



# ANSI Testing

## Proposed Changes to ANSI C12



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# Session Objectives

- Understand contents of ANSI C12.20-2010 for 0.2 and 0.5 Accuracy Class Meters
- Understand the Relationship of C12.20 to C12.1
- Understand ANSI C12.20 Changes Planned for 2015 Edition and ANSI C12.1 changes planned for 2014
- Understand new ANSI C12.29 for Field Testing and potential time frame
- Discuss – Will this affect how we test in the field?



# Current Meter Testing Standards

Meter Testing for new and in-service kilowatt-hour meters, both electronic and electromechanical is specified in ANSI C12.1-2008, *American National Standard for Electric Meters, Code for Electricity Metering*. Most utility commissions use this Standard as a reference or the basis for their meter testing requirements.

ANSI C12.20-2010, *American National Standard for Electricity Meters, 0.2 and 0.5 Accuracy Classes*, provides different test tolerances and a few different or modified tests for higher accuracy meters. There is no reference made in C12.20 to field testing. The only mention of in-service testing refers back to Section 5 of C12.1



# Current ANSI C12.20 Requirements

- ANSI C12.20 establishes aspects and acceptable performance criteria for 0.2 and 0.5 percent accuracy class meters meeting Blondel's Theorem. This means that C12.20 is not applicable for 2S meters.
- Where there are differences between C12.20 and C12.1, ANSI Standard C12.20 takes precedence.



# Current ANSI C12.20 Contents

- Meter Requirements
- Acceptable Performance of New Types of Electricity Metering Devices and Associated Equipment
- Refers back to C12.1 Section 4
- Also has additional (and modified) tests specific to higher accuracy class meters
- Standards for In-Service Performance (refers to C12.1 Section 5)
- No mention of Field Testing in ANSI C12.20 – 2010
- The 2010 revision of the standard was broadened to allow three phase current and voltage sources as an optional test method to the single phase, series, parallel method



# Current ANSI Field Testing Standards

- In ANSI C12.1–2008 there is no mention of field testing
- The In-Service section 5 of this standard was deemed in need of strengthening and ANSI C12 main committee decided there was a need to look at field testing.
- A draft of ANSI C12.1 – 2013 with a new section 5 is ready for approval.
- A Field Test Working Group was established to create a new ANSI standard focusing on Field Testing (ANSI C12.29)
- Both C12.1 and C12.20 will refer to this standard for field testing



# Current ANSI C12.1 Testing Requirements

Table 3 – List of Tests

| Tests (✓)<br>Performed in Series | Descriptions Of Certification Tests                 | ANSI C12.1      |
|----------------------------------|---|-----------------|
|                                  | No Load   | Test #1         |
|                                  | Starting Load                                       | Test #2         |
|                                  | Load Performance                                    | Test #3         |
|                                  | Effect of Variation of Power Factor                 | Test #4         |
|                                  | Effect of Variation of Voltage                      | Test #5 or 5a   |
|                                  | Effect of Variation of Frequency                    | Test #6         |
|                                  | Equality of Current Circuits                        | Test #7         |
|                                  | Internal Meter Losses                               | Test #8         |
|                                  | Temperature Rise                                    | Test #9         |
|                                  | Effect of Register Friction                         | Test #10        |
|                                  | Effect of Internal Heating                          | Test #11        |
|                                  | Effect of Tilt                                      | Test #12        |
|                                  | Stability of Performance                            | Test #13        |
|                                  | Independence of Elements                            | Test #14        |
| ✓                                | Insulation  | Test #15        |
| ✓                                | Voltage Interruptions                               | Test #16        |
| ✓                                | Effect of High Voltage Line Surges                  | Test #17        |
|                                  | Effect of External Magnetic Field                   | Test #18        |
|                                  | Effect of Variation of Ambient Temperature          | Test #19 or 19a |
|                                  | Effect of Temporary Overloads                       | Test #20        |
|                                  | Effect of Current Surges in Ground Conductors       | Test #21        |
|                                  | Effect of Superimposed Signals                      | Test #22        |
|                                  | Effect of Voltage Variation-secondary Time Base     | Test #23        |
|                                  | Effect of Variation of Amb. Temp.-second. Time Base | Test #24        |
| ✓                                | Effect of electrical Fast Transient/Burst           | Test #25        |
| ✓                                | Effect of electrical oscillatory SWC test           | Test #25a       |
|                                  | Effect of Radio Frequency Interference              | Test #26        |
|                                  | Radio Frequency Conducted and Radiated Emission     | Test #27        |
| ✓                                | Effect of Electrostatic Discharge (ESD)             | Test #28        |
|                                  | Effect of Storage Temperature                       | Test #29        |
| ✓                                | Effect of Operating Temperature                     | Test #30        |
| ✓                                | Effect of Relative Humidity                         | Test #31        |
|                                  | Mechanical Shock                                    | Test #32        |
|                                  | Transportation Drop                                 | Test #33        |
|                                  | Mechanical Vibration                                | Test #34        |
|                                  | Transportation Vibration                            | Test #35        |
|                                  | Weather Simulation                                  | Test #36        |
|                                  | Salt-spray  | Test #37        |
|                                  | Raintightness                                       | Test #38        |



