



Engineer Research and  
Development Center

# Meg-Alert: A Commercial Product for Remote Testing and Monitoring of Motors and Generators

## 2014 Lock Maintenance Workshop

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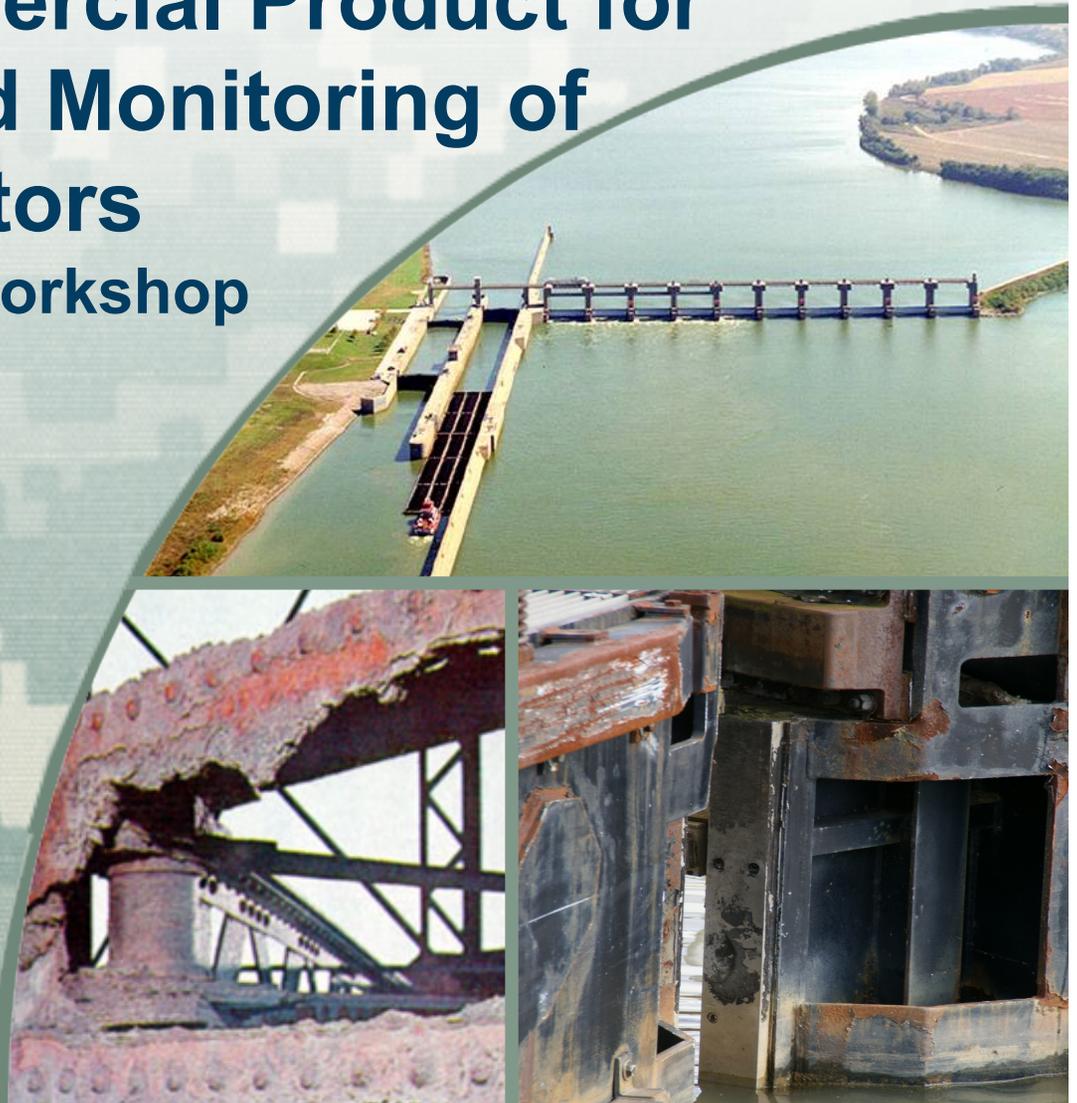
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US Army Corps  
of Engineers®



# Overview

- Why Motors and Generators Fail
- Meg-ohm Testing
- How Meg-Alert Products Work
- Benefits



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# Why Motors and Generators Fail

Direct Causes

Secondary Causes

Benefits of Early Detection

- **INSULATION Failure**
  - Begins immediately at first start-up
  - Self-Accelerating - Once it begins, it produces conditions (heat) that accelerate insulation breakdown.



