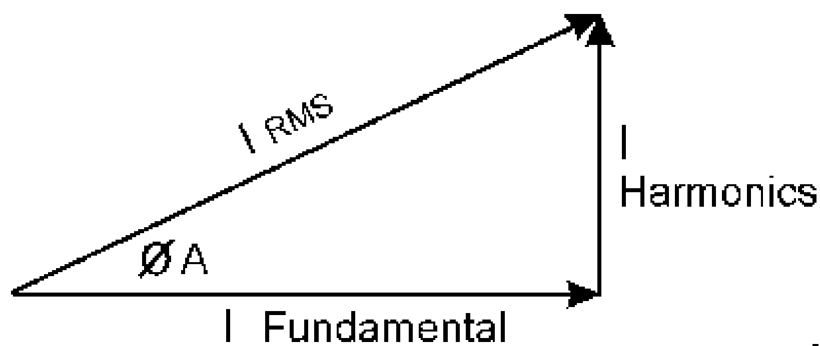

Figure B.

The figure B above shows the pythagorean relationship a distorted current waveforms rms level shares with its fundamental frequency component and its total harmonic content

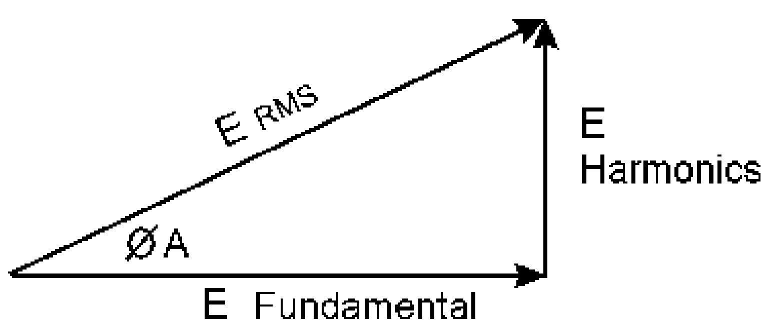

Figure C.

Figure C above shows the similar relationship (like figure B) a distorted voltage waveform shares with its fundamental frequency component and its total harmonic content

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