TESCO METERING

New ANSI Standard and Application in the Field

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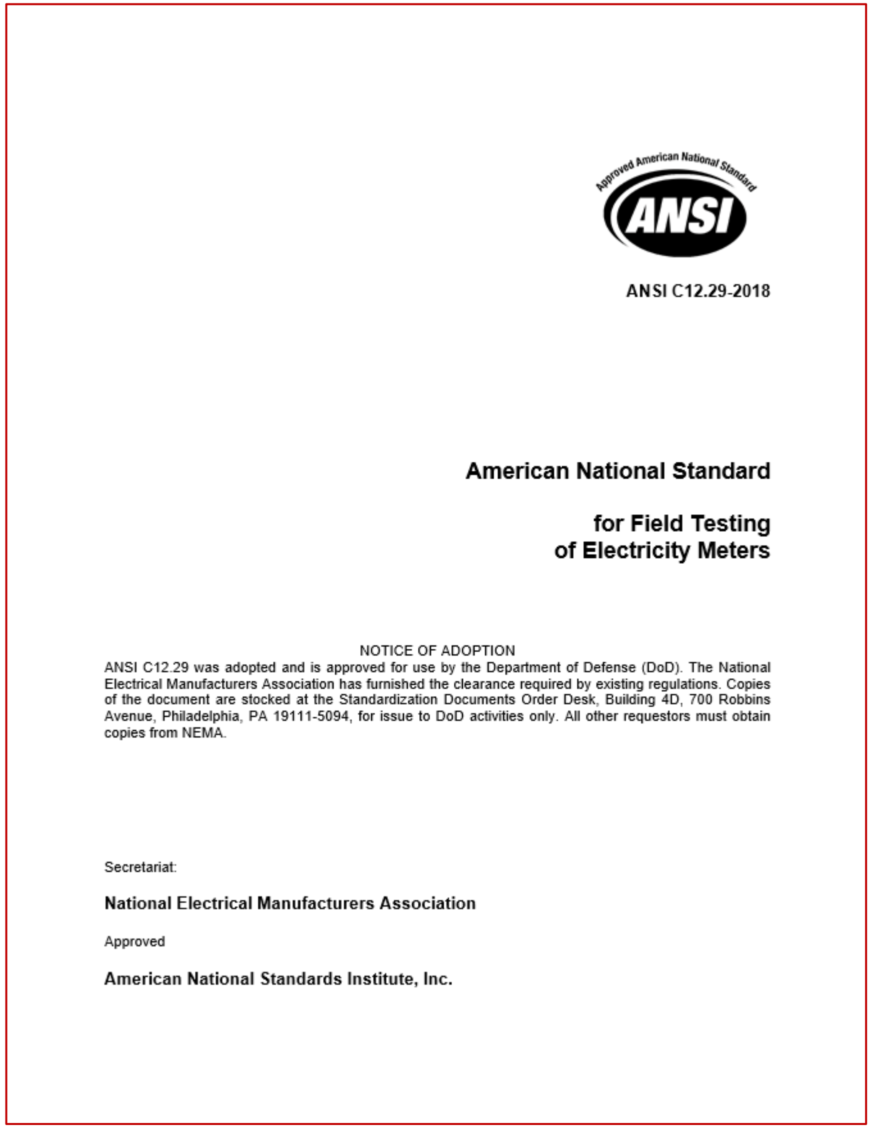
OVERVIEW

Purpose:

To provide guidelines and expectations for the field testing of electric meters, recognizing that field conditions differ significantly from laboratory environments. The goal is to ensure meter accuracy and identify outliers without requiring full environmental control.



Approved American National Standard

ANSI

ANSI C12.29-2018

American National Standard

for Field Testing
of Electricity Meters

NOTICE OF ADOPTION

ANSI C12.29 was adopted and is approved for use by the Department of Defense (DoD). The National Electrical Manufacturers Association has furnished the clearance required by existing regulations. Copies of the document are stocked at the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, for issue to DoD activities only. All other requestors must obtain copies from NEMA.

