



Customer Perceptions of New AMI Meters & What Meter Services Can do to Help or Hinder the Cause



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for the Mid-South Electric Metering Association 2014



Session Objectives

- Understand Customer concerns about Smart Meters and AMI
- Be able to respond as a Utility and as a Utility Worker



Customer Concerns

Real and perceived

- Health - new AMI meter's will kill my cat or make me sick
- Safety – new AMI meter's will burn down my house
- High Billing – new AMI meter is going to increase my bill
- Privacy - Big Brother is watching me



Health Concerns

- RF Emissions
- We sites and internet information and misinformation
- Cell Phones vs Meters
- Measuring RF





Safety Issues?

For the first time in our collective careers meters have been in the popular meter in an unflaterring way. Segments of the general population have the perception that;

- AMI Meters may spontaneously catch
- AMI Meters may blow up
- AMI Meters may disconnect power by themselves
- AMI meters are “cheap computers” and are not robust enough for long term outdoor use



What regulatory alternatives are out there?

When US Consumers think about electrical safety within their home they think about licensed electricians and inspectors for electrical work and the UL Mark for products used within their home.

- Customer: Why don't meters have a UL label?
Are the AMI meters safe?
- Utility: Are ANSI standards "tough" enough?
How good is the meter vendor testing?

"We have taken unprecedented steps to test our meters", said PECO President and CEO Craig Adams. "We are confident in the results of the scientific testing by independent experts. Based on our work, along with results of extensive independent testing, PECO has selected the Landis+Gyr (L+G) meter for use for our customers. And, UL (Underwriters Laboratories), a leading testing and certification company, has conducted safety performance tests using the UL safety requirements for utility meters and found that the L+G meter design we are using is fully compliant with these tests. We will continue to test and monitor our meters to ensure they meet the highest safety standards. Safety is always our top priority."

- Excerpt from PECO News Release October 9, 2012



UL Meter Safety Standard 2735

Currently a Draft Standard under review

Scope

All Type S and Type A electric meters rated up to 600 volts and any other type of meter intended for installation within the enclosure of “complete equipment”.

Contents

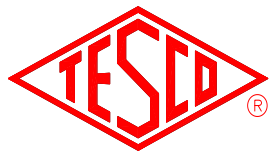
Meter Construction Requirements

Meter Performance

Meter Markings

Standards for Components





UL Meter Safety Standard 2735

Meter Construction Requirements

Meter forms as defined in ANSI C12.10 unless alternate forms are specified by a Utility

Enclosures

Covers

CT's, internal and external

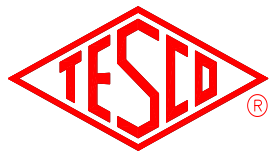
Batteries

Service Switches

Circuit Boards

UL recognized or tested components





UL Meter Safety Standard 2735

Meter Performance Tests

Tests for various fault conditions

How easy to set on fire



Strength of Construction



Some tests from ANSI C12.1 Section 4

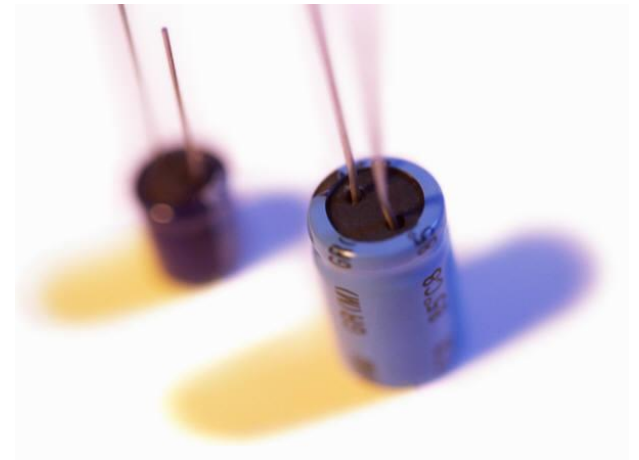


UL Meter Safety Standard 2735

Component Standards

UL Standards for many meter components will apply:

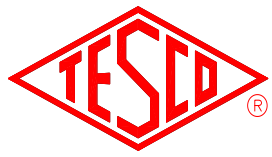
- Fuses
- Transformers
- Switches
- Terminal Blocks
- Connectors





Issues to Address

- UL is very interested in capitalizing on this opportunity to regulate electric meters – a market they have been excluded from in the past by the NFPA
- Draft Standard 2735 was issued without any prior notification to the ANSI C12 Main Committee despite assurances that UL would work with and participate with ANSI to avoid a Standard that contradicts the complementary ANSI standard
- Manufacturing cost for a meter would increase significantly – neither the manufacturer nor the end user are sure how much this cost increase will be or if the increase is warranted.



