



THE EASTERN SPECIALTY COMPANY

Field Verification: Test Equipment and Best Practices



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*For MEUA Meter School 102
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2:00 p.m. – 4:00 p.m.*

Why Do We Test Meters?



We Test for Several Different Reasons

- *Acceptance testing from Meter Manufacturers (Trust but Verify)*
- *Ensure Accuracy of our Meters*
- *Comply with PSC requirements*
- *Verify the integrity of a new Metering Installation*
- *Verify the integrity of our existing Metering Installations*
- *Satisfy Customer High-Bill inquiries*

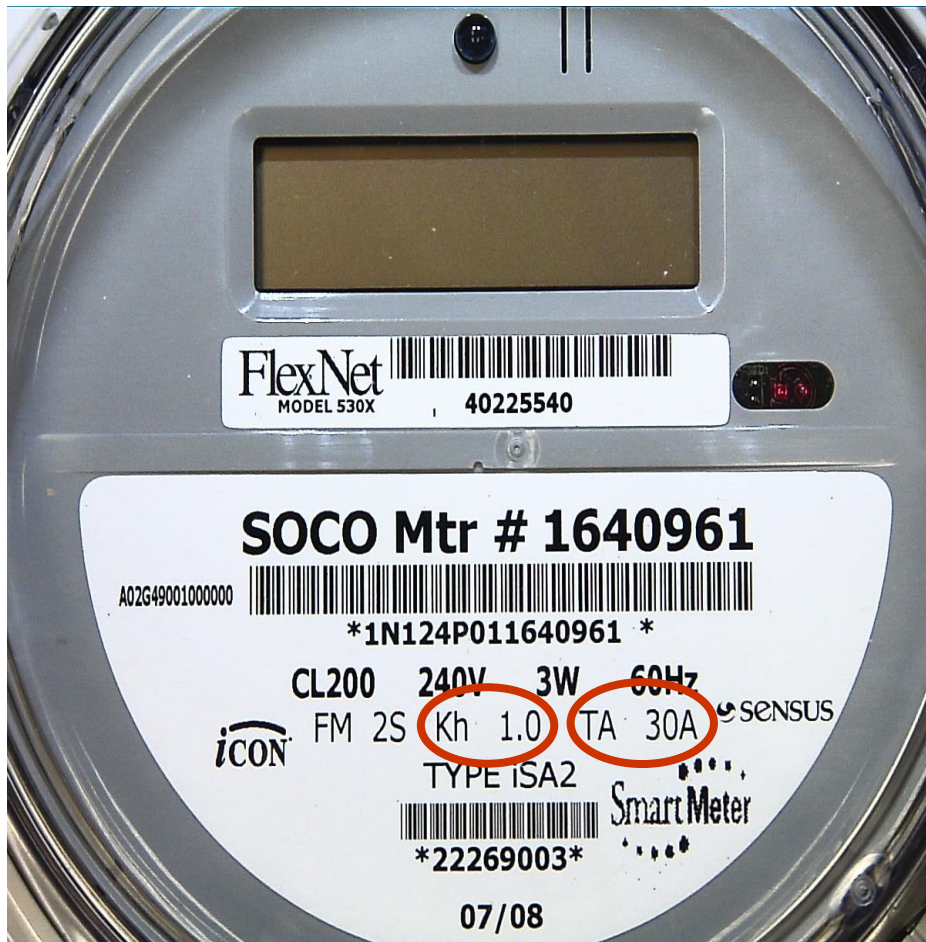


What Kind of Tests Do We Do?

- *Complaint Test:*
 - *High Bill Inquiry*
- *Installation Test:*
 - *Any new Trans-Rated Metering Installation*
- *Periodic Test:*
 - *All existing Trans-Rated Metering Installations*
- *Sample Test:*
 - *Required by the PSC*
- *Acceptance Test:*
 - *Shop testing new and returned meters*



Test Amps & Meter kWh



TA (test amps) is the test load recommended by the manufacturer for the full-load test. This meter should be tested using a 30 amp load for the full-load test and a 3 amp load for the light-load test.

On mechanical meters, the kWh is the amount of energy required to rotate a meter's disc one revolution.

On electronic meters, the kWh is the amount of energy represented by each test pulse.

One test pulse from this meter represents one watt-hour of energy.

The kWh is used to calculate revolutions of the standard.



Test Amps for Transformer Rated Meters is Typically 2.5 Amps

ANSI Code for Electricity Metering states that Test Loads for T.R. Meters may be 100% of the Secondary Current Transformer rating for Full Load, and 10% of rating for Light Load.

