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Meter Test & Field Service

31 DECEMBER 2004

Testing meter accuracy to international standards

With deregulation, increased competition and the long-term replacement of less accurate induction type watt-hour meters, the need to make more accurate measurements, more frequently, under real world signal conditions, has never been more important.

Both suppliers and consumers of electricity need confidence that what they distribute or receive is exactly what was expected. As a result, watt-hour meter testing has become compulsory in most countries, and is supported by specific international standards. Furthermore, power quality metering is gaining in importance as industrial processes become more sensitive to power quality. This, along with the introduction of performance-based rates that incorporate financial penalties when power quality does not meet minimum standards, will drive the need for even more measurements.

IEC 61036 Test Conditions
Reference Voltages
Reference Currents
Reference Frequencies
Mechanical
Climatic Influences
Voltage & Current Power consumption
Influence on supply Voltage
Influence of over currents
Influence of internal heating
Electromagnetic compatibility
Radio interference, conducted and susceptibility
Accuracy against varying influences

Figure 1 - IEC 61036 Requirements, test conditions and limits for Class1 and 2 meters

Meter testing has until recently been a task of bringing together an array of test instruments, including voltage and current supplies and reference meters. These tests, if performed in accordance with the requirements specified in IEC 610362, 605143 and 605214 or the ANSI C12.12 -2002, require accurate control of sags, swells, harmonics and power factor.

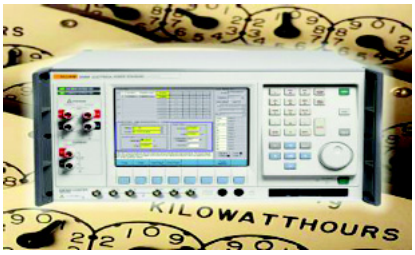
A meter manufacturer publishing specifications that reference IEC or ANSI standards provides 'consumer assurance' that the meter has undergone rigorous performance tests. Furthermore, both meter type tests and acceptance/conformity tests involve test equipment whose voltage and current supplies generate accurate real world signal phenomena. Type tests are performed by the meter manufacturer on one prototype, or a sample number of meters of the same type, to ensure compliance with all aspects of the standard. However, the utility is responsible for acceptance/conformity testing on a sample size determined by the utility based on the quantity purchased. Tests may differ where legal requirements between states and countries influence test procedures used by the utility.

TESTING CLASS 1 AND 2 METER ACCURACY

IEC 61036 defines the accuracy limits for each class of meter. Furthermore, it lists the influencing quantities that the meter must be subjected to at specified reference voltages and currents. Harmonics influences and associated test limits are divided into the following three tests:

- Half wave rectification (dc and even harmonics)
- Phase fired control (odd harmonics)
- Burst control (sub-harmonics).

In each of these three tests, the limit of error is 3.0 % for Class 1 meters. A further accuracy requirement is placed on the meter with regard to the correct measurement of power, with a 5th harmonic component, of magnitude 0.5 Imax. The allowable variation in percentage error is 0.8%.



IEC 61036 also provides guidance on test equipment connection; specific waveforms used to generate the required harmonics; and direction on connecting a reference meter used as a comparison device.

ELECTRICAL POWER STANDARD PHOTO

An alternative approach is to use the latest generation of electrical power standards developed specifically to source many of the signal requirements defined within these standards. This new generation of equipment replaces the need for a reference meter and balancing load impedance, while at the same time the task of sourcing the required harmonics is simplified. Power standards that accurately source signals relative to reference meter techniques not only compensate for differing load impedance, but also offer many of the power quality phenomena, automation and traceability required to address single and polyphase meter test applications.

NOTES:

1. A meter in which current and voltage act on solid-state (electronic) elements to produce an output proportional to watt-hours.
2. IEC 61036 applies only to newly manufactured indoor or utdoor static watt-hour meters of accuracy classes 1 and 2, for the measurement of AC electrical active energy of a frequency in the range 45 Hz to 65 Hz and to their type tests only.
3. IEC 60514 covers methods for acceptance inspection (100% inspection and statistical sampling inspection) and testing of newly manufactured DC induction type watt-hour meters of Class 2 which are produced and delivered in large quantities.
4. IEC 60521 applies only to newly manufactured induction type watt-hour meters of accuracy classes 0.5, 1 and 2, for the measurement of AC electrical active energy of a frequency in the range 45 Hz to 65 Hz and to their type tests only. This publication supersedes IEC 60043 (1960), 60170 (1964) and 60280 (1968).

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