Challenges of Implementing a UL Standard

- Agreement on a common standard by UL and ANSI
- Meter vendor acceptance of the new standard
- Coordination of UL and ANSI testing of meters
- Lead Time and Cost of UL listing
- Need for ANSI Testing in the shadow of a UL Standard
- UL part of new meter certification process
- UL part of new component selection and design changes





Pro's and Con's of a UL Mark on Electric Meters

Pro's

- Greater perception of safety by the general public
- Outside inspection to maintain certification
- All changes to meter construction are monitored and approved by an outside group



Pro's and Con's of a UL Mark on Electric Meters

Con's

- Greater cost to Utility and Utility customers
- Slower innovation for meters
- Potential for short term meter shortages after implementation
- Potential for fewer meter vendors and options for Utilities



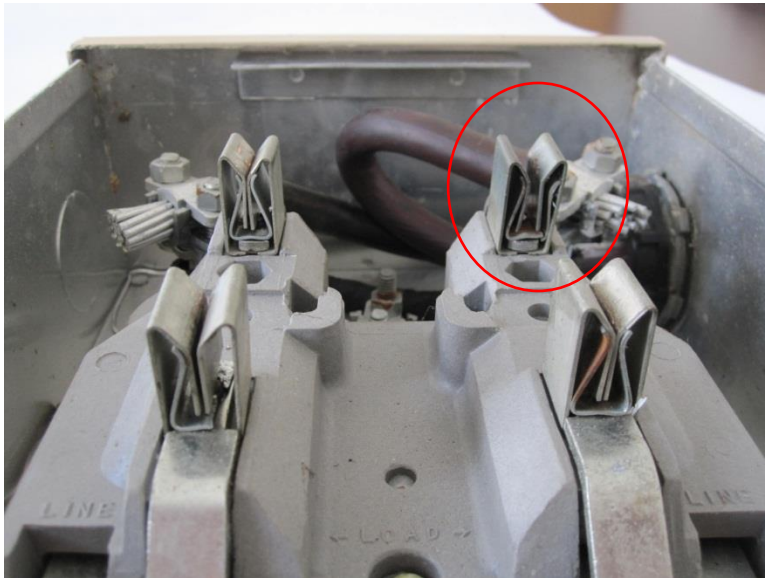
Use of UL as an Independent Test Lab

Current involvement of UL in the metering space

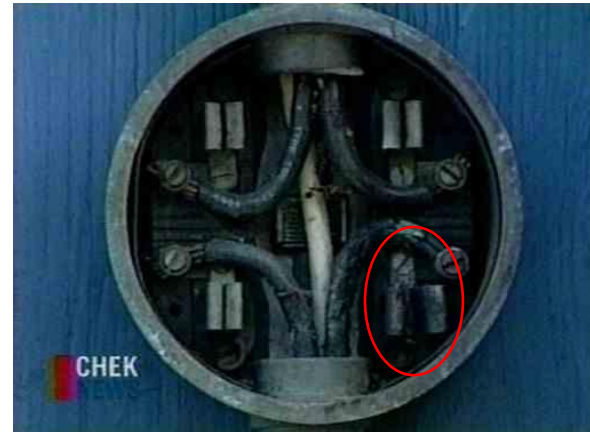
- Independent Test Lab to run ANSI tests
- Independent Test Lab to run customer specific tests
- Independent Test Lab to recommend and run safety tests on any metering product