- Full Load may be tested at 5 Amps
- Light Load may be tested at .5 Amps



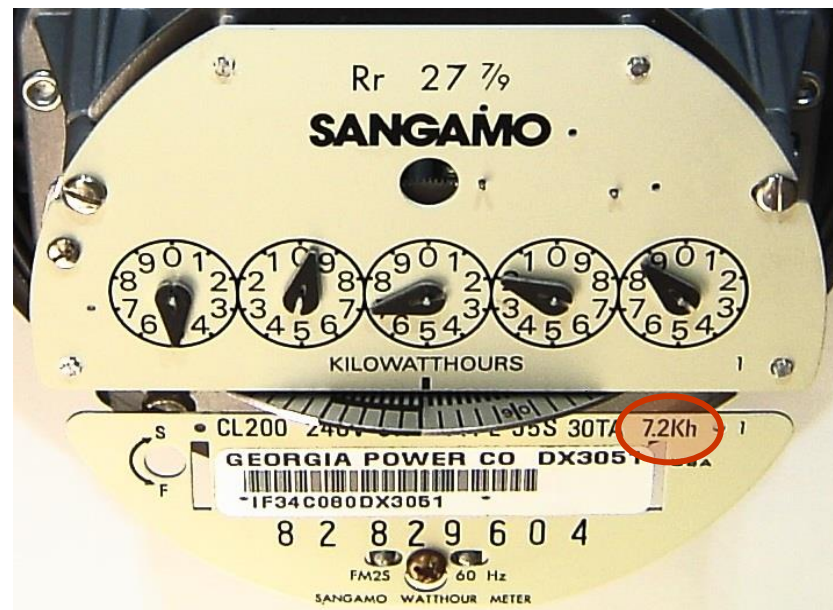
Calculating Load on Electronic Meters

$$\frac{3600 \times Kh \times \text{Meter Multiplier}}{\text{Seconds per Revolution}} = \text{Watts}$$



Determining Load on a Mechanical Meter

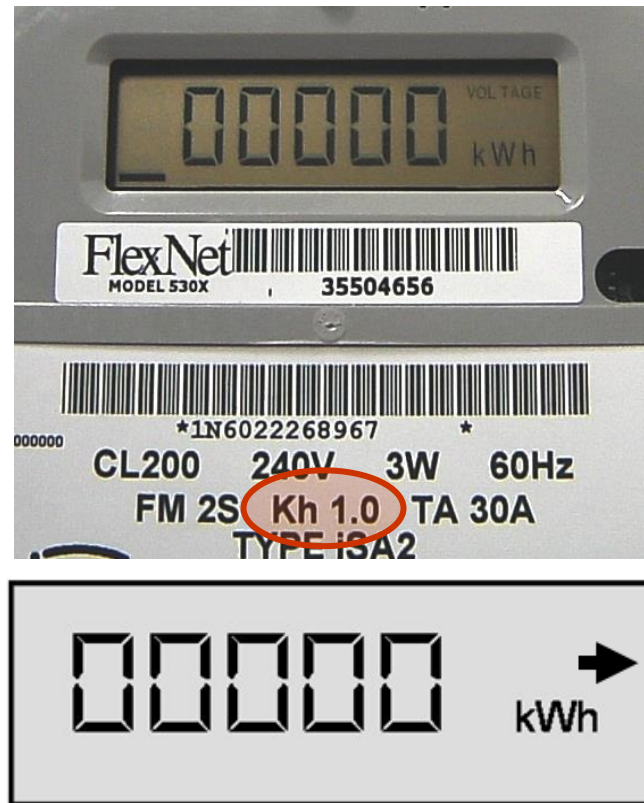
The Load on Mechanical Meters can easily be calculated by timing the meter's disk and solving the formula shown below.



$$\frac{3600 \times \text{Kh} \times \text{Meter Multiplier}}{\text{Seconds per Revolution}} = \text{Watts}$$

