



– Site Verification – Protocols & Tools for Complex Metering Installations



Notes from the Field
Prepared by Tom Lawton, TESCO

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Premise

- Over much of the 20th century, utilities, regulators and customers each relied upon lab and field meter testing efforts which were primarily focused upon the accuracy of the watt-hour meter and demand register.
- This focus is now changing with overwhelming deployment of electronic meters and significant deployment of AMR and AMI meters throughout the installed base in North America.
- The focus has now shifted to the metering installation as a whole and not the accuracy of the meter.



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Field Testing

Common Features and Common Sources of Concern

Electro Mechanical meters were subject to registration errors caused by mechanical issues with moving parts resulting in either the loss of revenue to the utility or over billing for the customer. Some of the more common problems were:

- Friction wear
- Gear mesh misalignment
- Retarding magnet failure
- Timing motors



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Electronic Meters – new failure modes require new testing and inspection methods

Electronic meters fail as do electro mechanical meters but differently

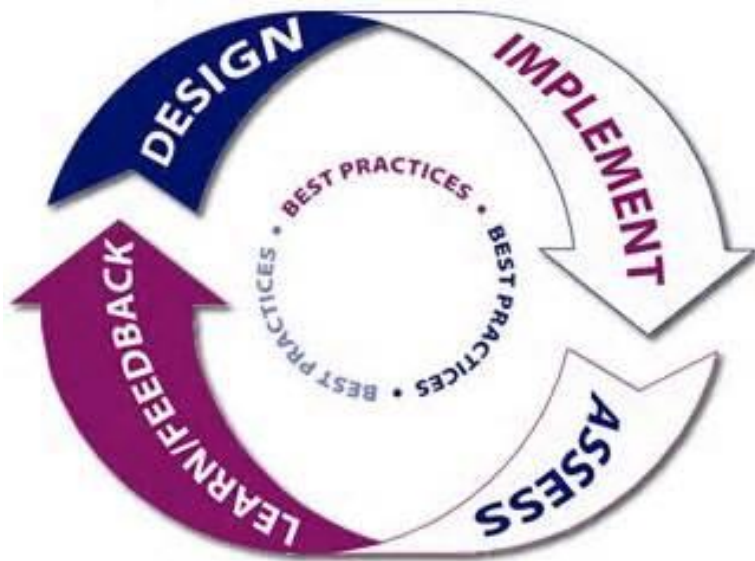
- Their overall life expectancy is not nearly the same
- Failure modes include drift (unexpected)
- Failure modes include catastrophic (expected)
- Failure modes include non-catastrophic but significant measurement error modes
- Failure modes can include non-measurement issues which render the meter ineffective or inaccurate for billing purposes.



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Best Practices

- Residential vs Commercial
- Self-Contained vs Transformer Rated
- Follow the money and be as proactive as possible



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Potential Site Check List

- Double check the meter number, the location the test result and the meter record
- Perform a visual safety inspection of the site. This includes utility and customer equipment. Things to look for include intact down ground on pole, properly attached enclosure, unwanted voltage on enclosure, proper trimming and site tidiness (absence of discarded seals, etc.)
- Visually inspect for energy diversions (intentional and not). This includes broken or missing wires, jumpers, open test switch, unconnected wires and foreign objects on meters or other metering equipment. Broken or missing wires can seriously cause the under measurement of energy. A simple broken wire on a CT or VT can cause the loss of 1/3 to 1/2 of the registration on either 3 element or 2 element metering, respectively.
- Visually check lightning arrestors and transformers for damage or leaks.
- Check for proper grounding and bonding of metering equipment. Poor grounding and bonding practices may result in inaccurate measurements that go undetected for long periods of time. Implementing a single point ground policy and practice can reduce or eliminate this type of issue.
- Burden test CTs and voltage check PTs.

Potential Site Check List (cont)

- Verify service voltage. Stuck regulator or seasonal capacitor can impact service voltage.
- Verify condition of metering control wire. This includes looking for cracks in insulation, broken wires, loose connections, etc.
- Compare the test switch wiring with the wiring at the CTs and VTs. Verify CTs and VTs not cross wired. Be sure CTs are grounded in one location (test switch) only.
- Check for bad test switch by examining voltage at the top and bottom of the switch. Also verify amps using amp probe on both sides of the test switch. Verify neutral connection to cabinet (voltage).
- Check rotation by closing in one phase at a time at the test switch and observing the phase meter for forward rotation. If forward rotation is not observed measurements may be significantly impacted as the phases are most likely cancelling each other out.
- Test meter for accuracy. Verify demand if applicable with observed load. If meter is performing compensation (line and/or transformer losses) the compensation should be verified either through direct testing at the site or by examining recorded pulse data.
- Loss compensation is generally a very small percentage of the overall measurement and would not be caught under utilities normal high/low checks. However, the small percentages when applied to large loads or generation can really add up overtime. Billing adjustments can easily be in the \$million range if not caught early.



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Potential Site Check List (cont)

- Verify metering vectors. Traditionally this has been done using instruments such as a circuit analyzer. Many solid state meters today can provide vector diagrams along with volt/amp/pf and values using meter manufacturer software or meter displays. Many of these desired values are programmed into the meters Alternate/Utility display. Examining these values can provide much information about the metering integrity. It may also assist in determining if unbalanced loads are present and if CTs are sized properly. The vendor software generally has the ability to capture both diagnostic and vector information electronically. These electronic records should be kept in the meter shop for future comparisons.
- If metering is providing pulses/EOI pulse to customers, SCADA systems or other meters for totalization they also should be verified vs. the known load on the meter.
- Verify meter information including meter multiplier (rework it), serial number, dials/decimals, Mp, Ke, Primary Kh, Kr and Rate. Errors in this type of information can also cause a adverse impact on measured/reported values.
- Verify CT shunts are all opened.



Shop Testing

- Accuracy Testing
- Meter Communications Performance
- Software & Firmware Verification
- Setting Verification
- Functional Testing
- Disconnect/Reconnect Functionality and as left setting



Testing Frequency & Cost



- Tools (hardware and software)
- Personnel
- Frequency
- Test
- Report
- Analyze
- Learn, Share, Adapt

Questions and Discussion



Tom Lawton

TESCO – The Eastern Specialty Company

Bristol, PA

215-688-0298 (cell)

1-800-762-8211

This presentation can also be found under Meter Conferences and Schools on the TESCO web site:

www.tesco-advent.com



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