Searching for Hot Spots - Common Features and Common Sources of Concern

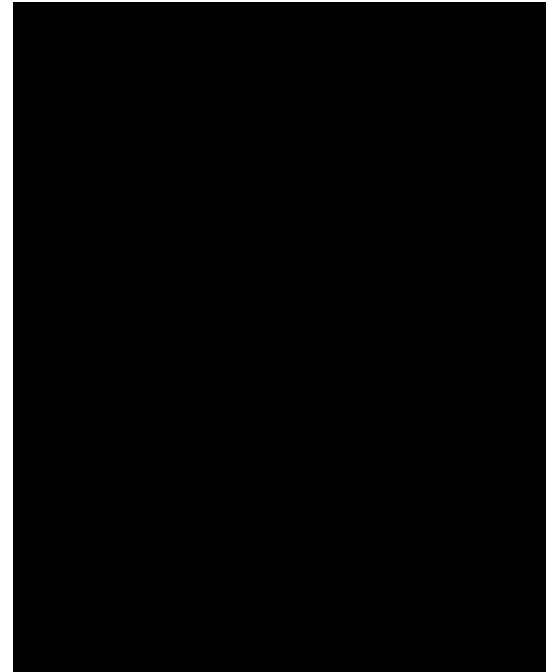


- Pitted and discolored meter blades
- Melted plastic around one or more of the meter stabs (typically the plastic around one stab is where the deformation starts)
- Pitted and discolored socket jaws
- Loss of spring tension in the socket jaws