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# Why Motors and Generators Fail

Direct Causes	Secondary Causes	Benefits of Early Detection
Chemical	Operating environment	
Dirt/Contaminants	Operating environment conditions Reduces heat loss and increases operating temperature	
Mechanical Stress	Shocks Loads / Frequent Starts / Surges Vibration / Mechanical Coil Movement	
Moisture	Condensation from Temperature Changes Environmental Conditions - high airborne moisture	
Over-voltage	System Peaks / Surges VFD Applications	
Thermal Breakdown*	Overload Operation / High Ambient Temperatures Dirt Contamination / Mechanical (bearings, etc.)	

\* IEEE Standard 43: For every 10 degrees C rise in temperature above nameplate operating temperature, life expectancy of the winding insulation is cut in half.



# Why Motors and Generators Fail

Direct Causes

Secondary Causes

Benefits of Early Detection

- Early detection of insulation deterioration is possible in every case.
- Requires frequent meg-ohm testing at full voltage.
- Reconditioning **SAVES 50%** of cost of rewinding or replacing motor
- **Increases safety** as emergency breakdown may be disastrous
- **Increases production time** depending on use of motor



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# Meg-ohm Testing

IEEE Standard 43

Types of Tests

- Meg-ohm testing is a reliable indicator of a motor's probability of failure upon startup
- Minimum requirements:

**$(\text{Operating Voltage} / 1000) + 1 = \text{Minimum Meg-ohms}$**

**Example:  $(480 \text{ volts} / 1000 + 1 = 1.48 \text{ Meg-ohms})$**



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# Meg-ohm Testing

IEEE Standard 43

Types of Tests

- Static cold resistance between windings & ground
- “Polarity index”:
  - 10 minute reading as motor cools down from operating temperature
  - Time required to return to normal is indicator of insulation degradation
  - Resistance should increase by a factor of 10-20 over 10 minute period
  - Slow speed recovery means motor failure is imminent



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# How Meg-Alert Products Work

Basic Operation

Output Options

Frequency of Testing

- Meg-Alert is a permanently installed meg-ohm tester
- Meg-Alert applies a current-limited DC voltage to the windings of the motor or generator whenever it is not operating
- Precisely measures leakage of current to ground
- Non-destructive
- No operational costs



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# How Meg-Alert Products Work

Basic Operation

Output Options

Frequency of Testing

- Alarm: Impending motor failure. Locks out starter; sends audio and visual signal
- Optional Pre-Alarm: Early signs of insulation deterioration detected. Sends visual signal; motor still operates
- Optional Transducer: Sends constant stream of digital data for analysis & trending

Alarm & Pre-Alarm settings are based on IEEE recommendations; set-points can be field adjusted.



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# How Meg-Alert Products Work

Basic Operation

Output Options

Frequency of Testing

- Meg-Alert uses 100% of available offline time to test and monitor the motor's insulation condition
- Constant-duty motors instantly utilize Meg-Alert devices when idle for maintenance, power failures, etc., conducting critical testing for insulation breakdown



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- Motor and generator manufacturers recommend meg-ohm testing on a regular and frequent basis.
- If testing is conducted per recommendations, Meg-Alert will yield immediate cost savings based on fully automatic and continuous testing.



Maintenance Time Savings

Repair/Replacement Savings

Emergency Breakdown Savings

## Additional Benefits:

- **Reliability**
- **Safety**
- **Continuous**
- **Predictive**



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No possibility of neglecting or forgetting this critically important maintenance procedure.

Eliminates the human factor (other duties, scheduling conflicts, communications breakdowns, forgetfulness).

Ensures a critical maintenance function is performed routinely.

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Maintenance Time Savings

Repair/Replacement Savings

Emergency Breakdown Savings

## Additional Benefits:

- Reliability
- **Safety**
- Continuous
- Predictive



Hands-off process increases safety.