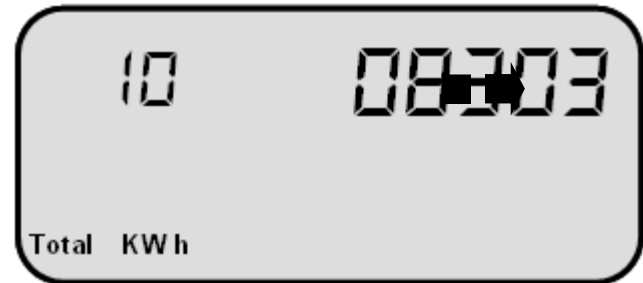
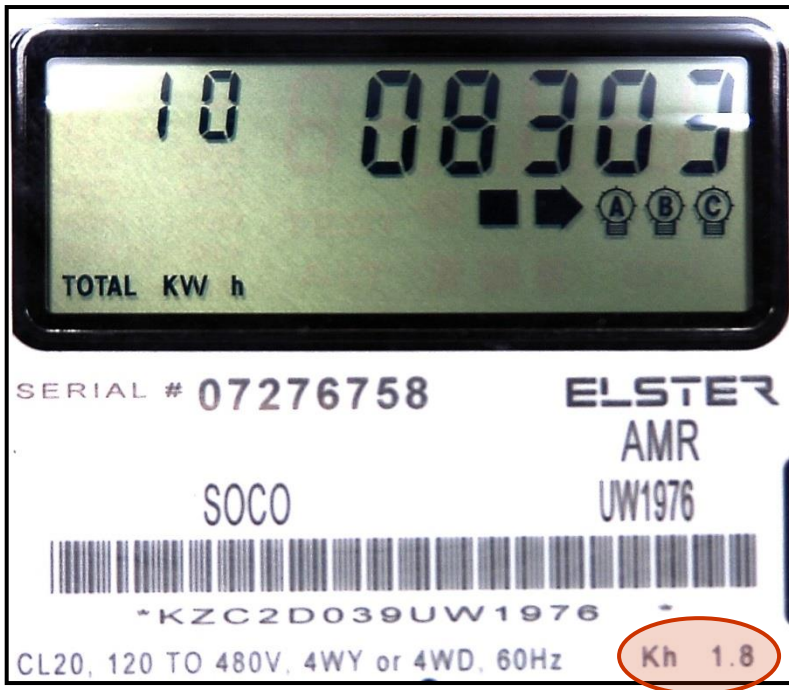


Determining Load on a Senus iCon Meter



Each increment of the line segment represents one Kh value.

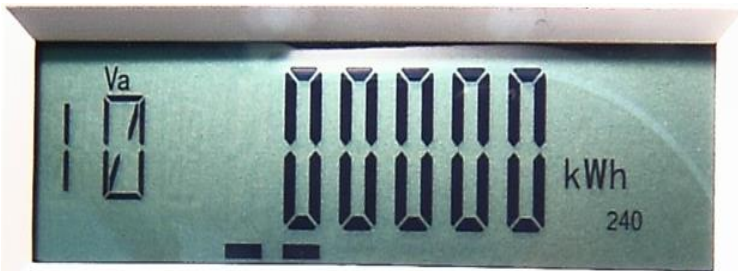
Determining Load on an Elster Meter



- *The black square indicates load on an Elster meter.*
- *The time from the instant that the square first appears, goes away, and then reappears represents one Kh value.*



Determining Load on a Landis + Gyr Meter



- *Landis + Gyr meters have two short line segments that move across the bottom of the display.*
- *When the two line segments make a complete trip across the display, one Kh value of energy has been consumed.*





Overview of Field Test Methods & Equipment



ACCURACY REQUIREMENTS

ANSI C12.1-1995

- **Test Loads**

Full Load \approx 100% of Test Amperes at unity power factor

Light Load \approx 10% of Test Amperes at unity power factor

Power Factor \approx 100% of Test Amperes at 50% power factor

(Test Loads for T.R. Meters may be 100% of Secondary Current

Transformer rating for Full Load and 10% of rating for Light Load.)

- **Acceptable Performance**

Average Percent registration shall not be less than 98% or more than 102%

$$\text{Avg \% Registration} = \frac{\text{FL} + \text{LL}}{2} \quad \text{Weighted \% Registration} = \frac{4\text{FL} + \text{LL}}{5}$$

- **Adjustment Limits**

Adjustments are required when error in registration exceeds 1% at Light Load and Full Load or 2% at Power Factor.

Meter accuracy shall be adjusted as close to 100% as practical.