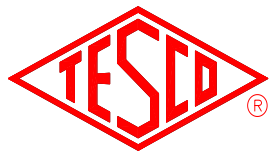


Hot Socket Simulation Fixture

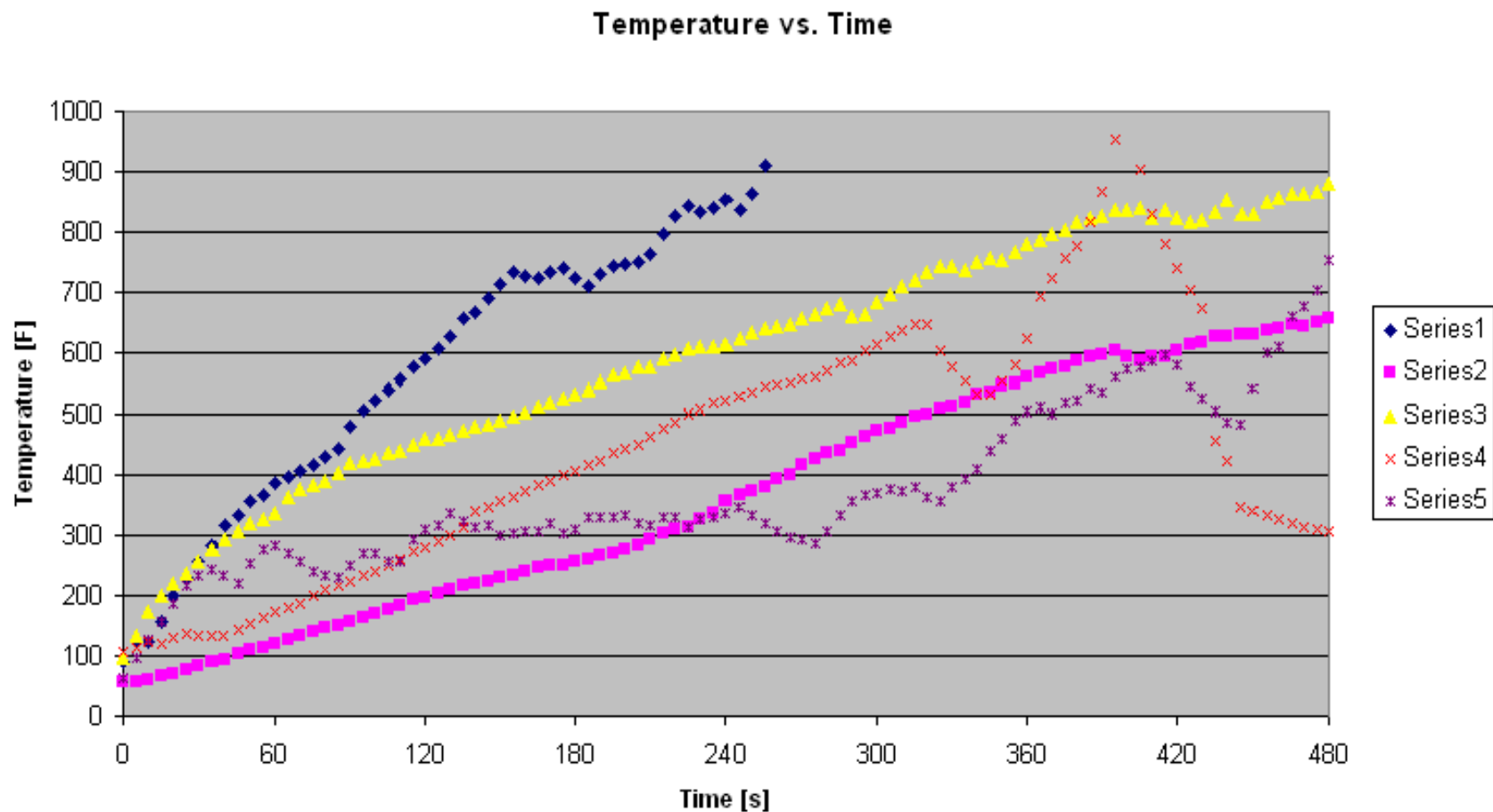


[Click to view video](#)