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Sections 1, 2, 3

1 SCOPE

This document establishes guidelines for the testing of electricity meters in the field.

2 BACKGROUND

Testing of electricity meters in the field is significantly different than testing meters in a laboratory. In the field there may be little control of the environment or load conditions. The purpose of this document is to describe the conditions under which field test can be expected to provide useful results and the errors one might encounter.

The philosophy behind the approach taken here is quite different from the normal laboratory approach. In the laboratory the technician carefully establishes the environmental conditions then performs the testing. In the field we generally have neither control over the environment nor detailed knowledge of it. Therefore, the approach of this document is to perform the test without prior consideration of the details of test conditions. If the results fall within the expected errors, then the meter is accepted as passing the test. If the results fall outside of the expected range, then further investigation is done to determine if the test conditions fall outside the normal range. If they are within the normal range, then the meter has failed the test. If the operating conditions fall outside the normal range, then further evaluation is required.

3 REFERENCES

ANSI C12.1 *American National Standard for Electric Meters, Code for Electricity Metering*
ANSI C12.20 *American National Standard for Electricity Meters—0.1, 0.2, and 0.5 Accuracy Classes*

4 ENVIRONMENTAL CONDITIONS

In field testing we do not have control of the test environment.

4.1 Temperature

For the purpose of field testing, temperature has been broken into three ranges:

Table 1 – Temperature ranges

Low Temperature Range (LTR)	Tmin < T < 0°C	where Tmin is the lowest operating temperature certified by the meter manufacturer
Normal Temperature Range (NTR)	0°C ≤ T ≤ 50°C	Range over which performance is expected to match the "Nominal" requirements
High Temperature Range (HTR)	50°C < T < Tmax	where Tmax is the highest operating temperature certified by the meter manufacturer

4.2 Voltage

The voltage used to excite the meter should be within the operating range specified by the manufacturer. Meter excitation may be provided by the test equipment or from the customer service.

For the purpose of field testing, voltage quality has been broken into two ranges:

Table 2 Voltage Quality (Harmonic content)

Normal Harmonic Distortion (NHD)	THD ≤ 30%	Range over which harmonic distortion on the voltage is expected to have no significant effect.
High Harmonic Distortion (HHD)	THD > 30%	Range over which harmonic distortion on the voltage may have an effect outside of normal accuracy expectations.

4.3 Current

The current used to excite the meter may be any current greater than the low current limit of the current class and less than the maximum current class. Meter excitation may be provided by the test equipment or from the customer service.

For the purpose of field testing, current has been broken into two ranges for each current class.

Table 3 – Current ranges by current class

Current Class	Low Current	Normal Current
2	I < 0.025	0.025 ≤ I ≤ 2
10	I < 0.25	0.25 ≤ I ≤ 10
20	I < 0.25	0.25 ≤ I ≤ 20
100	I < 1.5	1.5 ≤ I ≤ 100
200	I < 3.0	3.0 ≤ I ≤ 200
320	I < 5.0	5.0 ≤ I ≤ 320

SECTION 4.3 CONTINUED

For the purpose of field testing, current has been broken into two ranges based on the harmonic content of the current.

Table 4 – Current ranges by harmonic content

Low Harmonic Content (LHC)	THD ≤ 100%	Range over which harmonic distortion on the current is expected to have no significant effect.
High Harmonic Content (HHC)	THD > 100%	Range over which harmonic distortion on the current may have an effect outside of normal accuracy expectations.

SECTIONS 4.4 & 4.5

4.4 Frequency

Frequencies within the range of 60Hz ± 1.2 Hz shall be considered within the normal range of operation.

4.5 Other influence quantities and disturbances

In type testing we are able to control all influence quantities and disturbances. In the field we not only cannot control these quantities we generally cannot determine their presence, absence or strength. Therefore, the error limits set in this document include an assumption that they are sufficiently small to not cause errors outside the limits presented herein.