Comparison Test Using a Portable Meter Test System

- *Test Jack, Watthour Standard and Current Synthesizer in one lightweight unit.*
- *No setup wiring is needed.*
- *Simple to use, even for non-metering personnel.*



- *Limited Use*
 - *Some units are limited to Single Phase meters only.*
 - *Others will test all Self-contained and Transformer Rated meters except the 5S/35S/45S.*

Comparison Check Using a Second Watthour Meter

- *Easy and inexpensive way to handle high bill complaints.*
- *A control meter, with known accuracy is placed in series with the customer's meter using a duplex adapter.*
- *The control meter is left in place for a sufficient period of time (i.e. one week).*
- *Readings on both meters are recorded when the control meter is installed and when removed.*
- *The accuracy of the customer's meter is calculated from any difference in consumption.*



Radian RM-17

- *Tests Single Phase Self-Contained watthour meters.*
- *Meter Forms 1S, 2S, 2SE, 12S and 12SE.*
- *Closed link meter testing.*
- *Produces 0.2 - 50 amps current.*
- *Operates on any AC voltage source (60 to 600 volts).*
- *Tests Full Load, Light Load and Power Factor*



Radian RM-17

- *The socket adapter jumps the Customers service when installed but the front of the adapter remains de-energized.*
- *Programmed with default Meter Forms, Kh values and tests.*
- *Customizable program to create new or edit existing tests.*
- *Once test is chosen select Run Test. The meter will power up and the test will start.*
- *Test results will provide FL, LL, PF and Weighted Accuracy Average.*



ProbeWell MT-1/NT9

- *Portable 3 Phase watthour meter tester.*
- *Tests meter forms: 1S, 2S, 2SE, 3S, 4S, 6S, 8S, 9S, 12S, 12SE, 14S, 15S, 16S and 16SE*
- *Does NOT test a 5S, 35S or 45S*
- *Closed link testing.*
- *Capable of producing 0.25 to 50 amps of three phase current.*
- *Operates on any AC voltage source (100-600 volts).*
- *Test results will provide FL, LL, PF and Weighted Accuracy Average.*
- *Reverse power flow capability for bi-directional solid state meters.*



ProbeWell MT-1/NT9

- Set the Form Selector switch on the back of the adapter to the correct form and move the twist spades to the correct location.
- The socket adapter jumps the Customers service when installed but the front of the adapter remains de-energized.
- Choose the Preset-Quick, Preset-Full test or select User-Defined Test.
- If either Preset Test is selected the unit will determine the type of service and meter form installed.
- When the optical pickup is used testing a solid state meter the test becomes fully automatic after the power switch is turned on.
- Once the test is complete the results page will display the FL, LL, PF and Weighted Accuracy average.



Powermetrix Automated Meter Tester

- Tests most ANSI socket based meters.
- Closed link meter testing
- Synthesized voltage & up to 30 amps current source.
- Operates on any AC voltage source (100 to 530 volts).
- Test Wh, VARh, VAh



Radian Portable Three-Phase Meter Tester

- *Tests most ANSI socket based meters.*
- *Closed link meter testing*
- *Synthesized voltage & up to 50 amps current source.*
- *Operates on any AC voltage source (90 to 300 volts).*
- *Test Wh, VARh, Vah*
- *CT Burden & Ratio*
- *Site Analysis*



Meter Tester / Site Analyzer

- Capable of Customer Load or Phantom Load Testing
- Available with built in Phantom Load for when there is little or no customer load, or whenever an ANSI compliant test is desired.
- A true Three phase voltage source is also available.
- CT Burden & Ratio, Service Vector Analysis, Harmonic Analysis

WECO WE-20 from Radian

“Portable Three-Phase Meter Tester / Analyzer”



Powermaster from Powermetrix

“Portable Three-Phase Meter Tester / Analyzer”

Meter Test Adapter is available



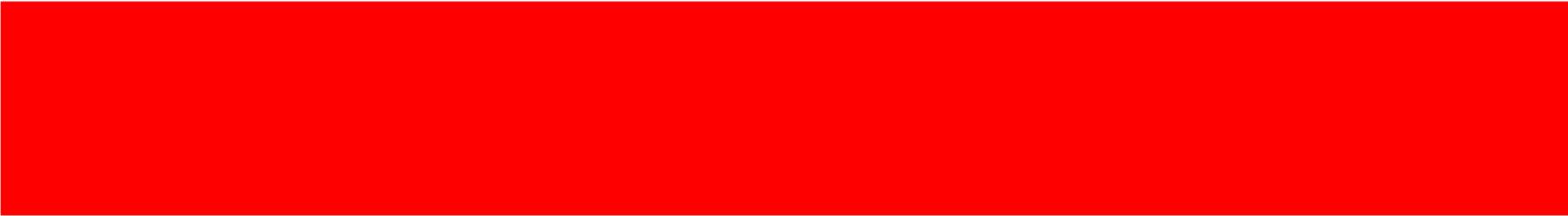
TESCO's 6330 Meter Site Analyzer

- ✓ An all-in-one field test kit
- ✓ Most versatile and complete tool for testing the entire functionality of transformer rated metering installations
- ✓ Convenient, portable, lightweight