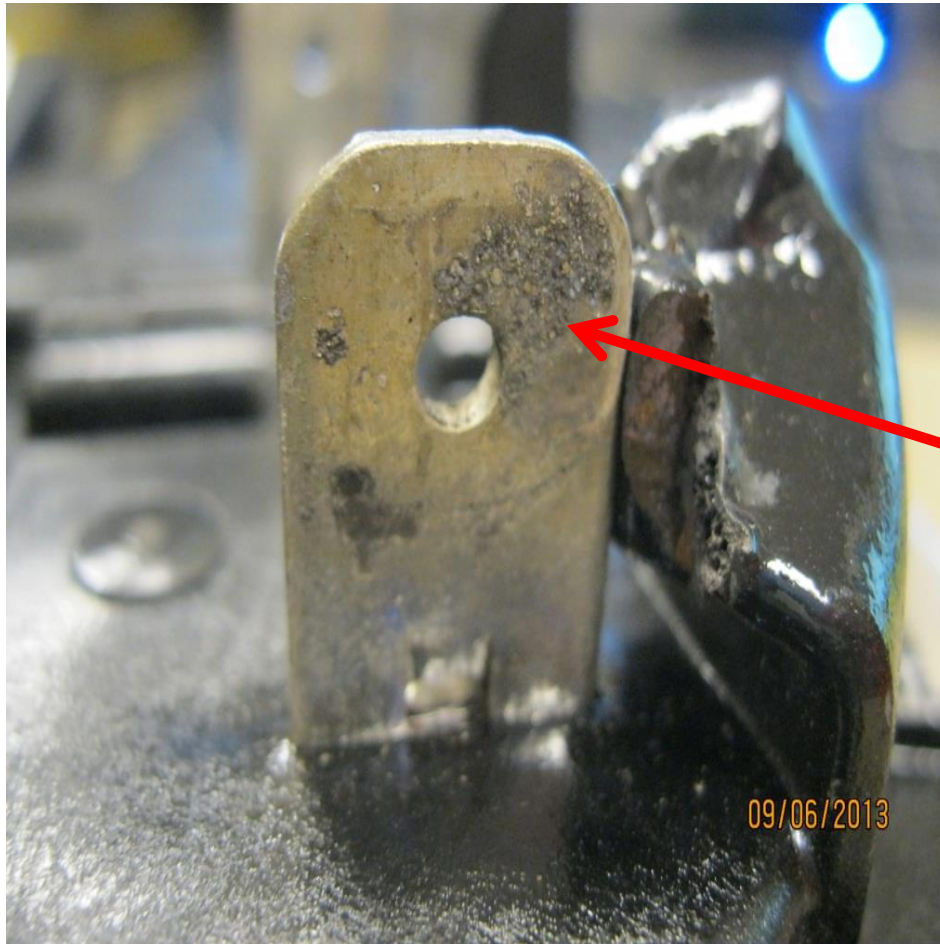


Temperature Rise Data





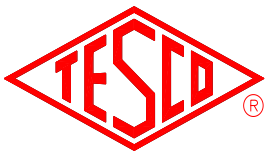
Jaw to Blade Arcing



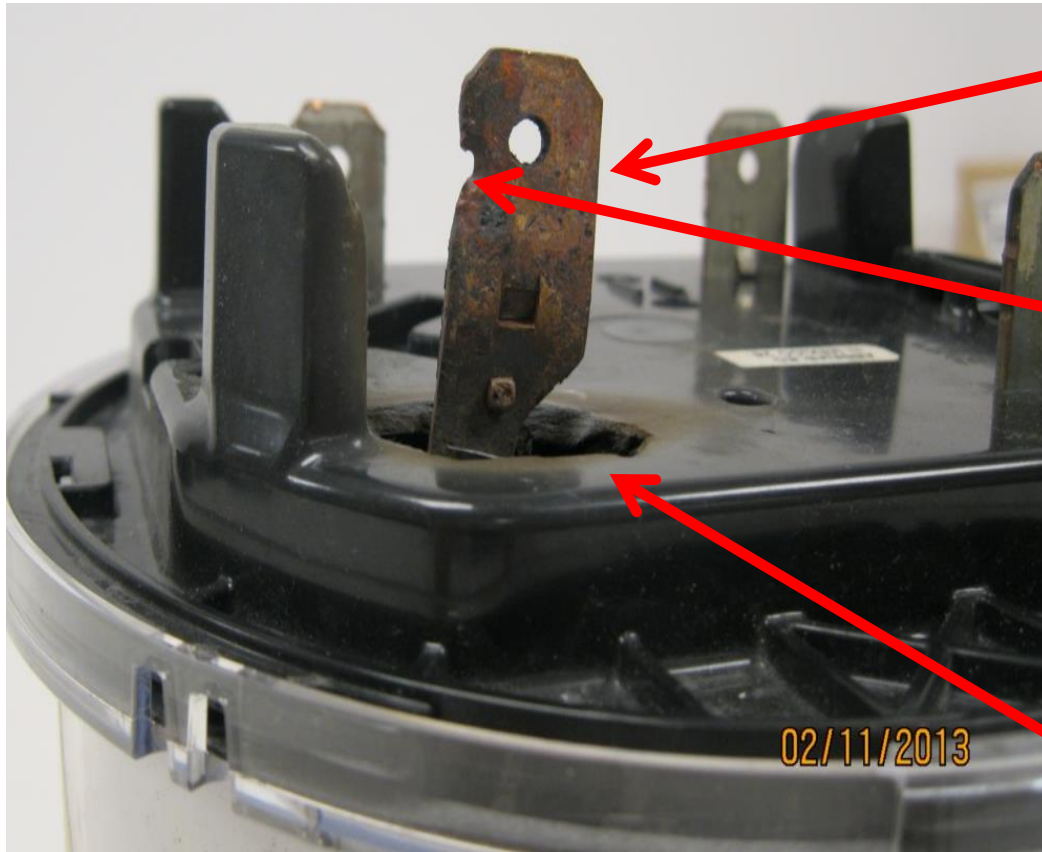
Jaws with intermittent connections will arc to the meter blade resulting in pitting on the blade.

Blade shows early signs of arcing.

Tin Melts at 232°C which is lower than the 350°C base plate plastic.



