“Something For Nothing” Hits Pay Dirt!

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Is there really anything in life today that comes without a cost?

This presentation, along with the paper in the proceedings manual, discusses a recent case study highlighting the question

Occasionally, it really DOES pay to “go the extra mile”..........................even if you feel you shouldn’t because “it’s not included in the maintenance agreement inventory!”
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How often does one simply feel the need to:

• Get to the job site
• Get the job completed
• Do nothing more than expected as quickly as possible
• …and head to the house!
“Something For Nothing”
Hits Pay Dirt!

Everyone has a tendency to do this
It is human nature to try and do as little as possible and maximize return
Sometimes it works and others........
“Something For Nothing”
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Fortunately, this is certainly more the exception than the rule.

We deal with consummate professionals in our daily endeavors.

At least I am confident I do with our organization, and I am sure most would share this opinion.
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Advanced Electrical Testing and Preventative Maintenance ~ Canton, OH

Jerry Bennett  Jeff Hinton
The Facility

Kraft foods in Coshocton, Ohio
Major food manufacturer and processor
This plant was a bacon processor
Little margin for error, and no tolerance for unscheduled outages
Maintenance testing and servicing was secured in April 2008

Service commenced in early June 2008

Component inventory included 222 items for Infrared and Ultrasonic services

Deficiencies identified included 19 infrared class, 42 electrical class, and 1 ultrasonic class problem

A report was prepared for the customer and an analysis of the ultrasonic anomaly was in order…
This customer contact initially was not very receptive to the services being performed.

His perception to the methods were met with skepticism at best.

The individual accompanied Jerry and Jeff around the facility observing them apply the service with lukewarm support.

It would not be long however, this mindset would receive a notable alteration.
Scope and Application of Services

Interestingly, the ultrasonic deficiency was identified on a component NOT included with the inventory.

While on a mezzanine servicing a main distribution panel, there were two 12.47 KV switches and transformers nearby and similar to the illustration below.
The Identified Anomaly

Two identical switches and transformers are perfect for comparison testing methods.

Being the diligent technicians Jerry and Jeff have always been, they decided to “take a listen” with the ultrasonic probe on these higher voltage class switches.

After all, ultrasound is the ONLY option in this scenario as medium and high voltage equipment should NEVER be opened up under load for safety reasons.
The Identified Anomaly

It was immediately apparent to Jerry and Jeff what was observed was NOT identical in nature.

The technicians were “surprised” at what they heard, respective of competing ultrasound from the transformers, that manifested as additional components.

Two recordings were made of each switch…

Switch #1

Switch #2

(Click picture to play recording)
The Analysis

Jerry contacted me for assistance on the spectral analysis of the recordings.

The first switch FFT and Time Domain views are seen below as Normal (Little frequency peaks/content in FFT and few excursions in the time domain present over the broadband of “white noise”).
The Analysis

The second switch had as much as a difference in appearance as it did in the tonal qualities.

This is seen below:
The second switch had as much as a difference in appearance as it did in the tonal qualities. It is even more evident in the FFT when the Overlay feature is used (Red #1 and White #2):
The Analysis

It is clear that when comparing the two recordings side by side, the 60 Hz harmonics and the frequency content is far more predominant in the white trace than the red.

This is indicative of tracking or destructive corona.....
Now with confirmation there is in fact a detrimental situation within the switch, a course of action must be determined.

Only a shutdown of the equipment for a visual inspection and testing with a low resistance ohmmeter and insulation resistance meter can verify what is suspected.

A discussion is conducted with the facility management team recommending this shutdown.

All are in agreement and this is set for the upcoming 4th of July holiday time frame.
Showtime

All coordination in place, utility power is removed for the area of the plant containing the suspect disconnect switch.

Adherence to the 1910.147 section of the OSHA standard covering lockout and tag out requirements are implemented.

Once satisfied all items are isolated and residual energy has been removed work can commence.

Jerry and Jeff begin the inspection upon opening of the enclosure.
During the visual inspection, it became immediately clear that our suspicions were correct.

The first discovery was a white, powdery substance was present on the SRML, cotton jacket insulation of the conductors where they passed through the phase barrier, mica insulating boards and seen below.
This is one of the most common symptoms that corona has advanced into the destructive stage, released nitrates into the air, and mixed with the oxygen to form a nitric acid, thereby degrading the insulation.
Another view of the “as found” conductors
The obvious solution was to remove and replace the conductors as the damage was beyond repair.

Upon executing this task, it proved very difficult to remove the conductors from the mica board as swelling from heating effects increased the diameter. (See below for visual)
Additionally, the contacts of the switch were inspected and tested and they, too, revealed an issue.

Contact resistance measurements were not acceptable and it was clear as to why…
Exercising the switch, cleaning and lubrication is the recommended first step when something like this is discovered. This was performed with desirable results as the visual reinspection proved the contacts were properly seated and the verification measurement supported this as well.

The next step was to install the new conductors, properly terminate the connections, and verify good contact resistance prior to reenergizing.
The mica insulating boards were thoroughly cleaned to eliminate any path to ground in the future.

The new conductors from the load side of the switch to the pin bushing of the transformer were properly installed and verified as seen below.
Showtime

Panoramic view of the overall installation…
Results

Upon completion of the maintenance repairs, a coordinated effort was implemented to restore power to the facility.

The switch was put back into service and another inspection with airborne and contact ultrasound was conducted.

The results were unmistakable as the symptoms were no longer present and as Jerry said, “It was quiet as a church mouse!”
Summary

It was obvious the problem was identified, solved and remedied.

The facility manager’s at Kraft were relieved a failure was averted.

The initially “skeptical” customer contact has now become “best friends” with Jerry, Jeff and everyone at AET.

This no doubt proves that ALL possible tools, test equipment, and techniques should be used to determine if a problem exists.
Conclusion

PREVENTATIVE MAINTENANCE DOES HIT PAY DIRT!!!

QUESTIONS?