ANSI C12.1-2008

American National Standard  
for Electric Meters

Code for Electricity Metering





# Current ANSI C12.20 Testing Requirements

Table 6 – List of tests

| ANSI C12.20    | Descriptions Of Certification Tests                             | Polyphase or Series-parallel loading | Tests (✓) Performed In Series | Precision or Nominal Source |
|----------------|---|--------------------------------------|-------------------------------|-----------------------------|
| Test #1        | No Load   | Either                               |                               | P                           |
| Test #2        | Starting Load   | Either                               |                               | P                           |
| Test #3        | Load Performance  | Either                               |                               | P                           |
| Test #4        | Effect of Variation of Power Factor                             | Either                               |                               | P                           |
| Test #5a or 5b | Effect of Variation of Voltage                                  | Either                               |                               | P                           |
| Test #6        | Effect of Variation of Frequency                                | Either                               |                               | P                           |
| Test #7        | Equality of Current Circuits                                    | Either                               |                               | P                           |
| Test #8        | Internal Meter Losses   | Either                               |                               | N                           |
| Test #9        | Temperature Rise  | Either                               |                               | N                           |
| Test #10       | Effect of Register Friction                                     | Either                               |                               | P                           |
| Test #11       | Effect of Internal Heating                                      | Either                               |                               | P                           |
| Test #12       | Effect of Tilt  | Either                               |                               | P                           |
| Test #13       | Stability of Performance  | Either                               |                               | N                           |
| Test #14       | Effect of Polyphase Loading                                     | Per Test                             |                               | P                           |
| Test #15       | Insulation  |                                      | ✓                             | NA                          |
| Test #16       | Voltage Interruptions   |                                      | ✓                             | N                           |
| Test #17       | Effect of High Voltage Line Surges                              |                                      | ✓                             | N                           |
| Test #18       | Effect of External Magnetic Field                               |                                      |                               | P                           |
| Test #19       | Effect of Variation of Ambient Temperature                      | Either                               |                               | P                           |
| Test #20       | Effect of Temporary Overloads                                   |                                      |                               | N                           |
| Test #21       | Effect of Current Surges in Ground Conductors                   |                                      |                               | N                           |
| Test #22       | Effect of Superimposed Signals                                  |                                      |                               | NA                          |
| Test #23       | Effect of Voltage Variation-secondary Time Base                 |                                      |                               | NA                          |
| Test #24       | Effect of Variation of Ambient Temperature -Secondary Time Base |                                      |                               | NA                          |
| Test #25       | Electrical Fast Transient/Burst                                 |                                      | ✓                             | N                           |
| Test #26       | Effect of Radio Frequency Interference                          |                                      |                               | N                           |
| Test #27       | Radio Frequency Conducted and Radiated Emission                 |                                      |                               | N                           |
| Test #28       | Effect of Electrostatic Discharge (ESD)                         |                                      | ✓                             | N                           |
| Test #29       | Effect of Storage Temperature                                   |                                      |                               | N                           |
| Test #30       | Effect of Operating Temperature                                 |                                      | ✓                             | N                           |
| Test #31       | Effect of Relative Humidity                                     |                                      | ✓                             | N                           |
| Test #32       | Mechanical Shock  |                                      |                               | NA                          |
| Test #33       | Transportation Drop   |                                      |                               | NA                          |
| Test #34       | Mechanical Vibration  |                                      |                               | NA                          |
| Test #35       | Transportation Vibration  |                                      |                               | NA                          |
| Test #36       | Weather Simulation  |                                      |                               | NA                          |
| Test #37       | Salt-spray  |                                      |                               | NA                          |
| Test #38       | Rain-tightness  |                                      |                               | NA                          |





# Current Meter Testing to Standards

- Many State Utility Commissions require that new higher accuracy class electric meters meet ANSI C12.1 and C12.20 requirements.
- New meters are tested using all or a group of tests specified in ANSI C12.1 and C12.20. These tests are typically performed by the meter vendors.
- Meter vendors have different interpretations of certain ANSI tests and even what “ANSI qualified” means.
- Meter vendors often perform ANSI testing early in the development of a meter and certify future modifications to the meter by stating the updated design is similar to the old design in form and function.