Severe Arcing Jaw to Blade



Tin burned off

Blade hole due to arcing to jaw – Copper melts at 1040°C (1900°F)

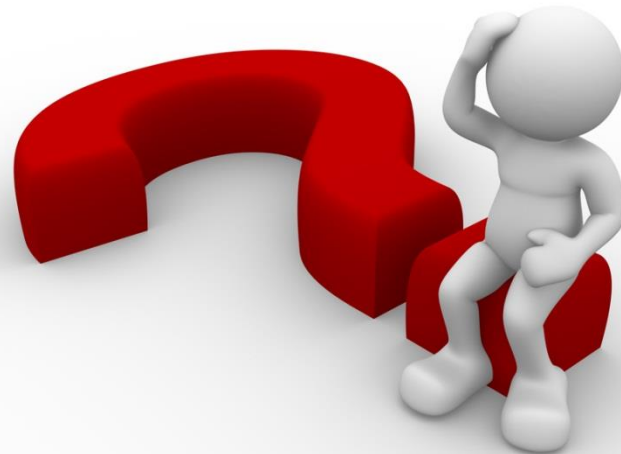
AX-SD base thermoset plastic melts at 960°C (1760°F)



What are the necessary ingredients for a hot socket?

There are three necessary ingredients to create a hot socket (Note: We are not suggesting that we have simulated or even understand all causes for all hot sockets and meter related fires, but rather that we have simulated and understand the causes behind most hot sockets and meter related fires);

- Loss of jaw tension in at least one of the socket jaws.
- Vibration (or other catalyst to initiate arcing)
- Minimal load present

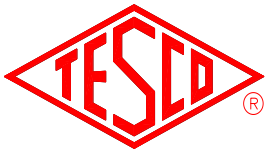




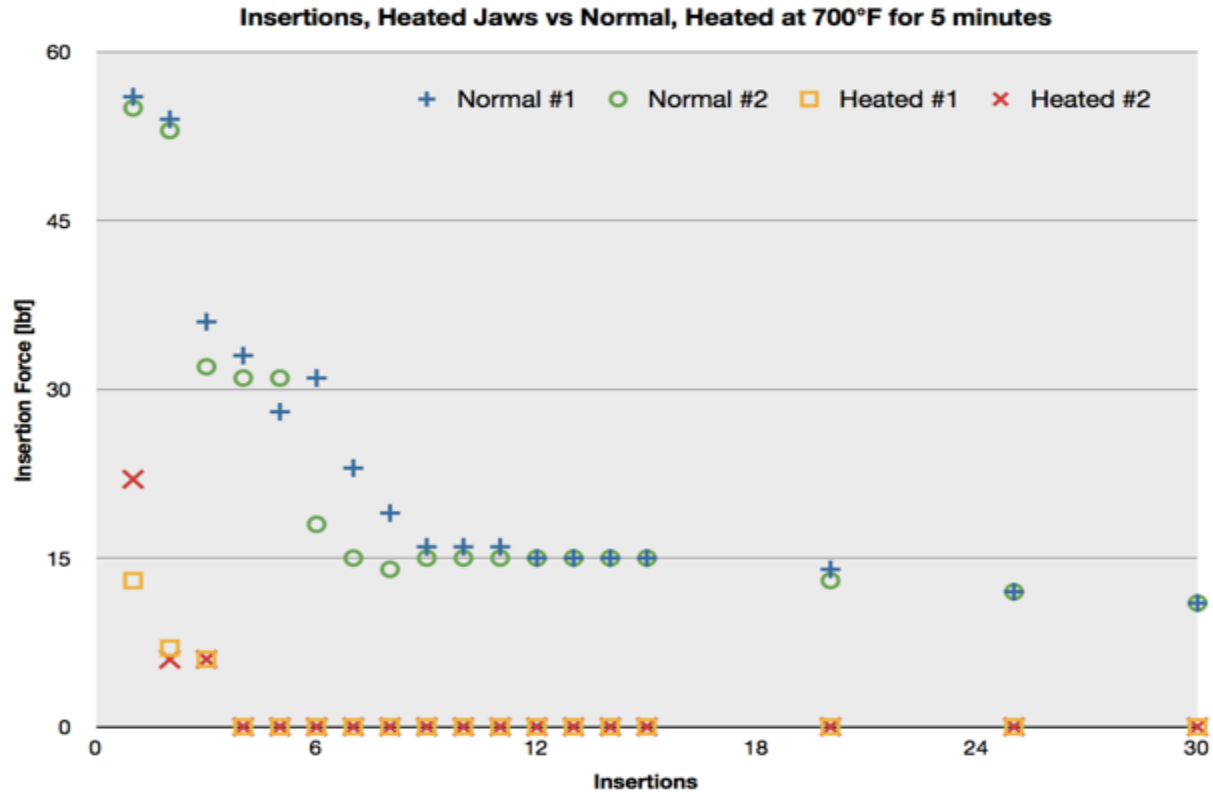
Reviewing the data and learning from the data