5 TEST METHODS

5.1 Testing using test set supplied voltages and currents

In this approach the test voltages and currents are supplied by the test equipment. The tester has total control over the voltage and load conditions so any voltage – load can be tested. Because the voltage and current waveforms can be completely controlled, errors associated with unknown harmonics, changing levels and deviations from nominal are minimized.

5.2 Testing using site voltage and test set supplied current

In this approach the test voltage is the site voltage. The test current is supplied by the test equipment. The tester has control over the load, so multiple load conditions can be tested. Since for most situations the site voltage is much more stable and free of harmonics, having the test equipment supply a well controlled current has most of the advantages of 5.1.

5.3 Testing using site voltage and current

In this approach the test voltage and test current are the actual voltage and current provided by the site. The tester has no control over the voltage or load conditions. Under customer load conditions the performance of the meter in its actual application is tested. In such a test, the applicable error in situ can be determined. Under extreme load conditions errors can be larger than under controlled conditions.

5.4 Test equipment requirements

Field test equipment should have “in the field” uncertainty of not more than one quarter of the accuracy class of the meter being tested. Minimum and preferred uncertainties for each accuracy class are shown in Table 1.

Table 1 – Field Test Equipment Accuracy

Meter Accuracy Class	Minimum Test Equipment Uncertainty	Preferred Test Equipment Uncertainty
0.1%	0.025%	0.01%
0.2%	0.05%	0.02%
0.5%	0.05%	0.05%
1.0%	0.05%	0.05%

Note: The test equipment manufacturer shall specify under what environmental and signal conditions the test set meets the above requirements.

6 PERFORMANCE EXPECTATIONS

This document is not intended to set forth mandatory performance requirements for meter installations in the field. It is intended to provide guidance as to what range of performance should be considered "normal" and what should generate concern and additional action.

6.1 Performance under normal operating conditions

For the purpose of this document, NORMAL operating conditions are defined as:

Temperature:	0°C ≤ T ≤ 50°C
Voltage:	Within range specified by manufacturer
Voltage distortion:	THD ≤ 30%
Current:	Within the normal current range for the current class
Current harmonics:	THD ≤ 50%
Frequency:	60 HZ ± 0.5 Hz
Power Factor	0.5 capacitive to 0.5 inductive

Under normal operating conditions the allowable meter error is given in Table 2

Table 2 – Allowable meter error

Meter Accuracy Class	Allowable Error
0.1%	0.25%
0.2%	0.5%
0.5%	1.0%
1.0%	2.0%

As stated in 2.0 Background, if the meter passes the test, (the measured error is less than that in Table 2), the meter should be considered good and no further investigation is necessary. If the meter fails the test then further investigation of the influence conditions which might be present is required.

6.2 Error under other operating conditions

When the operating conditions are outside of normal range, that does not create an expectation that the meter's error should be outside the maximum allowable error in Table 2. Rather, the indication is that if the error exceeds the maximum expected error, then further investigation may be warranted to determine the reason that the errors exceed expectation.

This effort might include additional measurements such as:

- Ambient temperature
- Meter surface temperature
- Voltage values
- Current values
- Harmonic content of voltage
- Harmonic content of current

Most of the above measurements are readily available on all modern field test systems.

Some possible influences may not be measurable but are appropriate to record:

- Potential sources of high AC electric fields
- Potential sources of large RF fields
- Condition of socket and associated wiring

ANSI Discussion

Practical Implications:

- Guides utilities and meter service teams in interpreting field test data.
- Encourages data-driven triage—don't assume failure unless environmental influences are ruled out.
- Supports field-based quality assurance without over-reliance on lab retesting.

Adoption & Use:

- Adopted by the U.S. Department of Defense (DoD).
- Recognized standard for meter performance verification in uncontrolled settings.

QUESTIONS AND DISCUSSION

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