No need for exposure to live current.

No safety issues due to emergency motor breakdowns.



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Maintenance Time Savings

Repair/Replacement Savings

Emergency Breakdown Savings

## Additional Benefits:

- Reliability
- Safety
- **Continuous** →
- Predictive



Eliminates the “snapshot” of testing done at a single point in time.

Constantly monitors the varying conditions (humidity, vibration, contaminants) that compromise winding insulation.



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Maintenance Time Savings

Repair/Replacement Savings

Emergency Breakdown Savings

## Additional Benefits:

- Reliability
- Safety
- Continuous
- **Predictive**



Meg-Alert provides a constant data stream of resistance measurements which can be logged and analyzed to spot aberrations and predict failure well in advance.



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- When insulation breakdown is detected in its early stages, the motor can be reconditioned (rather than rewound or replaced), saving up to 75% of new motor cost.
- Most motors cannot be rewound more than once.
- The Meg-Alert device provides very early warning of a motor or generator's impending failure.
- Downtime required for reconditioning and repairs can be scheduled more conveniently, and with less interruption to normal operations.
- Emergency unscheduled downtime is usually more expensive than scheduled downtime.



## Additional Benefits:

- **Start Up Surprises**



Continuous testing during downtime is particularly important for motors operating in extreme conditions.

Motors or generators that operate in extreme conditions with extended downtime are usually only activated during emergency situations, so an unexpected failure to operate can be doubly disastrous.



# U.S. Navy Users

- US Coast Guard
  - Great Lakes Ice Breaker
  - 14 Buoy Tenders
  - 26 WMEC Cutters
- US Navy
  - 7 USNS Vessels

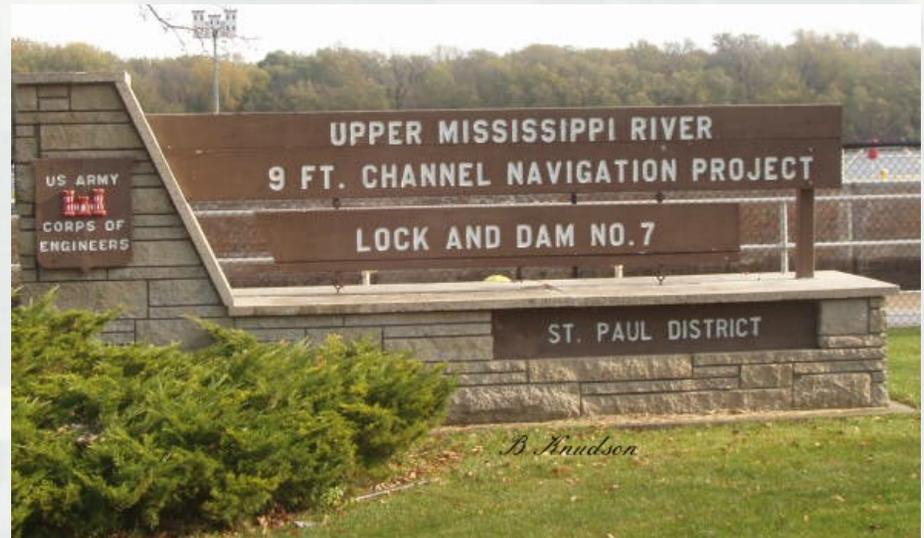


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“I purchased the Meg-Alert system in 2002, 10 years ago and I've never had a problem with it. We use the Meg-Alert system to protect the motors here at Lock and Dam No. 7 on the Mississippi River and the system has saved many motors from failing on start-up over that time. In addition to warning me if there is going to be a failure of a motor, the Meg-Alert also helps dry out the wet wiring. And because moisture is such a problem at a lock and dam, this is a great benefit. I would advocate that the Army Corps of Engineers install the Meg-Alert on all Locks and Dams nation-wide to allow for remote testing and monitoring of all critical motors and generators. With the amount of barge traffic we see in any given day, it is vital that we are always able to operate the lock and dam and that we are never shut down because of a motor problem. The Meg-Alert systems provide us that reliability!” - Bert Bateman



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Well, that leprechaun is ...!

# QUESTIONS



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