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# A CRASH COURSE IN POWER QUALITY

*TESCO's Meter School*

**TESCOOL** ▶▶

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3:45 PM – 4:30 PM

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# WHAT IS “POWER QUALITY”?

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- Power Quality refers to how well the Voltage, Frequency & Waveform match the established specifications.
- It can refer to compatibility load to the source.
- It can also used to describe how the utility customer feels their needs are being met



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# WHY IS IT IMPORTANT?

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- Poor Power Quality is expensive!

Damaged Equipment

Unplanned Downtime

Out of spec product

Danger to personnel (elevator, fires etc.)

Environmental Hazards



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# WHERE DOES POOR PQ COME FROM?

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- Utility Transformer

You can start here

- Wiring inside the customer's house or building

We have all see wiring that is more reminiscent of a bird's nest than professional, modern wiring.

- Devices/Equipment inside the building

Variable speed drives, computers, high-tech loads, and other internal loads cause disturbances & harmonics



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# KEY AREAS OF FOCUS

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- Sags
- Swells
- Harmonics
- Flicker
- Transients
- Grounding

- a.k.a. Surges
- A temporary increase in voltage which lasts several cycles(1/2 cycle to 1 minute duration)
- Caused by sudden changes in load or when a fault is cleared

- A temporary reduction in voltage.
- Caused by an abrupt increase in load or a failure of utility equipment

- Harmonics are defined as Sinusoidal Voltages or Currents having frequencies that are integer multiples of the frequency (fundamental frequency = 60 Hz for NA) at which the supply system is designed to operate
- Results in a distorted Waveform
- Caused by VFD's, Switching Power Supplies & Damaged Equipment



## Negative Sequence Harmonics

- 5th, 11th, 17th, etc. are important to industrial environments
- They are caused by electronically controlled motors.
- Negative sequence harmonics counteract electrical power systems. (They make motors run backwards).
- These cause motor overheating and failure.

## Zero Sequence & Triplen Harmonics

- Caused by computers and electronic equipment
- 3rd, 9th, 15th, etc. (div. by 3) are important to commercial environments.
- Triplen Harmonics cause a disruption in the balance of a 3-phase system and cause unusually high neutral current and causes overheating

## Harmonic THD or Total Harmonic Distortion

- Caused by computers and electronic equipment
- IEEE provides guidelines for acceptable harmonic current and voltage distortion levels.
- IEEE Standard 519-1992 states that THD for critical motors should be less than 5% Voltage THD & 20% Current THD
- Triplen Harmonics cause a disruption in the balance of a 3-phase system and cause unusually high neutral current and causes overheating

- A momentary or sustained fluctuation of Voltage that causes lighting to “Flicker”
- Short Term Flicker(PST) is measured over 10 minutes
- Long Term Flicker(PLT) is measured over 2 hours
- Can cause vision trouble, headaches, annoyance & distraction
- Mitigation focuses on reducing the amplitude of the voltage fluctuations

- Sudden brief fluctuations of voltage or current lasting only milliseconds
- Caused by lightning, switching operations or faults
- Typically corrected by surge suppressors



# GROUNDING & BONDING

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- Grounding is not a problem
- Bonding is not a problem
- Lack of Grounding and/or Bonding is a Huge Problem!!
- Without proper Grounding & Bonding Measurement Results will be suspect & mitigation devices will not function properly
- Without proper Grounding & Bonding Safety will also be compromised as protection devices will not function properly



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# QUESTIONS AND DISCUSSION

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Contact me anytime:

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**THANK YOU!**