No other system can do all of these tests in one package:

- ✓ Site Verification
- ✓ CT Testing (Ratio, Burden Only, Admittance)
- ✓ Demagnetization
- ✓ Customer Load or Phantom Load Testing (5 amp current load box)
- ✓ Meter Accuracy Testing (T.A. 5 amp)
- ✓ Demand Testing
- ✓ Phasor Diagrams
- ✓ Waveform and Data Recording
- ✓ Harmonics

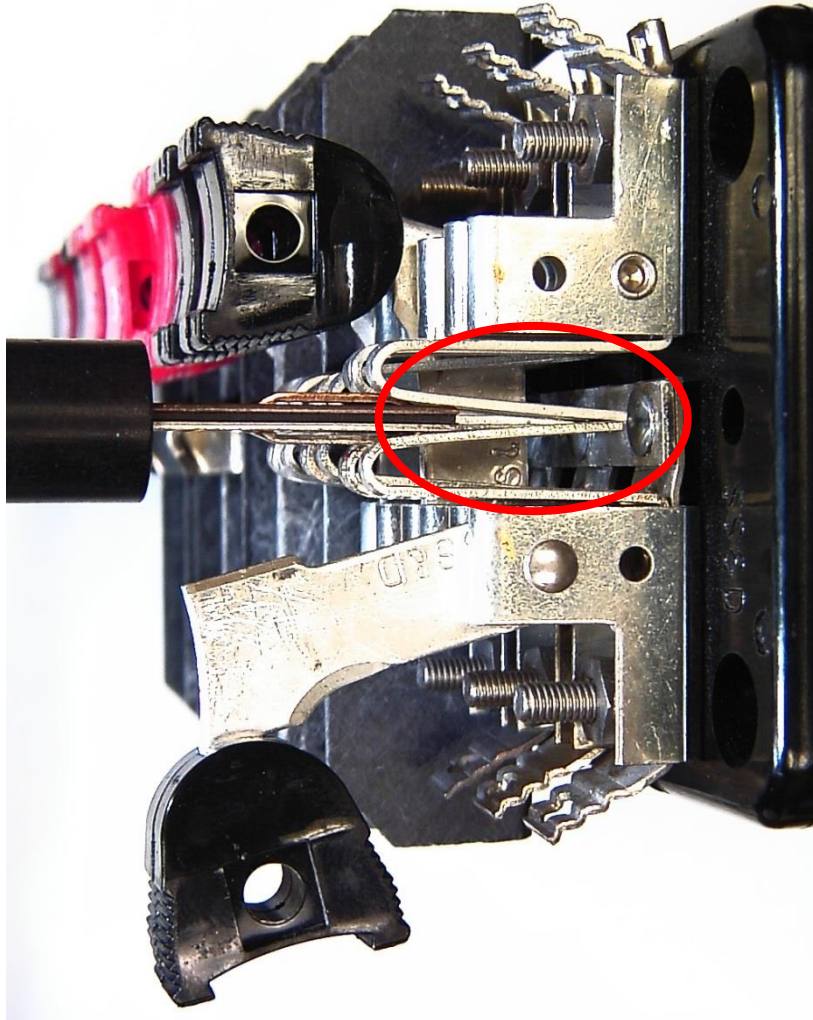




***Field Testing Using
Customer's Load***



“Current Return Switches”



- Each current return switch has a spring loaded contact into which the current probe from the test equipment is inserted.
- The spring contact is designed to make the circuit through the test equipment before it breaks the contact through the test switch. This guards against accidentally opening the CT secondary circuit.
- The current probe from the test equipment has two contact surfaces with an insulator in between. GPC's test equipment requires the copper contact to be up and the tin plated contact to be down so that the current flows in a forward direction through the test equipment.