# ANSI C12.1 – 2013 Section 5

## Proposed Changes

- More options for statistical models to use
- More options for what to do if a group starts to perform poorly
- Addresses the type of statistical testing available for ancillary devices (e.g. disconnect switches; communication devices).
- Addresses the need to use statistical methods to determine as far in advance as possible the potential failure modes and life expectancies of any new technology being deployed to the field.



# What do These Changes Mean for Field Testing

- The revised Section 5 for ANSI C12.1 will not specify any new field tests. The in-service testing required can be done in the field or in the meter shop as long as the basic requirements of the tests are met.
- The revised Section 5 tries to include ancillary devices including disconnect switches included with the meter and external CT's and PT's.
- This portion of the Standard focuses on the performance of the device as a group and not the specifics of the test being performed.
- ANSI C12 Main Committee has decided that this aspect of testing has been overlooked and has created a working group to address the “how-to” of field testing. A new standard, ANSI C12.29 is anticipated to be be drafted by this working group and presented to the main committee of C12 for approval.
- This working group has no time table to complete their work, but they are hoping to have a draft ready for the Spring 2014 ANSI meeting (The main committee meets every 6 months in conjunction with the EEI TD&M conference.



# New ANSI C12.29 for Field Testing Metering Devices



ANSI C12.29 will establish recommended field testing for metering devices and should eventually be referenced in C12.1 and C12.20. The new standard is expected to have three Sections:

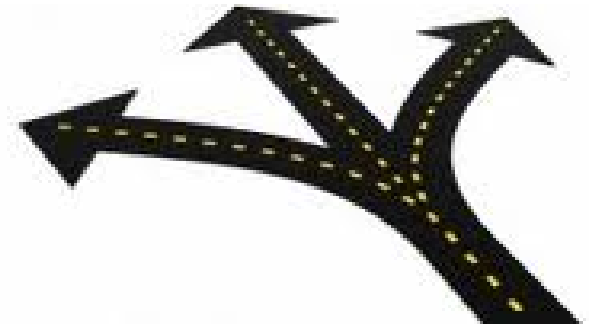
- Meter Testing
- Instrument Transformer Testing
- Site Wiring and Auxiliary Devices



# New ANSI C12.29 for Field Testing Metering Devices

Meter Testing will be divided into three categories based on where current and voltage is supplied...

- Using Customer Potential with Current Supplied by the Test Equipment
- Using Customer Potential and Customer Supplied Current
- Using Potential and Current Supplied by Test Equipment



# New ANSI C12.29 for Field Testing Metering Devices

Instrument Transformer testing is anticipated to focus on:

- Burden Testing - The theory and practical application in the field
- Ratio Testing - Practical application in the field
- Visual inspection of the CT's and PT's



# New ANSI C12.29 for Field Testing Metering Devices

Site Wiring and Auxiliary devices is anticipated to focus on:

- Visual inspection
- Continuity testing
- Service Ground testing
- Communication testing
- Disconnect testing
- Additional device testing





# New ANSI C12.29 for Field Testing Metering Devices

What the new Standard is not expected to do:

- Mandate a new test or tests
- Mandate the “right way” to do this test
- Mandate the use of any equipment or specific processes

This Standard is anticipated to be a “Best Practices” type of document and not a new set of requirements for Utility Metering Groups



# New ANSI C12.29 for Field Testing Metering Devices

Given the early stages for this Working Group this is all personal opinion and could change before the new Standard is completed.

There is also no mandate that this Standard ever has to come into existence. If the Committee never presents a draft or if the ANSI C12 main committee rejects the draft there will be no C12.9 in the near future, and if approved, C12.1 and C12.20 do not have to reference the new Standard



# Site Verification...

## The New Field Testing

Where are ANSI and the voting members heading?

Toward more comprehensive field testing that focuses on far more than just accuracy testing. The members vision for the future of field testing is that utilities will perform the following checks when checking a metering installation in the field

- Meter Accuracy testing
- Meter Communications Performance
- Software and firmware verification
- Setting verification
- Functional testing
- Disconnect/reconnect Functionality and as left setting
- Tamper Verification
- Site Audits appropriate to the type of meter



# Questions and Discussion



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