- Repeated meter insertions degrades the tension in the socket jaws (see graph), but not to dangerous levels
- Exposure to elevated temperatures rapidly degrades the socket jaw tension to dangerous levels (see graph)
- Visual inspection will catch some but not all dangerous socket jaws
- Arcing creates the heat
- Exposure to elevated temperatures has a cumulative effect on the meter socket jaw
- Relatively small vibration can initiate arcing





Insertions	Normal #1	Normal #2	Heated #1	Heated #2
1	56	55	13	22
2	54	53	7	6
3	36	32	6	6
4	33	31	0	0
5	28	31	0	0
6	31	18	0	0
7	23	15	0	0
8	19	14	0	0
9	16	15	0	0
10	16	15	0	0
11	16	15	0	0
12	15	15	0	0
13	15	15	0	0
14	15	15	0	0
15	15	15	0	0
20	14	13	0	0
25	12	12	0	0
30	11	11	0	0





Field Inspection of Sockets Best Practices

- Example field check list
 - Gaps in meter socket jaws
 - Discoloration of one jaw vs. the other three
 - Signs of melted or deformed plastic on meter base
 - Pitting of either meter blade or socket jaw
 - Loss of tension in meter socket jaws
 - Check condition of wire insulation and connections to meter jaws
 - Check the overall condition of the box, socket, meter and how they attach to each other and the building.
 - Look for signs of tampering
 - Look for signs of water or debris inside of the meter can





Who Sees Hot Sockets?

- Most AMI deployments utilize third party contractors to handle residential and some self contained non-2S services.
- After to or prior to AMI deployments, Utility personnel typically see these sockets
- Transformer rated meters typically handled by the meter service department of the utility.
- Hot socket concerns with lever by-pass sockets used on 3-phase meters are extremely rare.





What can be done once a hot socket is identified?

- Easiest resolution is to replace the damaged jaw.
- **Never** try and repair a damaged jaw. The tension in the damaged jaw will not return simply by taking a pair of pliers and closing the jaw tighter.
- Either the entire box should be replaced or the damaged jaw (assuming the wiring and other jaws are deemed safe through the rest of the inspection.)



Base Line Data Electro Mechanical meters vs solid state vs the latest generation of meters designed with hot sockets in mind

- At the start of our laboratory investigation the oldest electro mechanical meters withstood hot sockets the best
- The latest vintage solid state meters withstood hot sockets the least.
- Over the course of the past twelve months some meter manufacturers have begun to release 2S meters designed to withstand hot sockets and some have even begun to put temperature sensing closer to the meter blades instead of only on the metrology boards.
- One meter vendor's service switch meter has used high temperature base plate plastic since it was launched in 2008.)





High Bills

- Bill increases after a meter installation is always perceived as a new meter issue – this has always been true.
- Public is now more aware that a new meter is going on their house and any increase in their bill is immediately linked to the new meter and not to a change in usage.



Privacy Issue—Big Brother is watching me

The utility knows everything I am doing

Current involvement of UL in the metering space

- The utility will know everything I am doing
- My every move can be tracked
- I will never have any privacy again



Privacy Issues – real or imagined

Potential Responses

- There is no two way communication unless the consumer has equipment in the house to talk to the meter
- This would be rate based
- The information available from the internet is far more of a privacy invasion
- The phone utility knows who you are talking to
- The electric utility only knows how much energy you are using



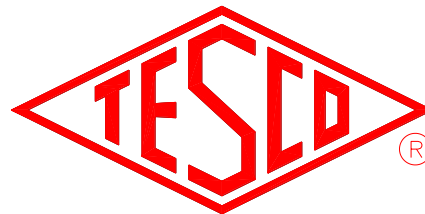
Questions?



Please feel free to call or e-mail any questions

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