Customer Load Testing and System Analyzers

***Radian
RD31-221***



***Spinlab
Bird Dog Plus***



***testMET
Gold Miner***



***PowerMetrix
PowerMaster***



Comparison Test Using Customer's Load

- *Test equipment is put in series with the customer's load.*
- *Meter continues to register – No need to put meter in Test Mode.*

Radian Research RD-30 Three Phase Analyzing Standards



Powermaster "Portable Three-Phase Meter Tester / Analyzer"



In addition to meter accuracy tests:

- ***CT burden and ratio test***
- ***System wiring verification***
- ***Harmonic analysis***



PowerMetrix – Power Master



TESCO Field Test Equipment



Cat. 2990 Desktop Meter Test Station



Cat. 2199 Desktop MQB



Cat. 2210 Desktop Test Interface Station



Cat. GA-50 Field Test Kit with Resistive Load



Cat. 2200 Field Test Interface Kit



Cat. 6330 Site Analyzer



SAFETY is the #1 Priority!

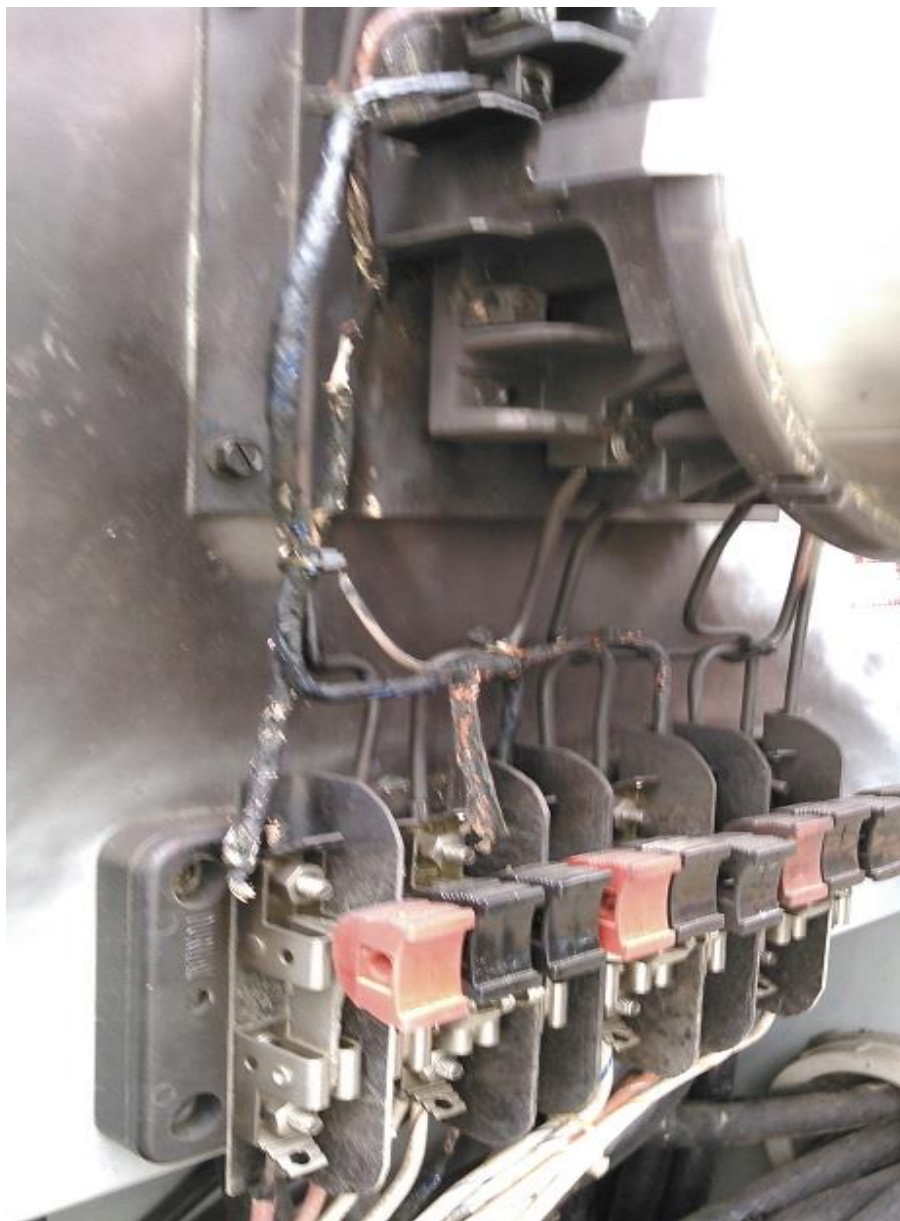
Always use your Personal Protective Equipment!

- *Hard Hat*
- *Safety Glasses*
- *FR Clothing*
- *Dielectric Gloves with “Grabbit” or Leather Protectors*















Questions?



Tom Lawton

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***This presentation can also be found under Meter
Conferences and Schools on the TESCO website:***

www.tescometering.com

