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Equipment Reliability
Enhancing Electrical Safety with Ultrasound

ue systems inc
The ultrasound approach

www.uesystems.com
Your Source for Ultrasonic Detection Equipment and Plant Reliability.
About UE Systems

  - 50 years experience with ULTRASOUND.

- Direct Corporate support in North America.
  - 15 Regional Offices in the US.
  - Regional Offices in Canada.
  - Regional Office in Mexico.
Understanding Electrical Inspection with Ultrasound

• What is Ultrasound Technology?
• What applications can Ultrasound be used for?
• What will ultrasound detect in electrical applications? (Corona, Tracking, Arcing, Partial Discharge)
• How to diagnose electrical problems with through ultrasound imaging.
How about you?

Are you using Ultrasound in daily inspections?
What is Ultrasound?

• Very simply, ultrasound instruments are listening devices.
• Listen for high frequency sound that is not heard in the audible range (human hearing)
• Instruments listen for & translate the high frequency sound into audible sound heard through the headset.
• New instruments listen & translate to a visual screen with a heat map.
What is Ultrasound?

- Ultrasonic range is 20kHz to 100kHz
- Normal human hearing is around 16kHz to 17kHz (upper range)
- Unit of measurement is a decibel (dB)
- Advantages:
  - Very directional
  - Easy to locate sources of ultrasound
  - We can hear ultrasounds above normal plant background noise
Ultrasound Applications

- Compressed air & gas leak detection
- Electrical inspections
  - Corona, Tracking, & Arcing
- Mechanical inspections
  - Bearings, pumps, motors, gearboxes, lubrication
- Steam traps
NFPA 70B Recommended Practice

Electrical Equipment Maintenance:
- CSA Z463 (Canadian equivalent)
- Defines an Electrical Preventive Maintenance Program (EPM)
- Mentions ultrasound in two sections:
  - Partial Discharge (PD)
  - Corona Discharge
Why we use Ultrasound

• Electrical inspection with Ultrasound.
  – Primarily a safety initiative
  – Used on low, medium, & high voltage systems
  – Quickness of scanning
  – We can scan and listen without opening energized electrical components
Electrical Inspection

- **Corona** - is a partial discharge into air from a sharp point at high potential. Corona discharges take place when the strength of the electric field is large enough to ionize the air.
Corona Causes

- Ionization forms ozone and nitrogen oxides. These combine with moisture and produce nitric acid.

- The nitric acid is destructive to most dielectrics and certain metallic compositions, resulting in: **Corrosion**
Electrical Inspection
(Tracking)

Effect: Undetected tracking reduced insulation value of the wire and can resulted in arcing.
Electrical Inspection
(Tracking/Arcing)

**Effect:** Corrosion deteriorated the insulation and can lead to catastrophic events.
Electrical Inspection

• **Best Practices:**
  – Infrared scans are typically done by an outside service provider annually, or semiannually.
  – In between annual infrared scans, use ultrasound to periodically listen for conditions.
  – Only relying on infrared increases the chances of missing conditions not detected by infrared.
  – The best method of diagnosing electrical issues with ultrasound is through the use of recorded ultrasounds.
Corona

- Ionization of air surrounding an electrical connection >1000 volts
- By-product of ionization is nitric acid
- Does not produce significant heat
Corona Time Wave

Note the difference with this one and the next slide.
Tracking Time Wave

Tracking

– Low current pathway to ground across an insulator
– Can be present at any voltage
Arcing

- High current pathway to ground across an insulator.
- Only the “bursts” of the electrical discharge are heard.
- Very distinct sudden starts and stops of the discharge.
Arcing Time Wave

Arcing Time Series
Advancements in Ultrasound

- Visual devices
- MEMS
- Beamforming technology
- AI software that indicates the issues and severity.
Conclusions

• Ultrasound is a very versatile instrument that has become a must have technology for plant equipment reliability.
• Advancements in software and instrumentation has allowed for increased safety & use of ultrasound on electrical components.
• Combining ultrasound & infrared together allows the inspector a greater opportunity to detect electrical anomalies before catastrophic failure thus averting unscheduled downtime.
Questions??

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